

**M.Sc. Botany – Semester I**  
**B101: BIOLOGY AND DIVERSITY OF ALGAE AND BRYOPHYTES**  
**Theory**

S. No	Unit
<b>SECTION A</b>	
1.	Criteria employed in classification of algae. Classification given by Fritsch, Bold and Wynne, Lee. Thallus organization, reproduction and life cycles in algae.
2.	Range of thallus structure, reproduction, life histories of Chlorophyceae with special reference to the genera: <i>Chlamydomonas</i> , <i>Tetraspora</i> , <i>Volvox</i> , <i>Chlorella</i> , <i>Scenedesmus</i> , <i>Ulva</i> , <i>Enteromorpha</i> , <i>Cladophora</i> , <i>Fritschiella</i> , <i>Oedogonium</i> , <i>Spirogyra</i> , <i>Cosmarium</i> , <i>Caulerpa</i> , <i>Chara</i> .
3.	Salient features of Protochlorophyta; Xanthophyta: <i>Vaucheria</i> . Bacillariophyta: <i>Cyclotella</i> , <i>Navicula</i> ; Phaeophyta: <i>Ectocarpus</i> , <i>Dictyota</i> , <i>Padina</i> , <i>Laminaria</i> , <i>Sargassum</i> .
4.	Salient features of Rhodophyta: <i>Gelidium</i> , <i>Gracilaria</i> , <i>Polysiphonia</i> ; Cyanophyta: <i>Nostoc</i> , <i>Lyngbya</i> , <i>Spirulina</i> .
<b>SECTION B</b>	
5.	Diversity of marine and fresh water algae in India. Economic importance of algae– single cell protein, pigments, lipids, and omega fatty acids. Algal blooms. Algal bio fertilizers. Cultivation of economically important seaweeds– <i>Porphyra</i> , <i>Gracilaria</i> , <i>Gelidium</i> . Mass culture of micro algae.
6.	Classification of Bryophytes given by Smith, Campbell. Ecological and economic importance of Bryophytes. Conduction in Bryophytes.
7.	Morphology, structure, reproduction and life history of Hepatocopsida: Marchantiales: <i>Marchantia</i> ; Jungermaniales: <i>Pellia</i> , <i>Porella</i> ; Anthocertopsida: <i>Anthoceros</i> .
8.	Morphology, structure, reproduction and life history of Bryopsida: Sphagnales: <i>Sphagnum</i> ; Funariales: <i>Funaria</i> ; Polytrichales: <i>Polytrichum</i> .

**Practical**

S. No	Exhibit/Experiment
1.	Examination of vegetative and reproductive morphology of Chlorophyceae: <i>Chlamydomonas</i> , <i>Tetraspora</i> , <i>Volvox</i> , <i>Chlorella</i> , <i>Scenedesmus</i> , <i>Ulva</i> , <i>Enteromorpha</i> , <i>Cladophora</i> , <i>Fritschiella</i> , <i>Oedogonium</i> , <i>Spirogyra</i> , <i>Cosmarium</i> , <i>Caulerpa</i> , <i>Chara</i> .
2.	Examination of vegetative and reproductive morphology of Bacillariophyceae:

	<i>Cyclotella, Navicula</i> ; Phaeophyceae: <i>Ectocarpus, Dictyota, Padina, Laminaria, Sargassum</i> .
3.	Examination of vegetative and reproductive morphology of Rhodophyceae: <i>Gelidium, Gracilaria, Polysiphonia</i> .
4.	Examination vegetative and reproductive morphology of Xanthophyceae: <i>Vaucheria</i> Cyanophyceae: <i>Nostoc, Lyngbya, Spirulina</i> .
5.	Field work to get acquaintance with the algae of Visakhapatnam coast and fresh water algae in and around Visakhapatnam.
6.	An examination of the external features and internal structure and reproductive organs of: <i>Riccia, Targionia, Monoclea, Plagiochasma</i> .
7.	An examination of the external features and internal structure and reproductive organs of the genera: <i>Fimbriaria, Marchantia, Pellia, Porella</i> .
8.	An examination of the external features and internal structure and reproductive organs of: <i>Anthoceros, Notothylus, Andreaea, Funaria, Polytrichum</i> .

#### Reference Books

1.	Lee RW. 2007. <b>Classification of Algae</b> .
2.	Kumar HD. 1988. <b>Introductory Phycology</b> . Affiliated East West Press Pvt. Ltd., New Delhi.
3.	Round FE. 1986. <b>The Biology of Algae</b> . Cambridge University Press, New York.
4.	Bold HC and Wynne MJ. 1978. <b>Introduction to the Algae</b> . Prentice-Hall, New Jersey.
5.	Presscot GW. 1969. <b>The Algae- a Review</b> . Houghton Mifflin Company, Boston.
6.	Morris I. 1967. <b>An Introduction to the Algae</b> . Cambridge University Press, UK.
7.	Chapman VJ. 1962. <b>The Algae</b> . Macmillan and Co Ltd., London.
8.	Lewin RA. 1962. <b>Physiology and Biochemistry of Algae</b> . Academic Press, New York.
9.	Round FE. 1962. <b>Ecology of Algae</b> . Cambridge University Press, New York
10.	Smith GE (ed) 1950. <b>Fresh Water Algae</b> . Elsevier Science, USA.
11.	Fritsch FE. 1945. <b>The Structure and Reproduction of Algae Vols. 1&amp; II</b> . Cambridge University Press, New York.
11.	Chopra RN and Kumra PK. 1988. <b>Biology of Bryophytes</b> . New Age International (P) Ltd. Publishers, New Delhi.
12.	Parihar NS. 1991. <b>Bryophyta</b> . Central Book Depot, Allahabad.

<b>13.</b>	Puri P. 1980. <b>Bryophytes</b> . Atmaram and Sons, Delhi.
<b>14.</b>	Smith GM. 1955. <b>Cryptogamic Botany Vol.II</b> . Tata McGraw Hill Publishing Co. Ltd., New Delhi.
<b>15.</b>	Kashyap S. 1929. <b>Liverworts of the Western Himalayas and Punjab Plains Part I and Part II</b> . University of Panjab, Lahore, Pakistan.



**M.Sc. Botany - Semester I**  
**B 102: BIOLOGY AND DIVERSITY OF BACTERIA, VIRUSES AND FUNGI**  
**Theory**

S. No	Unit
<b>SECTION A</b>	
1.	General account of archaeobacteria, eubacteria and cyanobacteria. Classification of eubacteria. Ultrastructure, nutrition, reproduction and economic importance of bacteria.
2.	Morphology and chemical composition of Actinomycetes, Spirochetes, Rickettsiae and Mycoplasmas.
3.	Classification of viruses. Ultrastructure and chemistry of viruses. Replication and transmission of viruses. History, origin and evolution of plant viruses. Plant viral diseases.
4.	Microbial Ecology: quorum sensing, gentrification, phosphorous solubilization, nitrogen fixation.
<b>SECTION B</b>	
5.	Classification and phylogeny of fungi. Molecular aspects in classification. Thallus organization in fungi. Ultrastructure of fungal cell. Unicellular and multicellular organization. Cell wall composition. Fungal diseases in plants and humans.
6.	General account of Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina.
7.	Reproduction in fungi: vegetative, asexual and sexual. Heterothallism, heterokaryosis and parasexuality. Nutrition in fungi: saprobic, biotrophic, and symbiotic.
8.	Fungi in industry: medicine, food, pest and weed management (biocontrol agents). Mushroom cultivation. Fermentation methods. Mycorrhiza.

**Practical**

S. No	Exhibits/ Experiments
1.	Tools of microbiology: Care and use of the microscope, Spectrophotometer, P <sup>H</sup> meter, Micrometer, Hemocytometer, Autoclave, Centrifuge, Biological safety

	cabinets, Inoculation needle and loop, Incubator, Colony counter & Lyophilizer.
2.	Differential staining: Gram staining.
3.	Differential staining: Acid fast staining.
4.	Study of bacterial growth: To prepare the growth curve of bacteria.
5.	Study of cyanobacteria: Isolation and cultivation of cyanobacteria.
6.	Isolation of rhizobia from root nodules.
7.	Cultivation of viruses in embryonated eggs.
8.	Isolation of fungi by Petri plate exposure method.
9.	Morphological study of: <i>Stemonitis</i> , <i>Saprolegnia</i> , <i>Mucor</i> , <i>Morchella</i> , <i>Aspergillus</i> , <i>Agaricus</i> , <i>Cyathus</i> , <i>Synchytrium</i> , <i>Helminthosporium</i> .
10.	Symptomatology and anatomical study of some diseased specimens: white rust, powdery mildew, green ear of bajra, rust of wheat, rust of linseed, Tikka disease of ground nut, red rot of sugarcane, blast of rice, citrus canker, tobacco mosaic disease.
<b>References Books</b>	
1.	Kaursethi I and Surinder KW 2011. <b>Text Book of Fungi and their Allies</b> . Macmillan publishers, New Delhi, India.
2.	Ram Reddy S & Reddy SM 2007. <b>Essentials of Virology</b> . Scientific publishers, Jodhpur, India.
3.	Sharma K 2005. <b>Manual of Microbiology Tools and Techniques</b> . Ane Book, New Delhi, India.
4.	Matthew RH 2004. <b>Plant virology</b> . 4 <sup>th</sup> edition. Academic press an imprint of Elsevier, California, USA.
5.	Prescott <i>et al.</i> 2003. <b>Microbiology</b> . McGraw Hill Education, New York.
6.	Aneja KR 2003. <b>Experiments in Microbiology, Plant pathology and Biotechnology</b> . New Age International publishers, New Delhi.
7.	Verma HN 2003. <b>Basics of plant Virology</b> . IBH publishing co. Pvt. Ltd., New Delhi.

8.	Mehrotra KS and Aneja KR 2003. <b>An Introduction to Mycology</b> . New Age International Publishers, New Delhi.
9.	Sullia SB and Shantharam S 2001. <b>General Microbiology</b> . Oxford and IBH publishing Co. Pvt. Ltd, New Delhi.
10.	Reddy SM and Ram Reddy S 2000. <b>Microbiology a Laboratory Manual</b> . BSC Publishers and Distributors, Hyderabad.
11.	Flint SJ, Enquist LW, Krug RM, Racaniello VR, Skalka AM 2000. <b>Principles of Virology, Molecular Biology, Pathogenesis and Control</b> . ASM press, Washington DC.
12.	Rao AS 1999. <b>Introduction to Microbiology</b> . Prentice Hall of India Pvt. Ltd., Delhi.
13.	Alexopoulos CJ, Mims CW, Blackwell M 1996. <b>Introductory Mycology</b> . 4 <sup>th</sup> edition. Replika press, North Delhi.
14.	Paul S 1995. <b>Bacteria in Biology, Biotechnology and Medicine</b> . 5 <sup>th</sup> edition. John Wiley and son Ltd., UK.
15.	Pelczar, Chan and Krieg 1993. <b>Microbiology</b> . 5 <sup>th</sup> edition. McGraw Hill Education, New York.
16.	<i>Stainer</i> RT, Ingraham JL, Wheelis ML and Painter PR 1987. <b>General Microbiology</b> . 5 <sup>th</sup> Edition. Macmillan, London.
17.	Smith KM 1968. <b>Plant viruses</b> . Elsevier, New York.
18.	Rangaswamy G 1962. <b>Bacterial Plant disease in India</b> . Asia Publishing House, Bombay.





**M.Sc. Botany - Semester I**  
**B103 CELL BIOLOGY OF PLANTS**

**Theory**

S. No	Unit
<b>SECTION A</b>	
1.	The cell theory. Origin and development of cell biology as a separate branch. Dimensions of size and weight: micron to angstrom, microgram to pictogram. Ultra structure and organization of prokaryotic and eukaryotic cells. Specialized cell types.
2.	Chemical foundation: macromolecules–structure, shape and information. Non-covalent interactions in relation to function of nucleic acids and proteins. Biochemical energetics: types of energy– thermal, electrical and radiant energy, interconvertability of energy. Laws of thermodynamics as applicable to biological systems.
3.	Cell wall:structure and functions, cell wall architecture, biogenesis and growth. Plasmodesmata: structure and function, plasmodesmata in comparison to gap junctions of animal cells. Plasma membrane: structure, models and functions. ATPases receptors, carriers, channels, pumps. Vacuole structure and function, vacuolar ATPases, transporters.
4.	Cytoskeleton: microtubules and microfilaments, their role in cell division and motility; intermediate filaments– role in providing strength. Labeled antibody technique for visualizing cytoskeleton.
<b>SECTION B</b>	
5.	Chloroplast and Mitochondria: structure and function, genome organization, nucleo-cytoplasmic interactions, RNA editing.
6.	Other organelles: structure and function– endoplasmic reticulum, Golgi apparatus lysosomes,, ribosomes, microbodies, peroxisomes.
7.	Tools in cell biology I: microscopy–working principles of light microscopy, resolution power of microscope, different types of light microscopes, stains used. Image processing methods in microscopy. Scanning electron microscopy. Transmission electron microscopy– principle of working, preparation of specimens for electron microscopy –Fixing, sectioning, spreading molecules, negative staining, shadow casting, freeze fracture and freeze etching.
8.	Tools in cell biology II: subcellular fractionation– homogenization, principle of density gradient centrifugation. Spectroscopic techniques– principle and applications

	of UV- visible, ESR. Spectrofluorimetry. Circular dichroism (CD). Nuclear magnetic resonance (NMR). Whole cell autoradiography. Radiolabeling techniques: properties of different radioisotopes used in biology, their detection and measurement, incorporation of radioisotopes in biological tissues and cells.
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### Practical

S. No	Exhibit/Experiment
1.	Electron microscopic picture of prokaryotic and eukaryotic cells.
2.	Images of cytoskeleton.
3.	Electron microscope pictures of chloroplast and mitochondria.
4.	Electron microscope pictures of endoplasmic reticulum, Golgi apparatus.
5.	Study of mitosis using acetocarmine.
6.	Isolation of mitochondria and the activity of its marker enzyme, succinate dehydrogenase (SDM).
7.	Fluorescence staining with FDA for cell viability and cell wall staining with calcofluor.
8.	Pictures of images of shadow casting, negative staining, freeze fracturing and freeze etching.
9.	Images of cells in fluorescence, phase contrast and confocal microscopy, whole cell autoradiography.
10.	Establishing sucrose density gradients.

### Reference Books

1.	Alberts B, Breyer D, Hopkin K, Johnson AD, Lewis J, Raff M, Roberts K and Watter P 2014. <b>Essential Cell Biology</b> . 4 <sup>th</sup> Edition. Garland publishers, New York.
2.	Sharp D, Ploppe G and Sikorski E 2014. <b>Lewin's Cells</b> . 3 <sup>rd</sup> Edition. Viva Books, New Delhi.
3.	Cooper GM, Hausman RE 2013. <b>The Cell – A Molecular Approach</b> . 6 <sup>th</sup> Edition. Sinauer Associates, Incorporated, USA.
4.	Karp G 2013. <b>Cell and Molecular Biology – Concepts and Experiments</b> . 7 <sup>th</sup> Edition. Wiley Global Education, USA
5.	McLennan A, Bates A, Turner P, White M 2013. <b>Bios Instant Notes in Molecular Biology</b> . 4 <sup>th</sup> Edition. Garland publishers, New York.
6.	Cowling G, Allen T 2011. <b>The Cell. A very Short Introduction</b> . Oxford University Press, USA.

7.	Alberts B, Johnson A, Lewis J, Raff M, Roberts K, Walker P 2007. <b>Molecular Biology of the Cell</b> . 5 <sup>th</sup> Edition. Garland publishers, New York.
8.	Schaffer SW 2007. <b>Mitochondria: The Dynamic Organelle</b> . 1 <sup>st</sup> Edition. Springer Verlag.
9.	Wilson J, Hunt T 2007. <b>Molecular Biology of the Cell</b> 5 <sup>th</sup> edition. <b>The Problems Book</b> . 2 <sup>nd</sup> Edition. Garland publishers, New York.
10.	Celis JE (ed) 2006. <b>Cell Biology—A Laboratory Hand Book</b> . 3 <sup>rd</sup> Edition. Elsevier, USA.
11.	Lodish H, Berk A, Kaiser CA, Kreiger M, Scott P M, Bretcher A, Ploegh H, Matsudaira P. 2004. <b>Molecular Cell Biology</b> . 5 <sup>th</sup> edition. W. H. Freeman and Company, New York.
12.	De DN 2000. <b>Plant Cell Vacuoles. An Introduction</b> . CSIRO Publication Collingwood, Australia.
13.	Krishna Murthy KV 2000. <b>Methods in Cell Wall Cytochemistry</b> . CPC Press, Boca Raton, Florida.
14.	Lodish, Berk A, Zipursky SL, Matsudaira P, Baltimore D and Darnell J 2000 <b>Molecular Cell Biology</b> . 4 <sup>th</sup> Edition. W.H. Freeman and Co., New York.
15.	Alberts B, Bray D, Lewis J, Raff M, Roberts K and Watson JD 1999. <b>Molecular Biology of the Cell</b> , Garland Publishing, New York.
16.	Kleinsmith LJ and Kish VM 1995. <b>Principles of Cell and Molecular Biology</b> . 2 <sup>nd</sup> Edition. Harper Collins College Publishers, New York, USA.
17.	Avers CJ 1986. <b>Molecular Cell Biology</b> . Addison Wesley Publishing Company USA.



**M.Sc. Botany – Semester I**  
**B 104 CYTOLOGY AND CYTOGENETICS**

**Theory**

S. No	Unit
<b>SECTION A</b>	
<b>1.</b>	Nucleus: structure of nuclear membrane and nuclear pore complex, nucleolus, ribosome biosynthesis. Chromatin: eu and heterochromatin, arrangement of chromatin. Molecular organization of chromatin: components, nucleosomes – composition and organization, 10 nm, 30 nm, solenoid, scaffolds. Chromosome structure: molecular organization of centromeres and telomeres. Types of chromosomes: lampbrush, polytene.
<b>2.</b>	Chromosome identification: karyotype analysis. Chromosome banding techniques – Q, C, G and R banding. Flowcytometry and confocal microscopy in karyotype analysis. Computer assisted karyotype analysis – chromosome microdissection and micro cloning. FISH and GISH techniques.
<b>3.</b>	Chromosomal structural aberrations: origin, meiosis and breeding behaviour of duplications, deficiencies, inversions and interchanges. Types of inversions. Robertsonian translocations – basic concept of complex translocation heterozygotes.
<b>4.</b>	Chromosomal numerical aberrations: classification of numerical aberrations. Aneuploids – trisomics (primary, secondary, tertiary), monosomics and nullisomics – meiotic behavior. Eupolyploids – origin and production of auto -and allopolyploids, meiosis in autotetraploid. Genome of tobacco and wheat as examples of allopolyploids.
<b>SECTION B</b>	
<b>5.</b>	Nuclear DNA content: C-value paradox, hyperchromicity, cot curves and their significance. Molecular organization of eukaryotic nuclear genome: highly repeated, middle repeated and unique sequences.
<b>6.</b>	Cell cycle and its regulation: the G1, S, G2 and M phases. Synchronous and asynchronous cell divisions. The measurement of duration of different phases of cell cycle using a flow cytometer. Check points in cell cycle – role of cyclins and cyclin-dependent kinases in regulation of cell cycle.
<b>7.</b>	The different stages of mitosis and meiosis: description of the stages. Experimental control of cell division. Significance of meiosis.

8.	Apoptosis: mechanism and significance. Initiation of cancer at cellular level – proto oncogenes and oncogenes; retinoblastoma and E2F proteins.
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### Practical

S. No	Exhibit/ Experiment
1.	Photographs of interphase nucleus, 10 nm, 30nm and scaffolds. Electron microscope picture of metaphase chromosome, <i>in-situ</i> hybridization of chromosome spreads showing telomeres and centromeres. rRNA synthesis –christmas tree configuration.
2.	Pictures of lampbrush and polytene chromosomes.
3.	Photographs of chromosomes with different banding patterns. Identifying homologous chromosomes from the pictures.
4.	Preparation of karyotypes in <i>Allium/ Aloe</i> (with treated root tips).Construction of idograms from pictures of karyotypes.
5.	Photographs showing meiosis in structural and numerical aberrations.
6.	Meiosis in <i>Rheo discolor</i> showing complex translocation heterozygote.
7.	Preparation of slides from <i>Allium</i> floral buds for observation and identification of stages of meiosis.
8.	C value paradox chart and Britten and Kohne's Cot curves picture.

### Reference Books

1.	Singh RJ. 2014. <b>Plant Cytogenetics</b> . 2 <sup>nd</sup> Edition. CRC Press, India.
2.	Pierce BA. 2013. <b>Genetics: A Conceptual Approach</b> . 5 <sup>th</sup> Edition. W. H. Freeman, California.
3.	William K, Cummings S, Spencer MR and Charlotte A. 2013. <b>Essentials of Genetics</b> . Pearson Books, Delhi.
4.	Hartwell L. 2011 <b>Genetics: From Genes to Genomes, Study Guide and Solution Manual</b> . 4 <sup>th</sup> Edition. Nero, McGraw Hill Publishing company, New York.
5.	Bass H and Birchler J. 2011. <b>Plant cytogenetics: Genome structure and chromosome Function</b> . Springer, New York.
6.	Ram M. 2010. <b>Cytogenetics and Genetics</b> . PHI Learning Pvt. Ltd., Delhi.
7.	Anthony J, Griffiths F, Wessig SR, Carroll SB and Doebley J. 2010. <b>Introduction to genetic analysis</b> . 10 <sup>th</sup> Edition. W. H. Freeman, California.
8.	Russel PJ. 2009. <b>Genetics–A Molecular Approach</b> . 3 <sup>rd</sup> Edition. Pearson Benjamin Cummings, San Francisco, USA.
9.	Roy D. 2009. <b>Cytogenetics</b> . Alfa Science International Ltd., UK.

10.	Brooker R. 2008. <b>Genetics, Analysis and Principles</b> . 3 <sup>rd</sup> edition. McGraw Hill Science.
11.	Gupta P.K .1995. <b>Cytogenetics</b> . Rastogi & Company, Meerut.
12.	Sybenga J. 1992. <b>Cytogenetics in Plant Breeding</b> . Springer London Ltd.
13.	David M. Prescott. 1988. <b>Cells</b> . Jones and Bartlett Publ. Boston.
14.	Swanson M and Young. 1982. <b>Cytogenetics</b> . Prentice Hall, India.
15.	Khush GS. 1973. <b>Cytogenetics of Aneuploids</b> . Academic Press, New York and London.
16.	Sybenga J. 1973. <b>General Cytogenetics</b> . North Holland and American Elsevier Publishing Co., New York.
17.	Burnham CR. 1962. <b>Discussions in Cytogenetics</b> . Burgess Publishing Co., Minnesota.





**M.Sc. Botany - Semester II**

**B 201 GENETICS**

**Theory**

<b>S. No</b>	<b>Unit</b>
<b>SECTION A</b>	
<b>1.</b>	Concept of genetic markers and their types. Mendel's experiments and theories, application of probability laws to Mendelian principles. Chi-square testing for goodness of fit. Penetrance and expressivity. Pleiotropism. Phenocopies. Codominance and incomplete dominance.
<b>2.</b>	Multiple allelism: interaction among multiple alleles, complementation test, pseudoalleles. Gene interaction and modified F <sub>2</sub> ratios in two gene interactions.
<b>3.</b>	Linkage and crossing over: identifying linkage from F <sub>2</sub> and test cross, recombination frequency and distance between genes. Linkage maps. Tetrad analysis—ordered and unordered tetrads.
<b>4.</b>	Recombination in prokaryotes: transformation, conjugation, transduction, sexduction. Mapping of genes in bacteria using transformation and conjugation (interrupted mating). Fine structure analysis of gene – Benzer's work.
<b>SECTION B</b>	
<b>5.</b>	Sex determination: chromosomal and genetic basis. Sex-linked inheritance. Sex influenced and sex limited characters. Polygenic inheritance: heritability and its measurement. QTL mapping.
<b>6.</b>	Extra chromosomal inheritance: inheritance of mitochondrial and chloroplast genes. Male sterility. Chloroplast mutations. Maternal inheritance.
<b>7.</b>	Nature of the eukaryotic gene: split gene with a promoter and terminator. Variant forms of eukaryotic gene – nested genes, overlapping genes, assembled genes, assorted genes. Multigene families— organization and significance. Transposable elements in pro- and eukaryotes: types, mechanism of transposition, significance of transposable elements.
<b>8.</b>	Mutations: types, causes and detection. Physical and chemical mutagens. Lethal, conditional, biochemical, loss of function, gain of function. Molecular basis of mutations. Spontaneity of mutations, site-directed mutagenesis. Recombination: molecular mechanism— role of rec A, B, C, D enzymes, Holliday model, site specific recombination.

### Practical

S. No	Exhibit/Experiment/Assignment
1.	Assignment on Mendel's principles, chisquare test, proabability.
2.	Assignment on dominance relationships, multiple alleles and two gene interactions.
3.	Assignment on linkage and crossing over.

### Reference Books

1.	Benajamin Pierce 2013. <b>Genetics: A Conceptual Approach.</b> 5 <sup>th</sup> Edition.W.H. Freeman and Company.
1.	Lewin B. 2000. <b>Gene VII.</b> Oxford University Press, New York, USA.
2.	Snustad DP. and Simons MJ 2000. <b>Principles of Genetics.</b> 2 <sup>nd</sup> Edition. John Wiley and Sons Inc., USA.
3.	Atherly AG, Girton JR and McDonald JF. 1999. <b>The Science of Genetics.</b> Saunders College Publishing, Fort Worth, USA.
4.	Karp G. 1999. <b>Cells and Molecular Biology: concepts and Experiments.</b> Hohn Wiley and Sons Inc., USA.
5.	Hartl DL and Jones EW. 1998. <b>Genetics: Principles and Analysis.</b> 4 <sup>th</sup> Edition. Jones and Bartlett Publishers, Massachusetts, USA.
6.	Malacinski GM and Freifelder D. 1998. <b>Essentials of Molecular Biology.</b> 3 <sup>rd</sup> Edition. Jones and Bartlet Publishers Inc., London.
7.	Russel PJ. 1998. <b>Genetics.</b> 5 <sup>th</sup> Edition. The Benjamin/ Cummings Publishing Company Inc., USA.
8.	Lewis R. 1997. <b>Human Genetics: Concepts and Applications.</b> 2 <sup>nd</sup> Edition. WCB McGraw Hill, USA.
9.	Griffiths RCL, Anthony JF, Miller JH and Suzuki DT. 1996. <b>Genetic analysis.</b> 6 <sup>th</sup> Edition. W. H. Freeman and Co., New York.



**M.Sc. Botany - Semester II**  
**B 202 MOLECULAR BIOLOGY OF PLANTS**

**Theory**

S. No	Unit
<b>SECTION A</b>	
<b>1.</b>	Composition and structure of biomolecules: carbohydrates, lipids, proteins (Ramachandran plot) domains, motifs and folds. Nucleic acids– DNA structure, A, B and Z forms of DNA. Types of small RNAs: Si RNA, micro RNA, catalytic RNA.
<b>2.</b>	DNA replication: semi-conservative, semi-discontinuous- Okazaki fragments, uni and bi directional mode of replication. RNA priming, enzymes for DNA replication– gyrase, helicase, topoisomerases and polymerases, SSBs. Mechanism of DNA replication– in prokaryotes–rolling circle and theta mode of replication, in eukaryotes– multiple replicons. Fidelity of replication. Replication at ends of chromosomes. Extrachromosomal replicons. DNA damage and repair.
<b>3.</b>	RNA synthesis and processing: transcription process in prokaryotes and eukaryotes. Transcription factors. RNA processing– mRNA processing – spliceosome, capping and tailing, processing of tRNA and rRNA.
<b>4.</b>	Protein synthesis: structure of tRNA, aminoacylation of tRNA, aminoacyl tRNA synthetases. Ribosome as a translation factory. Genetic code– codon assignment, characteristics of genetic code. Mechanism of translation in prokaryotes and eukaryotes– initiation elongation and termination. Chemical proof reading during translation. Translation inhibitors. Post translational modifications.
<b>SECTION B</b>	
<b>5.</b>	Protein sorting and targeting of proteins into nucleus, chloroplasts, mitochondria, vacuoles and peroxisomes. Protein trafficking through GERL system– signal peptide, signal recognition particle, vesicles.
<b>6.</b>	Signal transduction: signaling molecules, ligands and receptors. G protein coupled receptors. Receptor tyrosine kinases. MAP kinases. Second messengers, signal amplification, cAMPs. Ca-calmodulin pathway.
<b>7.</b>	Regulation of gene expression in prokaryotes: bacteria – Lac, arabinose ,Tryp operons, positive and negative control. Regulation in viruses–lytic and lysogenic cycles.
<b>8.</b>	Regulation of gene expression in eukaryotes: cis and trans factors. Motifs of DNA

	binding domains of trans factors–zinc fingers, leucine zippers, helix turn helix. Temporal and spatial regulation. Role of chromatin in gene expression. DNA methylation and gene imprinting. Gene silencing.
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### Practical

S. No	Exhibit/Experiment
1.	Isolation of DNA using CTAB method.
2.	Histochemical staining of carbohydrates, proteins and fats in the plant cells.
3.	Electrophoresis of seed proteins.
4.	Assignments on problems related to DNA structure, replication, transcription and translation
5.	Photographs depicting the content of theory

### Reference Books

1.	Snustad P, Simmons MJ. 2003. <b>Principles of Genetics</b> . 3 <sup>rd</sup> Edition. John Wiley and Sons, Inc, USA.
2.	Buchaman BB, Gruissem,W and Jones R. 2000. <b>Biochemistry and Molecular Biology of plants</b> : American Societies of plant physiologists, John Wiley and Sons Ltd., Maryland, U.S.A.
3.	Lewin B. 2000. <b>Genes IX</b> , Oxford University Press, New York.
5.	Lodish BA, Zipursky SL, Matsdaira P, Baltimore D and Darnell J. 2000. <b>Molecular Cell Biology</b> . 4 <sup>th</sup> Edition. W.H. Freeman and Co., New York.
6.	Alberts B, Bray D, Lewis J, Ralf M, Roberts K and Watson JD.1999. <b>Molecular Biology of the Cell</b> . Garland publishing Inc., New York.
7.	Weaver RF. 1999. <b>Molecular Biology</b> . WCB /McGraw-Hill,.
8.	Shaw CH. 1998. <b>Plant Molecular Biology. A practical approach</b> , IRL Press, Oxford.
9.	Glick BR and Thompson JE. 1992. <b>Methods in Plant Molecular Biology and Biotechnology</b> , CRC Press, Boc Raton Florida.



**M.Sc. Botany – Semester II**

**B 203 BIOLOGY AND DIVERSITY OF PTERIDOPHYTES AND GYMNOSPERMS**

**Theory**

S. No	Unit
<b>SECTION A: Pteridophytes</b>	
1.	Classification of Pteridophyta. Origin of Pteridophytes. Pteridophytes in comparison to Bryophytes and Gymnosperms. Distinguishing features of Pteridophyta. Economic importance of Pteridophytes.
2.	Morphology, anatomy and reproduction of <i>Psilotum</i> , <i>Lycopodium</i> , <i>Selaginella</i> , <i>Isoetes</i> , <i>Equisetum</i> , <i>Ophioglossum</i> , <i>Osmunda</i> , <i>Gleichenia</i> , <i>Cyathea</i> , <i>Marselia</i> , <i>Adiantum</i> , <i>Salvinia</i> and <i>Azolla</i> .
3.	General account of fossil pteridophytes–Psilopsida, Lycopsida, Sphenopsida and Pteridopsida.
4.	Evolution of stelar types in Pteridophytes. Heterospory and origin of seed habit. Evolution of the sporophyte.
<b>SECTION B: Gymnosperms</b>	
5.	The evolutionary time scale: eras, periods and epochs. General account of fossils. Types of fossil formations.
6.	Gymnosperms in comparison to ferns and seed plants. Classification of Gymnosperms and their distribution in India. Economic importance of Gymnosperms.
7.	General account of the families of Pteridospermales–Lyginopteridaceae, Meduloisaceae, Caytoniaceae; Bennettitales–Cycadeodiaceae; Pentoxylales – Pentoxylaceae; Cordaitales–Cordaitaceae.
8.	Structure and reproduction in living Gymnosperms of Cycadopsida, Coniferopsida and Gnetopsida.

**Practical**

S. No	Exhibit/Experiment
1.	Examination of the external features, anatomy and reproductive structures of <i>Psilotum</i> , <i>Lycopodium</i> , <i>Selaginella</i> , <i>Isoetes</i> and <i>Equisetum</i> .
2.	Examination of the external features, anatomy and reproductive structures of <i>Ophioglossum</i> , <i>Osmunda</i> , <i>Gleichenla</i> , <i>Cyathea</i> , <i>Marselia</i> , <i>Adiantum</i> , <i>Salvinla</i> and

	<i>Azolla</i> .
3.	Observations of the slides of the following fossil plants— <i>Rhynia</i> , <i>Lepidodendron</i> , <i>Lepidocarpon</i> , <i>Miadesmia</i> , and <i>Sphenophyllum</i> .
4.	Observations of the slides fossil Pteridophytes: <i>Calamites</i> , <i>Calamostachys</i> , <i>Zygoptera</i> and <i>Etaopteris</i> .
5.	Examination of the external features, anatomy and reproductive structures of <i>Ginkgo</i> , <i>Pinus</i> , <i>Cupressus</i> and <i>Cryptomeria</i> .
6.	Examination of the external features, anatomy and reproductive structures of <i>Araucaria</i> , <i>Ephedra</i> and <i>Gnetum</i> .
7.	Study of fossil gymnosperms from prepared slides: <i>Lyginopteris</i> , <i>Lagenostoma</i> and <i>Medullosa</i> .
8.	Study of fossil gymnosperms from prepared slides: <i>Trigonocarpus</i> , <i>Conostoma</i> , <i>Heterangium</i> , <i>Cordaites</i> .

#### Reference Books

1.	Saxena P and Pathak C. 2012. <b>A Text Book of Pteridophyta.</b> , Wisdom Press, New Delhi.
2.	Sharma OP. 2006. <b>Pteridophyta.</b> MacMillan India Ltd., New Delhi.
3.	Parihar NS. 1996. <b>Biology and Morphology of Pteridophytes.</b> Central Book Depot, Allahabad.
4.	Smith GM. 1995. <b>Cryptogamic Botany. Vol. II.</b> McGraw Hill Book Company, New York.
5.	Sporne KR. 1962. <b>The Morphology of Pteridophytes.</b> Hutchinson University Library, London.
6.	Evans AJ. 1936. <b>Morphology of Vascular Plants (Lower groups).</b> McGraw Hill Book Company, New York.
7.	Biswas C and Johri BM. 1997. <b>The Gymnosperms.</b> Narosa Publishing House, New Delhi.
8.	Bhatnagar SP and Moitra A. 1996. <b>Gymnosperms.</b> New Age International Private Limited, New Delhi.
9.	Sharma OP. 1996. <b>Gymnosperms.</b> Pragati Prakashan, Meerut.
11.	Stewart WN and Rothwell GW. 1993. <b>Paleobotany and the Evolution of Plants.</b> Cambridge University Press, USA.
12.	Singh H. 1978. <b>Embryology of Gymnosperms.</b> Gebrudev Bortraeger, Berlin.



<b>13.</b>	Arnold CA. 1974. <b>An introduction to Paleobotany.</b> McGraw Hill Book Co., Inc., New York.
<b>14.</b>	Sporne KR. 1967. <b>The Morphology of Gymnosperms.</b> Hutchinson University Library, London.
<b>15.</b>	Chamberlain CJ. 1935. <b>Gymnosperms structure and evolution.</b> University of Chicago Press, USA.



## M.Sc. Botany - Semester II

### B 204 PLANT CELL, TISSUE AND ORGAN CULTURE

#### Theory

S. No	Unit
<b>SECTION A</b>	
1.	Plant cell and tissue culture: introduction, history, scope. Basic concepts of tissue of culture: tissue culture cycle, types of cultures. Concept of cellular differentiation, totipotency.
2.	Culture media: composition and effects of media components, phytohormones – effects in tissue culture. Sterilization methods.
3.	Pathways of regeneration – biochemical and molecular aspects of tissue culture cycle.
4.	Technique and applications of cryopreservation and germplasm storage.
<b>SECTION B</b>	
5.	Organogenesis and adventitious embryogenesis. Fundamental aspects of morphogenesis, somatic embryogenesis. Methods of androgenic and gynogenic haploid production-dihaploids and application in agriculture. Embryo rescue.
6.	Cell culture: establishment, plating efficiency, induction and selection of mutants. Free cell cultures: production of secondary metabolites/natural products.
7.	Somatic hybridization: protoplast isolation, fusion and culture, hybrid selection and regeneration, possibilities, achievements, limitations, merits and demerits . Cybrids. Protoplasts in genetic transformation.
8.	Applications of plant tissue culture: clonal propagation, artificial seeds and its applications, somaclonal variation and its applications.

#### Practical

S. No	Exhibit/Experiment
1.	General out lay of plant tissue culture laboratory.
2.	Preparation of media.
3.	Callus induction – carrot.
4.	Clonal propagation through meristem cultures.
5.	Embryo culture – groundnut.
6.	Anther culture – <i>Datura</i> /tobacco.
7.	Establishment of cell cultures and determination of growth pattern.
8.	Determination of plating efficiency of cell cultures.

9.	Protoplast isolation and culture.
10.	Protoplast fusion.
11.	Observation of different developmental stages of somatic embryo in embryogenic callus.
12.	Preparation of artificial seeds.

#### Reference Books

1.	Collin HA and Edwards S. 1998. <b>Plant Cell Culture</b> . Bioscientific Publishers, Oxford, UK.
2.	Callow JA, Ford-Lloyd BV and Newbury HJ. 1997. <b>Biotechnology and Plant Genetic Resources: Conservation and Use</b> . CAB International, UK.
3.	Raghavan V. 1997. <b>Molecular Biology of Flowering plants</b> . Cambridge University press, New York, USA.
4.	Bhojwani SS and Razdan MK. 1996. <b>Plant tissue culture: Theory and Practice</b> . (A revised edition). Elsevier Science Publishers, New York, USA.
5.	Jain SM, Sopory SK and Velleux RE. 1996. <b>In Vitro Haploid production in Higher Plants. Volumes 1-5</b> . Fundamental aspects and Methods Kluwer Academic Publishers, Dordrecht, Netherlands.
6.	Vasil IK and Thorpe TA. 1994. <b>Plant Cell and Tissue Culture</b> . Kluwer Academic Publishers, Dordrecht, Netherlands.
7.	Bhojwani SS. 1990. <b>Plant Tissue Culture: Applications and Limitations</b> . Elsevier Science Publishers, New York, USA.
8.	Raghavan V. 1986. <b>Embryogenesis in Angiosperms: A Developmental and Experimental Study</b> . Cambridge University Press, New York, USA.
9.	Kartha KK. 1985. <b>Cryopreservation of Plant Cells and Organs</b> . CRC Press, Boca Raton, Florida, USA.



**M.Sc. Botany – Semester III**  
**B 301 TAXONOMY OF ANGIOSPERMS AND PLANT RESOURCES**  
**UTILIZATION AND CONSERVATION**

**Theory**

S. No	Unit
<b>SECTION A</b>	
<b>1.</b>	Origin and evolution of Angiosperms. Fossil Angiosperms. Taxonomy and Systematics. Concepts of species. Taxonomic hierarchy - species, genus, family and other categories. Principles used in assessing relationship and delimitation of taxa and attribution of rank. Plant identification. Plant nomenclature – Binomial nomenclature, ICBN. Plant collection and documentation.
<b>2.</b>	Brief analysis of the features and evolutionary tendencies noticed in the following groups: Ranales, Rosales, Centrospermae, Tubiflorae, Amentiferae, Helobiales, Liliflorae and Glumiflorae.
<b>3.</b>	Taxonomic evidences: embryology, cytology and phytochemistry. Taxonomic tools: herbaria, floras, botanical gardens, biochemical and molecular techniques, computers and GIS (Geo Information Systems). Cladistics in taxonomy. Numerical taxonomy and sero taxonomy.
<b>4.</b>	Systems of Angiosperm classification: Phenetic versus Phylogenetic system. Relative merits and demerits of major systems of classification: Takhtajan, Cronquist and Thorne. Basic concepts of Molecular Systematics: Gene sequencing, Restriction site analysis, Allozymes etc., Angiosperm Phylogeny Group (APG III) classification system, Relevance of Taxonomy to conservation, sustainable utilization of bioresources and ecosystem research.
<b>SECTION B</b>	
<b>5.</b>	World centres of primary diversity of domesticated plants. The Indo-Burmese Centre, Plant Introductions and Secondary centers. Plant explorations. Origin of agriculture.
<b>6.</b>	Origin, evolution, Botany, cultivation and uses of :

	<p>1. Food Crops : Wheat, Rice</p> <p>2. Forage Crops : <i>Sorghum</i>, Red gram</p> <p>3. Fibre Crops : Cotton, Jute</p> <p>4. Oil yielding crops : Groundnut, Coconut</p> <p>5. Medicinal and aromatic crops : <i>Catharanthus</i>, <i>Withania</i>, <i>Cymbopogon</i></p>
7.	Green Revolution: benefits and adverse consequences. Ethnobotany: Introduction, concept, objectives and scope. Plant biodiversity: Concept, status in India, utilization and concerns, conservation of wild biodiversity.
8.	Principles of conservation: Strategies for conservation, <i>In-situ</i> conservation: protected areas in India- reserves, wetlands, mangroves, <i>Ex-situ</i> conservation: principles and practices. Botanical gardens. BSI, ICAR and CSIR.

### Practical

<b>Exhibits/ Experiments/ Suggested Laboratory Exercises</b>	
<b>Taxonomy</b>	
1.	Description of a specimen from representative and locally available families.
2.	Description of a species based on various specimens to study intraspecific variation: A collective exercise.
3.	Description of various species of a genus: location of key character and preparation of keys at genetic level.
4.	Location of key characters and use of keys at family level.
5.	Field trips within and around the campus; compilation of field notes and preparation of herbarium sheets of such plants, wild or cultivated, as are abundant.
6.	Training in using floras and herbaria for identification of specimens described in the class.
7.	Demonstration of the utility of secondary metabolites in the taxonomy of some appropriate genera.
8.	Comparison of different species of a genus and different genera of a family to calculate similarity coefficients and preparations of dendrograms.

<b>Plant Resources Utilization and Conservation</b>	
<b>1.</b>	<p><b>Laboratory work:</b></p> <p>1. Food crops : Wheat, Rice</p> <p>2. Forage/fodder crops : <i>Sorghum</i>, Red gram</p> <p>3. Fiber crops : Cotton, Jute</p> <p>4. Oil yielding : Groundnut, Coconut</p> <p>5. Medicinal and Aromatic plants : <i>Catharanthus</i>, <i>Withania</i>, <i>Cymbopogon</i></p>
<b>2.</b>	<p><b>Scientific visits:</b></p> <p>The students should be taken to one of the following:</p> <p>A protected areas or Biosphere reserve or national park or sanctuary. A wetland.</p> <p>A mangrove.</p> <p>NBPGR (National Bureau of Plant Genetic Resources – New Delhi). BSI.</p> <p>CSIR</p> <p>Laboratory. FRI.</p> <p>Tropical Botanical Gardens.</p>

### Reference Books

<b>Taxonomy of Angiosperms</b>	
<b>1.</b>	Mondal AK. 2011. <b>Advanced Plant Taxonomy</b> . New Central Book Agency Pvt. Ltd., Kolkata.
<b>2.</b>	Simpson MG. 2006. <b>Plant Systematics</b> . Elsevier Academic Press, California, USA.
<b>3.</b>	Nordenstam BEI, Lazily G and Kassas M. 2000. <b>Plant systematic for 2<sup>nd</sup> Century</b> . Portland Press Ltd., London.
<b>4.</b>	Takhtajan AL. 1997. <b>Diversity and classification of Flowering Plants</b> . Columbia University Press, New York.
<b>5.</b>	Zomlefer WB. 1994. <b>A Guide to flowering plant families</b> . University of California Press, USA.
<b>6.</b>	Woodland DW. 1991. <b>Contemporary Plant Systematics</b> . Prentice Hall, New Jersey.
<b>7.</b>	Stace CA. 1989. <b>Plant Taxonomy and Biosystematics</b> .2 <sup>nd</sup> Edition. Edward Arnold Ltd., London.



8.	Jones SB Jr. and Luchsinger AE. 1986. <b>Plant Systematics</b> . 2 <sup>nd</sup> Edition. McGraw Hill Book Co., New York.
9.	Radford AE. 1986. <b>Fundamentals of Plant Systematics</b> . Harper and Row Publications, USA.
10.	Heywood VH and Moore DM. 1984. <b>Current concepts in Plant Taxonomy</b> . Academic Press, London.
11.	Davis PH and Heywood VH. 1973. <b>Principles of Angiosperms Taxonomy</b> . Robert E Kreiger Pub. Co., New York.
12.	Harrison HJ. 1971. <b>New concepts in Flowering Plant Taxonomy</b> . Hieman Educational Books Ltd., London.
13.	Jones AD and Wilbins AD. 1971. <b>Variations and Adaptations in Plant species</b> . Hieman and Co., Educational Books Ltd., London.
14.	Grant V. 1971. <b>Plant Biosystematics</b> . Academic press, London.
15.	Solbrig OT. 1970. <b>Principles and Methods of Plant Biosystematics</b> . Macmillan, London.
16.	Heslop-Harrison J. 1967. <b>Plant Taxonomy</b> . English language Books Soc. and Edward Arnold Pub. Ltd., U.K.
<b>Plant Resource Utilization And Conservation</b>	
17.	Sambamurthy AVSS and Subramanyam NS. 2000. <b>Economic Botany of Crop Plants</b> . Asiatech Publishers, Inc., New Delhi.
18.	Conway G. 1999. <b>The Doubly Green Revolution: Food for All in the 21st Century</b> . Comstock Publishing Associates, New York.
19.	Pinstrup – Anderson P. et al. 1999. <b>World Food Prospects: Critical Issues for the Early 21st Century</b> . International Food Policy Research Institute, Washington DC, USA.
20.	Kocchar SL. 1998. <b>Economic Botany of the Tropics</b> . 2nd Edition. Mac Millan India Ltd., Delhi.
21.	Plant Wealth of India 1997. Special Issue of Proceedings Indian National Science Academy B-63.
22.	Sharma OP. 1996. <b>Hills Economic Botany</b> . (Late Dr. A.F. Hill, adapted by O.P. Sharma). Tata McGraw Hill Co., Ltd., New Delhi.
23.	Frankel OH, Brown AHD and Burdon JJ. 1995. <b>The conservation of Plant Diversity</b> . Cambridge University Press, Cambridge, UK.

24.	Paroda RS and Arora RK. 1991. <b>Plant Genetic Resources Conservation and Management.</b> IPGRI (Publication) South Asia Office, C/o. NBPGR Pusa Campus, New Delhi.
25.	Swaminathan MS and Kocchar SL (ed). 1989. <b>Plants and Society.</b> Mac Millan Publication Ltd., London.
26.	Thakur RS, Puri HS and Hussain A. 1989. <b>Major Medicinal Plants of India.</b> Central Institute of Medicinal and Aromatic Plants. CSIR, Lucknow.
27.	Council of Scientific & Industrial Research 1986. <b>The useful plants of India. Publications and Information Directorate.</b> CSIR, New Delhi.
28.	Baker HG. 1978. <b>Plants and Civilization.</b> 3 <sup>rd</sup> Edition. C.A. Wadsworth, Belmont.
29.	Chrispeels MJ and Sadava D. 1977. <b>Plants, Food and People.</b> W.H. Freeman and Co., San Francisco, USA.
30.	Schery RW. 1972. <b>Plants for Man.</b> 2 <sup>nd</sup> Edition. Englewood Cliffs, New Jersey.
31.	Raw materials I - XII Revised Vol. I-III (1985-1992) supplement (2000).



## M.Sc. Botany – Semester III

### B302 PLANT REPRODUCTION

#### Theory:

Male Gametophyte: Structure of anthers; microsporogenesis; role of tapetum; pollen development, sperm dimorphism; pollen embryo sacs and compound pollen grains.

Female Gametophyte: Ovule development; megasporogenesis, organisation of the embryo sac; ultra structure of the embryo sac cells.

Pollination, Pollen-pistil interaction: Structure of the pistil; pollen-stigma interactions; Sporophytic and Gametophytic self-incompatibility, different methods to overcome self-incompatibility.

Fertilization: Pollen germination; pollen tube growth and guidance; Entry of pollen tube into the embryo sac; pollen tube discharge, syngamy and triple fusion; polyspermy and hetero fertilization.

Post-fertilisation events: Endosperm development; Types of Endosperm; Functions; Endosperm and embryo relationships.

Embryo development: Johanson and Soueges systems; Types.

Polyembryony; apomixis; parthenocarpy - outlines only.

Seed Dormancy: Seed dormancy; overcoming seed dormancy.

Outlines of Experimental Embryology – Anther culture, ovary culture, ovule culture; embryo culture; Invitro fertilisation.

Applications of Angiosperm Embryology (Agricultural, Horticultural and Taxonomic Considerations).

**Suggested Laboratory Exercises:**

Study of microsporogenesis and gametogenesis in sections of anthers.

Tests for pollen viability using stains and invitro germination.

Embryo sac development through examination of permanent, stained serial sections.

Study of nuclear and cellular endosperm through dissections and staining.

Isolation of different stages of embryo development from suitable seeds.

### **Suggested readings:**

1. Bhojwani, S.S and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4<sup>th</sup> revised and enlarged edition) Vikas Publishing House, New Delhi;
2. Leins, P., Tucker, S.C. and Endress. P.K. 1988. Aspects of Floral Development. J. Cramer, Germany;
3. Procter, M. and Yeo, P. 1973. The Pollination of Flowers. William Collins Sons, London;
4. Pulliah, T., Lakshminarayana, K. and Hanumantha Rao, B., 2008. Plant Reproduction, Scientific Publishers, Jodhpur, India;
5. Raghavan, V. 1997. Molecular Embryology of Flowering Plants. Cambridge University Press, Cambridge;
6. Raghavan, V. 1999. Developmental Biology of Flowering Plants. Springer – Verlag, New York;
7. Sedgely, M. and Griffin, A.R. 1989. Sexual Reproduction of Tree Crops, Academic Press, London;
8. Shivanna, K.R. and Swahney, V.K. (Eds.) 1997. Pollen Biotechnology for Crop Production and Improvement. Cambridge University Press, Cambridge;
9. Shivanna, K.R. and Rangaswamy, N.S. 1992. Pollen Biology, A Laboratory Manual. Springer-Verlag, Berlin;
10. Shivanna, K.R. and Johri, B.M.1985. The Angiosperm Pollen Structure and Function, Wiley Eastern Ltd., New Delhi;
11. The Plant Cell. Special Issue on Reproductive Biology of plants, Vol.5 (10) 1993. The American Society of Plant Physiologists, Rockville, Maryland, USA.



**M.Sc. Botany - Semester III**

**B 303 PLANT ECOLOGY**

**Theory**

<b>S. No</b>	<b>Unit</b>
<b>SECTION A</b>	
1.	The environment: physical environment, biotic environment and abiotic environment. Ecology and human welfare. Climate, soil and vegetation patterns of the world: life zones, major biomes, vegetation and soil types of the world.
2.	Habitat and niche: concept of habitat and niche, niche width and overlap, fundamental and realized niche, resource partitioning, character displacement.
3.	Population Ecology: characteristics of a population, population growth curves, population regulation, life history strategies (r and k selection), concept of meta population, demes and dispersal, interdemec extinctions, age structured population.
4.	Species interactions: types of interactions, interspecific competition, herbivory, carnivory. Ecological succession: types, mechanisms, changes involved in succession, concept of climax. Hydrosere and Xerosere
<b>SECTION B</b>	
5.	Community ecology: nature of communities, community structure and attributes, levels of species diversity and its measurement, edges and ecotones, community classification.
6.	Ecosystem: structure and function. Energy dynamics. Mineral cycling (carbon, nitrogen and phosphorus). Primary production and decomposition. Structure and function of some Indian ecosystems– Terrestrial (forest, grassland) and aquatic (fresh water, marine, estuarine).
7.	Biogeography: Major terrestrial biomes. Theories of island biogeography. Biogeographical zones of India.
8.	Applied ecology: Environmental pollution – air, water and soil, kinds, sources, quality parameters. Effects on plant ecosystems. Climate change – green house gases, ozone layer and ozone hole, consequences of climate change. Methods for mitigation of climate change: physical, chemical and biological. Biodiversity status, monitoring and documentation, major drivers of biodiversity change, biodiversity management approaches. Conservation biology: principles of conservation, major approaches to management. Indian case studies on



conservation, management strategy (Biosphere reserves, Project tiger).

### Practical

#### Exhibits/ Experiments/ Suggested Laboratory Exercises

<b>1.</b>	To study the stratification of plants in botanical gardens.
<b>2.</b>	To prepare life forms of botanical gardens of college campus. Compare the biological spectrum of college campus with normal biological spectrum.
<b>3.</b>	To estimate the frequency of plants in the college campus.
<b>4.</b>	To estimate the relative frequency of plants in the college campus.
<b>5.</b>	To estimate the density of a plant species in the college campus.
<b>6.</b>	To estimate the relative density of a plant species in college campus.
<b>7.</b>	To determine the minimal size and number of quadrats required for reliable estimate of biomass in grass land.
<b>8.</b>	To determine the basal area of a plant species in the campus.
<b>9.</b>	To determine the important value index (IVI) of plant species in the campus.
<b>10.</b>	To estimate IVI of the plant species in a woodland using point center quarter methods.
<b>11.</b>	To determine plant diversity indices (Shamon - Wiener) continuum of dominance, species richness, equitability and biodiversity of species in the campus.
<b>12.</b>	To estimate rate of carbon dioxide evolution from different soils using soda lime or alkali absorption method.
<b>13.</b>	To study environmental impact of a given developmental activity using check list as a EIA method.
<b>14.</b>	Enumeration in pond ecosystems.
<b>15.</b>	To study the composition of woodland ecosystem.
<b>16.</b>	Demonstration of chemical energy stored in leaves which was the transformed from radiation energy.
<b>17.</b>	Estimation of biomass of cropland plots.

<b>18.</b>	Estimation of chlorophyll.
<b>19.</b>	Determination of leaf area index methods with plain graph sheets.
<b>20.</b>	To determine the water holding capacity of soil collected from different locations

#### Reference Books

<b>1.</b>	American Public Health Association American Water Works Association. 2013. <b>Standard Methods for the Examination of Water and Waste Water.</b> General Books LLC, USA.
<b>2.</b>	Sharma PD. 2007. <b>Ecology and Environment.</b> Rastogi Publications, Meerut.
<b>3.</b>	Sharma PD. 2001. <b>Ecology and Environment.</b> Rastogi Publications, Meerut.
<b>4.</b>	Smith RL. 1996. <b>Ecology and field Biology.</b> Harper Collins, New York.
<b>5.</b>	Sokal RR and Rohit FJ. 1995. <b>Biometry.</b> W.H. Freeman and Co., New York.
<b>6.</b>	Batra NK. 1992. <b>Treatise on Plant Ecology.</b> Pradeep Publications, Delhi.
<b>7.</b>	CJ. 1989. <b>Ecological Methodology.</b> Harper and Row, New York, USA.
<b>8.</b>	Ludwig JA and Reynolds JF. 1988. <b>Statistical Ecology.</b> Wiley, New York.
<b>9.</b>	Magurran AE. 1988. <b>Ecological Diversity and its measurement.</b> Croom Helm, UK.
<b>10.</b>	Moore PD and Chapman SB. 1986. <b>Methods in Plant Ecology.</b> Blackwell Scientific, Oxford, UK.
<b>11.</b>	Pielow EC. 1984. <b>The interpretation of Ecological Data.</b> John and Wiley Sons, USA.
<b>12.</b>	Muller – Dombois D and Ellenberg H. 1974. <b>Aims and Methods of Vegetation Ecology.</b> Blackburn Press, New Jersey.
<b>13.</b>	Odum PE. 1971. <b>Fundamentals of Ecology.</b> 3 <sup>rd</sup> Edition. W. B. Saunders, Philadelphia.
<b>14.</b>	Dansemmire RF. 1968. <b>Plant Communities.</b> Horpes and Row, New York.
<b>15.</b>	Misra R. 1968. <b>Ecology Work Book.</b> Oxford and IBH Publishing Co., New Delhi.
<b>16.</b>	Ambasht RS and Ambasht NK. <b>A Text Book Plant Ecology.</b> CBS Publishers and distributors, New Delhi.



**M.Sc. Botany – Semester III**  
**B 304 PLANT PHYSIOLOGY**

**Theory**

S. No	Unit
<b>SECTION A</b>	
<b>1.</b>	Plant water relations: free energy and chemical potential, osmotic potential, water potential and its determination, active and passive absorption of water, stomatal physiology and mechanisms of stomatal opening and closing, Soil-plant-atmosphere-continuum concept (SPAC), mechanism of water transport.
<b>2.</b>	Mineral nutrition: passive and active uptake of ions, translocation of minerals in plants, essential elements: their functions and symptoms of mineral deficiency, importance of foliar nutrition and use of chelates in agriculture, root microbe interactions in facilitating nutrient uptake, mechanism of assimilate translocation.
<b>3.</b>	The flowering process: phytochrome: structure, photochemical and biochemical properties, role in photomorphogenesis. Photoperiodism and its significance, mechanisms of floral induction. Vernalization. Morphological, biochemical and metabolic changes accompanying seed germination.
<b>4.</b>	Plant growth regulators and elicitors: biosynthesis, physiological effects and mechanism of action of auxins, gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, polyamines, jasmonic acid and salicylic acid. Role of plant growth regulators in agriculture. Hormone receptors.
<b>SECTION B</b>	
<b>5.</b>	Fundamental of Enzymology: General aspects, allosteric mechanism, regulatory and active sites, isozymes, kinetics of enzymatic catalysis, Michaelis-Menten Equation and its significance, Mechanism of enzyme action.
<b>6.</b>	Photochemistry and Photosynthesis: General concepts and historical back ground, evolution of photosynthetic apparatus, Redox reactions, photosynthetic pigments and light harvesting complexes, photo-oxidation of water, mechanisms of electron and proton transport, structure, synthesis and function of ATP, carbon assimilation-the Calvin's cycle, photorespiration and its significance, the C <sub>4</sub> cycle and CAM pathway, biosynthesis of starch and sucrose, physiological and ecological considerations.
<b>7.</b>	Respiration and Lipid metabolism : Plant respiration, glycolysis, the TCA cycle, electron

	transport and ATP synthesis, pentose phosphate pathway, glyoxylate cycle, alternative oxidase system, structure and function of lipids, fatty acid biosynthesis of membrane lipids, structural lipids and storage lipids and their catabolism. Nitrogen fixation and nitrogen metabolism: Biological nitrogen fixation, nodule formation and nod factors, biosynthesis of amino acids and proteins, mechanism of nitrate uptake and reduction.
<b>8.</b>	Stress Physiology: Plant responses to biotic and abiotic stress, mechanisms of biotic and abiotic stress tolerance, water deficit and drought resistance, salinity stress, metal toxicity, heat stress and oxidative stress.

### **Practical**

<b>Exhibits/ Experiments/ Suggested Laboratory Exercises</b>	
<b>1.</b>	Determination of osmotic potential.
<b>2.</b>	Determination of water potential.
<b>3.</b>	Demonstration of osmosis.
<b>4.</b>	Determination of root pressure.
<b>5.</b>	Effects of high and low temperatures upon the permeability of the cytoplasmic membranes.
<b>6.</b>	Determination of suction force due to transpiration.
<b>7.</b>	Stomatal frequency and stomatal index of leaves.
<b>8.</b>	Rate of transpiration in leaves by cobalt chloride paper method.
<b>9.</b>	Determination of amylase activity
<b>10.</b>	Extraction and separation of chloroplast pigments by paper chromatographic method
<b>11.</b>	Determine chlorophyll a / chlorophyll b contents in C <sub>3</sub> and C <sub>4</sub> plants by spectrophotometric method
<b>12.</b>	Determination of Hill reaction
<b>13.</b>	Determination of rate of Aerobic respiration by continuous current method
<b>14.</b>	Determination of rate of Anaerobic respiration by continuous current method
<b>15.</b>	Determination of catalase activity
<b>16.</b>	Demonstration of Polyphenol oxidase
<b>17.</b>	Determination of reducing sugars

18.	Estimation of free acids in Bryophyllum in terms of milliequivalents of NaOH
19.	Extraction and estimation of seed proteins depending upon the solubility
20.	SDS – PAGE for soluble proteins extracted from the given plant materials
21.	Separation of isozymes esterase, peroxidase by native polyacrylamide gel electrophoresis
22.	Effect of Light quality on the rate of Photosynthesis
23.	Effect of CO <sub>2</sub> concentration on the rate of Photosynthesis
24.	Estimation of Starch by gravimetric method
25.	Demonstration of Starch hydrolysis
26.	Separation of Chloroplast pigments by chemical method
27.	Separation of amino acids and carbohydrates through two dimensional chromatographic method

#### Reference books

1.	Sinha SK 2014. <b>A text book of Plant Physiology</b> . Centrum Press, New Delhi.
2.	Seema Yadav 2014. <b>Plant Physiology</b> . SBW publishers, New Delhi.
3.	Heribert H and Kazuo S (eds) 2010. <b>Plant responses to abiotic stress. Series Topics in Current Genetics, Vol 4</b> . Springer, Berlin.
4.	Philip Stewart and Schine Gobig 2011. <b>Plant Physiology</b> . CRC Press.
5.	Moore TC. 2011. <b>Biochemistry and Physiology of Plant Hormones</b> . Springer, New York.
6.	Hooykaas PJJ, Hall MA and Libbenga KR (ed) 1999. <b>Biochemistry and Molecular Biology of Plant Hormones</b> . Elsevier, Amsterdam, Netherlands.
7.	Taiz L and Zeiger E. 1998. <b>Plant Physiology</b> . 2 <sup>nd</sup> Edition. Sinauer Associates including Publishers, Massachusetts, USA.
8.	Wisthoff P. 1998. <b>Molecular Plant Development from Gene to Plant</b> . Oxford University Press, Oxford, UK.
9.	Thomas and Vince – Prue D. 1997. <b>PhotoPeriodism in Plants</b> . 2 <sup>nd</sup> Edition. Academic Press, Sandeigo, USA.
10.	Hopkins WG. 1995. <b>Introduction to Plant Physiology</b> . John Wiley & Sons Including New York, USA.
11.	Mohr H and Schopfer P. 1995. <b>Plant Physiology</b> . Springer-Verlag, New York.

12.	Salisbury FB and Ross CW. 1992. <b>Plant Physiology</b> . 4 <sup>th</sup> Edition. Wordsworth Publishing Company, California, USA.
13.	Noggle GR and Fritz GJ. 1991. <b>Introductory plant physiology</b> . 2 <sup>nd</sup> Edition. Prentice hall of India Limited, New Delhi.
14.	Davies PJ (ed) 1987. <b>Plant hormones and their role in Plant Growth and Development</b> . Mertinus Nijhoff Publishers, Netherlands.
15.	Witham FH and Devlin RM. 1986. <b>Plant Physiology</b> . CBS Publishers and Distributors, Bangalore.
16.	Wilkins MD. 1987. <b>Advanced Plant Physiology</b> . English Language Book Society, Longman Scientific and Technical, Harlow, UK.
17.	Bewley JD and Black M. 1982. <b>Physiology and Biochemistry of seed in relation to germination and dormancy. Volume 1 and 2</b> . Springer – Verlag, Berlin.
18.	Khan AA. 1982. <b>The Physiology and Biochemistry of Seed Development, Dormancy and Germination</b> . Elsevier, Amsterdam, Netherlands.
19.	Ting IP. 1982. <b>Plant Physiology</b> . Addison-Wesley, Reading, MA.
20.	Murthy HNK. 1981. <b>Plant growth substances including applications in Agriculture</b> . Tata McGraw Hill Publishing Company Ltd., New Delhi.
21.	Kramer PM and Kozlowski TT. 1980. <b>Physiology of Woody Plants</b> . Academic Press, New York.
22.	Hewitt EJ and Smith TA. 1975. <b>Plant Mineral Nutrition</b> . English University Press,
23.	Meyer AM and Poljakoff-Mayber A. 1975. <b>The germination of Seeds</b> . Pergamon Press, Canada.
24.	Hess D. 1974. <b>Plant Physiology</b> . Narosa Publishing House, New Delhi.
25.	Audus LJ. 1972. <b>Plant Growth Substances. Volume 1</b> . Chemistry and Physiology. Leonard Hill, UK.
26.	Slayter RO. 1967. <b>Plant Water Relationships</b> . Academic Press, London
27.	Hillman WS. 1963. <b>Physiology of Flowering</b> . Holt, Reinhart and Winston, New York.





## M.Sc. Botany - Semester IV

### B 401 GENETIC ENGINEERING OF PLANTS AND MICROBES

#### Theory

S.No	Unit
<b>SECTION A</b>	
1.	Basics of rDNA technology: restriction enzymes–types, nomenclature, mechanism of action. Methodology of rDNA molecule synthesis–joining overlapping ends, blunt end joining, polylinkers. Vectors–features. Cloning vectors– plasmids, viral DNA, cosmids, bacterial and yeast artificial chromosomes(BACs and YACs). Expression vectors.
2.	Bacterial transformation. <i>In-vitro</i> packaging. Recognition of transformants–antibiotic resistance, <i>Lac Z</i> gene based selection. Genomic library, cDNA library.
3.	Methods of gene transfer in plants: electroporation, gene gun, <i>Agrobacterium</i> mediated– binary and co integrative vector based. Chloroplast transformation.
4.	Classical examples of successful cases of transgenic plants– fungal, bacterial, viral and insect tolerance (BT and proteinase inhibitors), herbicide tolerance, abiotic stress tolerance, male sterility– Barnase-Barstar. Quality improvement –golden rice, late ripening tomatoes (Flavr Savr).
<b>SECTION B</b>	
5.	Techniques in genetic engineering I: Blotting techniques– Southern, Northern and Western blotting, radioactive and non-radioactive labeling, detection of hybridization. <i>In-situ</i> hybridization– technique, radioactive and non-radioactive probes, enzyme and fluorescence detection methods (FISH), applications of the technique. PCR– technique, types, applications. DNA sequencing– basic principle of Sanger’s method, automated DNA sequencing, high throughput DNA sequencing.
6.	Techniques in genetic engineering II: DNA fingerprinting–hybridization based (RFLP), PCR based (RAPD, AFLP). Restriction mapping. Microarray technique and its applications. Sequencing genomes–whole genome sequencing, shot gun sequencing. Next generation sequencing– 454 sequencing.
7.	Plant growth promoting bacteria – nitrogen fixers, siderophores, phytohormone production. Genetic improvement of industrially important microbes for production of useful products – biopesticides, biofertilizers, antibiotics. Intellectual Property Rights, farmer’s rights. Patents. Ethical and environmental issues in genetic engineering.

8.	Bioinformatics: Scope. Data bases– types, Genbank, PIR, PDB. An account of NCBI. Web based tools for sequence searches –BLAST. Genome projects, genome annotation, gene annotation, features of the genome of <i>Arabidopsis</i> , rice. Genomics– structural genomics, comparative genomics, functional genomics. Molecular phylogeny and phylogenetic trees. Metagenomics.
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#### **Practicals**

S. No	Exhibit/Experiment
1.	Isolation of plasmid DNA
2.	Bacterial transformation and identification of transformation
3.	Plant DNA isolation
4.	Restriction enzyme digestion and gel electrophoresis
5.	Assignments on the syllabus
6.	Pictorial demonstration of the various techniques

#### **Reference Books**

1.	Glick BR, Pasternak JJ and Patten CL. 2010. <b>Molecular Biotechnology Principles and Applications of rDNA</b> . ASM Press, USA.
2.	Attwood TK, Smith DJP and Phukan S. 2009. <b>Introduction to Bioinformatics</b> . Pearson Education Ltd., UK.
3.	Sateesh MK. 2008. <b>Bioethics and Biosafety</b> . I K International Pvt. Ltd., Bangalore.
4.	Channarayappa. 2007. <b>Molecular Biotechnology Principles and practices</b> . Taylor and Francis, UK.
5.	Watson JD. 2007. <b>Recombinant DNA: Genes and Genomes: A short course</b> . W. H. Freeman, USA.
6.	Primrose SB and Twyman RM. 2006. <b>Principles of Genome Analysis and Genomics</b> . Blackwell publishers, USA.
7.	Lewin B. 2004. <b>Genes VIII</b> . Pearson Prentice Hall, New Jersey.
8.	Chawla HS. 2002. <b>Introduction to Plant Biotechnology</b> . Oxford and I B H Publishers, USA.



**M.Sc. Botany – Semester IV**  
**B 402 EVOLUTION AND PLANT BREEDING**

**Theory**

S. No	Unit
<b>SECTION A</b>	
<b>1.</b>	Origin of life and unicellular evolution: Origin of basic biological molecules, abiotic synthesis of monomers and polymers , concept of Oparin and Haldane, experiment of Miller (1953). The first cell – evolution of prokaryote, RNA world. Origin of eukaryotic cells– Endosymbiont theory, evolution of unicellular eukaryotes, anaerobic and aerobic metabolism.
<b>2.</b>	Theories of organic evolution: Lamarckism, Darwinism–concepts of variation, adaptation, struggle, fitness and natural selection, Synthetic theory, phyletic gradualism, punctuated equilibrium, concepts of neutral evolution.
<b>3.</b>	Molecular evolution: molecular divergence and molecular clocks–protein and nucleotide sequence analysis, gene duplication and divergence. Hardy-Weinberg equilibrium and its applications.
<b>4.</b>	Plant breeding: history, objectives, activities, important achievements and undesirable consequences. Organizations for crop improvement in India: ICAR, Agricultural universities, Central institutes for crop improvement, All India coordinated programmes. Plant Introduction, domestication and acclimatization.
<b>SECTION B</b>	
<b>5.</b>	Methods of breeding self pollinated crops: Mass selection, Pureline selection, Pedigree method, Bulk method, Backcross method, Multiline varieties.
<b>6.</b>	Methods of breeding cross pollinated plants: Bulk Selection, Recurrent selection, Synthetic varieties, Hybridization. Inbreeding depression and Heterosis – genetic and molecular basis.
<b>7.</b>	Breeding of vegetatively propagated crops. Role of apomixis in plant breeding. Mutation breeding.
<b>8.</b>	Biostatistical methods: basic concept of parametric and non-parametric methods. Graphical representation. Measures of central tendency and dispersion. Probability distributions–Binomial, Poisson and Normal distributions. Concepts of confidence intervals, types of error, levels of significance. Regression and correlation; t-test. ANOVA. Basic introduction to multivariate statistics.

### Practical

1.	Problems based on Hardy Weinberg law
2.	Line diagrams showing the plan of different methods of breeding self pollinated crops- Mass selection, Pureline selection, Pedigree method,
3.	Line diagrams showing the plan of different methods of breeding cross pollinated crops- Bulk Selection, Recurrent selection.
4.	Methods of hybridization in rice, sorghum, bajra, cotton in standing crop in the field.
5.	Assignments with problems for computing measures of central tendency and dispersion- mean, median and mode, standard deviation and standard error.
6.	Assignment with problems for computing correlation and regression coefficients.
7.	Assignment with problems for implementing t test.
8.	Assignment with problems for computing ANOVA.

### References

1.	Singh BD. 2012. <b>Plant Breeding: Principles and Methods</b> . Kalyani Publishers, Delhi.
2.	Stickberger MW. 1985. <b>Genetics</b> . McMillan, New York.
3.	Frey KJ. 1981. <b>Plant Breeding II</b> . Iowa State University Press, Oxford.
4.	Jones DA and Wilkins DA. 1971. <b>Variation and adaptation in plant species</b> . Heinemann Educational Books Ltd., London.
5.	Stebbins GL. 1971. <b>Chromosomal evolution in Higher Plants</b> . Edward Arnold Publishers Ltd., London.
6.	Poehlman JM and Borthakur D. 1969. <b>Breeding Asian field crops: With Special Reference to Crops of India</b> . Oxford and IBH Pub. Co., Delhi.
7.	Briggs FN and Knowles PF. 1967. <b>Introduction to Plant Breeding</b> . Reinhold Pub. Corp., New York.
8.	Brewbaker JL. 1964. <b>Agricultural Genetics</b> . Prentice-Hall, New Jersey, USA.
9.	Allard RW. 1961. <b>Principles of Plant Breeding</b> , 2 <sup>nd</sup> Edition. John Wiley and Sons Inc., New York.



**M.Sc. Botany - Semester IV**

**B 403 PLANT PATHOLOGY**

**Theory**

<b>S. No</b>	<b>Unit</b>
<b>SECTION A</b>	
<b>1.</b>	Importance of plant diseases, classification of plant diseases, causes of plant diseases, symptoms of plant diseases, post harvest diseases. Dispersal of plant pathogens- active and passive.
<b>2.</b>	Infection phenomena – pre penetration, penetration and post penetration. Factors affecting infection. Effect of environment on plant disease development – temperature, humidity and light.
<b>3.</b>	Molecular basics of host pathogen interactions (fungi, bacteria & viruses) and genetic engineering for disease resistance. Defense mechanisms in plants: pre-and post-infectious defense mechanisms, phytoalexins.
<b>4.</b>	Role of enzymes in plant diseases – pectic, macerating, cellulolytic, lignolytic, proteolytic, lypolytic enzymes and hemicellulases, inactivation of enzymes.
<b>SECTION B</b>	
<b>5.</b>	Role of toxins in plant diseases – Phytotoxins, vivo toxins, host specific patho toxins & non specific patho toxins.
<b>6.</b>	Control of plant diseases: Cultural practices: field & crop sanitation, crop rotation; Chemical control: systematic & non systematic fungicides; Biological control. microbial pesticides.  Plant diseases management through host resistance: vertical, horizontal, monogenic, polygenic, specific & general resistance. Development of resistant varieties.
<b>7.</b>	Symptoms, etiology, epidemiology & control measures with reference to the following:  Fungal diseases – Club root of crucifers, Damping off of seedlings. Leaf spot of

	turmeric, Ergot of bajra, Powdery mildew of Cucurbits, Whip smut of sugarcane, Grain smut of <i>Sorghum</i> , Bean rust, Coffee rust, Blast disease of rice, Wilt of cotton, Tikka disease of ground nut.
8.	Bacterial diseases – Citrus Canker, Angular leaf spot of cotton, Bacterial leaf Blight of rice, Brown rot of potatoes. Viral and phytoplasma diseases – Grassy shoot diseases of sugarcane, Little leaf of brinjal, Rice tungro.

### Practical

S. No	Exhibits/ Experiments
1.	Study of symptoms, microscopic examination of diseased parts and identification of the pathogens involved in different plant diseases  Fungal diseases–Club root of crucifers, Damping off of seedlings. Leaf spot of turmeric, Ergot of bajra, Powdery mildew of Cucurbits, Whip smut of sugarcane, Grain smut of <i>Sorghum</i> , Bean rust, Coffee rust, Blast disease of rice, Wilt of cotton, Tikka disease of ground nut.  Bacterial diseases–Citrus Canker, Angular leaf spot of cotton, Bacterial leaf Blight of rice, Brown rot of potatoes.  Viral and phytoplasma diseases – Grassy shoot disease of sugarcane, Little leaf of brinjal, rice tungro.
2.	Isolation of fungal pathogens from leaves.
3.	Isolation of fungal pathogens from soil.
4.	Extraction of pectolytic enzymes from a pathogen.
5.	Extraction of cellulase enzyme from a pathogen.
6.	Isolation of plant pathogen– bacteria.
7.	Isolation (purification) of plant viruses.

### Reference Books

1.	Ravichandra NG. 2013. <b>Fundamentals of Plant Pathology</b> . PHI Learning Pvt. Ltd., Delhi.
2.	Ronald PC. 2007. <b>Plant-Pathogen Interactions: Methods in Molecular Biology</b> . Humana Press, New Jersey.



3.	Mehrotra RS.2006. <b>Plant pathology</b> . Tata McGraw Hill Publishing Co. Ltd., New Delhi.
4.	Sharma PD. 2004. <b>Plant pathology</b> . Rastogi Publications, New Delhi.
	Bilgrami S and Dubey HC. 1998. <b>A text book of modern Plant pathology</b> . Sangam Books Ltd., Mumbai.
5.	Stacey G and Keen TN. (ed). 1996. <b>Plant Microbe Interactions. Vols. I-III</b> . Chapman and Hall, New York; <b>Vol. IV</b> . APS Press, St. Paul, Minnesota.
6.	Singh RS. 1990. <b>Plant diseases</b> . Oxford and IBH Publishing Co., New Delhi.
7.	Butler EJ. 1973. <b>Fungi and diseases in plants</b> . Periodical Expert Book Agency, Delhi.
8.	Roberts D and Boothroyd CW. 1973. <b>Fundamentals of Plant pathology</b> . W. H. Freeman and Co., Ltd., New York.
9.	Rangaswamy G. 1972. <b>Disease of crop plants in India</b> . Prentice Hall of India, New Delhi.
10.	Strobell GA and Mathre DE. 1970. <b>Outline of Plant pathology</b> . D. Van Nostrand-Reinhold Co., New York.
11.	Matthews REF. 1970. <b>Plant virology</b> . Academic Press, New York.
12.	Agrios GN. 1969. <b>Plant Pathology</b> . Academic Press, New York.
13.	Walker JC. 1969. <b>Plant pathology</b> . McGraw Hill Book Co., New York.
14.	Wheeler BEJ.1969. <b>An introduction of Plant diseases</b> . John Wiley and Sons Ltd., New York.
15.	Smith KM. 1968. <b>Plant viruses</b> . Methuen, London.
16.	Mundkar BB.1967. <b>Fungi and Plant diseases</b> . McMillan and Co. Ltd., Calcutta.
17.	Wood RKS.1967. <b>Physiological Plant Pathology</b> . Blackwell Scientific Publications, Oxford.
18.	Kelman A. 1967. <b>Source Book of Laboratory Exercise in Plant Pathology</b> . W. H. Freeman, New York.
19.	Rangaswamy G. 1962. <b>Bacterial Plant Diseases in India</b> . Asia Publishing House,

	Bombay.
<b>20.</b>	Horsfall JC and Diamond AE.1960. <b>Plant Pathology – An Advanced Treatise – 3 volumes.</b> Academic Press, New York.
<b>21.</b>	Goodman et al.1957. <b>Biochemistry and Physiology of Infections and Plant Diseases.</b> Princeton, Van Nostrand, Belgium.
<b>22.</b>	Plank JEV.1953. <b>Plant Diseases – Epidemics and Control.</b> Academic Press, New York.



**M.Sc. Botany - Semester IV**  
**B 404 CROP PHYSIOLOGY AND BIOTECHNOLOGY**

**Theory**

S. No	Unit
<b>SECTION A</b>	
1.	Crop Physiology: Molecular biology of light reactions. Photosynthetic pathways.
2.	Mechanism of Photorespiration. Biotechnological strategies to improve photosynthesis, yield components. Source – sink relationships.
3.	Stress Physiology: Physiology and molecular biology of stress tolerance in response to water, salt and heavy metal stress.
4.	Methods in biotechnology: Tissue culture techniques in crop improvement, Protoplasts and cell fusion.
<b>SECTION B</b>	
5.	Recombinant DNA technology: basic principles of recombinant DNA technique. Techniques of transferring genes into plants.
6.	Potentials of Biotechnology: Molecular mechanism to confer herbicide resistance in crop plants. Genetic engineering to improve plant disease resistance.
7.	Genetic manipulation of crops for insect resistance, Genetic engineering of seed proteins and oils.
8.	Bioinformatics: Fundamentals of Genomics and Proteomics. PCR and its application in crop improvement, Principles of microarray technology and its applications.

**Practical**

S. No	Exhibit/Experiment
1.	Exercise-1: Chlorophyll absorption spectrum and quantitative determinations, assay of Hill reaction in isolated chloroplast. Crop growth analysis.
2.	Exercise-2: Determination of CO <sub>2</sub> compensation points in some crop plants, Estimation of carbohydrate, protein and nucleic acid contents in plants.
3.	Exercise-3: Determination of the activities of some enzymes associated with Carbohydrates and protein metabolism.
4.	Exercise-4: Effect of nitrogen and potassium on the growth and yield of crop plants.
5.	Exercise-5: Leaf anatomy in relation to diversity in photosynthetic pathways.
6.	Exercise-6: Effect of water and salt stress on the accumulation of proteins.
7.	Exercise-7: Estimation of nitrogen, phosphorus and potassium.

8.	Exercise-8: Experiments to study the effect of water and salt stress on seed germination and seedling development.
9.	Exercise-9: Experiments to study the weed control using some common herbicides.
10.	Exercise-10: Polyacrylamide gel electrophoresis of proteins.
11.	Exercise-11: Isolation of DNA.
12.	Exercise-12: Polymerase chain reaction.
13.	Exercise-13: Isolation of explants, establishment and maintenance of callus; Sub-culture of callus. Study of Somaclonal variation.
14.	Exercise-14: Isolation and culture of single cells.
15.	Exercise-15: Experiments on herbicide resistance and disease resistance in plants.

#### Reference Books

1.	Lebowitz RJ. 1995. <b>Plant Biotechnology, a laboratory manual</b> . Wm. C. Brown Publishers, Qubuque.
2.	Murray Meo – young. 1995. <b>Comprehensive Biotechnology. Vol . 1</b> . Pergamon Press Oxford.
3.	Marshall G and Walters O (ed) 1994. <b>Molecular Biology in Crop Protection</b> . Champman and Hall.
4.	Old RW and Primrose SB. 1994. <b>Principles of gene manipulation</b> . Blackwell Science.
5.	Salunkhe DK, Bhatt NR and Desai BB. 1990. <b>Post Harvest Biotechnology of Flowers and Ornamental Plants</b> . N. Bayopokash, Calcutta
6.	Davies KE. (ed) 1988. <b>Genome Analysis</b> . IRI Press, Oxford.
7.	Pierik RIM. 1987. <b>Invitro Culture of Higher Plants</b> . Martinus Nihoff Publishers Dordrecht.
8.	Primrose SB. 1987. <b>Molecular Biotechnology</b> . Blackwell Scientific Publications,
9.	Day PR. 1986. <b>Biotechnology and Crop Improvement and Protection</b> . BCPC Publications.
10.	Mantell SH and Smith N (ed) 1983. <b>Plant Biotechnology</b> . Cambridge University Press, Cambridge.
11.	Noggle GR and Fritz GJ. 1977. <b>Introductory plant physiology</b> .
12.	Reinert J and Bajaj YPS. 1977. <b>Plant Cell, Tissue and Organ Culture</b> . Springer – verlag, Berlin.
13.	Lange OI, Kappen L and Schule DD. 1976. <b>Water and Plant Life</b> .

<b>14.</b>	Burris RH and Black CC (ed) 1975. <b>CO<sub>2</sub> Metabolism and Productivity of Plants.</b>
<b>15.</b>	Evans IT. 1975. <b>Crop Physiology.</b>
<b>16.</b>	Major AM and Mayber P. 1975. <b>The germination of seeds.</b> 2 <sup>nd</sup> Edition.
<b>17.</b>	Mayber PA and Gele J. (ed) 1975. <b>Plants in Saline Environments.</b>
<b>18.</b>	Ashston and Crafts A. 1973. <b>Mode of Action of Herbicides.</b>
<b>19.</b>	Epstein E. 1972. <b>Mineral Nutrition of Plants: Principles and Perspectives.</b>
<b>20.</b>	Fogg GK. 1972. <b>Photosynthesis.</b>
<b>21.</b>	Hillman WS. 1972. <b>The Physiology of Flowering</b>
<b>22.</b>	Kozlowski TT. (ed) 1972. <b>Seed Biology. 3 Vols.</b>
<b>23.</b>	Levitt J. 1972. <b>Response of Plants to Environmental Stresses.</b>
<b>24.</b>	Hatch MD, Osmond CB and Slatyer RO (ed) 1971. <b>Photosynthesis and Photorespiration.</b>
<b>25.</b>	Gregory RPF. 1971. <b>Biochemistry of Photosynthesis.</b>
<b>26.</b>	Zelitch I. 1971. <b>Photosynthesis, Photorespiration and Plant Productivity.</b>
<b>27.</b>	Gollek B. (ed) 1970. <b>Structure and Function of Plant Cells in Saline Habitats.</b>
<b>28.</b>	Kozlowski TT. (ed) 1968. <b>Water Deficit and Plant Growth.</b>
<b>29.</b>	<b>Annual Review of Plant Physiology.</b> 1950. Vol. – Annual Reviews Inc., Stanford.

**M.Sc. Botany – Semester I**  
**B101: BIOLOGY AND DIVERSITY OF ALGAE AND BRYOPHYTES**  
**Theory**

S. No	Unit
<b>SECTION A</b>	
1.	Criteria employed in classification of algae. Classification given by Fritsch, Bold and Wynne, Lee. Thallus organization, reproduction and life cycles in algae.
2.	Range of thallus structure, reproduction, life histories of Chlorophyceae with special reference to the genera: <i>Chlamydomonas</i> , <i>Tetraspora</i> , <i>Volvox</i> , <i>Chlorella</i> , <i>Scenedesmus</i> , <i>Ulva</i> , <i>Enteromorpha</i> , <i>Cladophora</i> , <i>Fritschiella</i> , <i>Oedogonium</i> , <i>Spirogyra</i> , <i>Cosmarium</i> , <i>Caulerpa</i> , <i>Chara</i> .
3.	Salient features of Protochlorophyta; Xanthophyta: <i>Vaucheria</i> . Bacillariophyta: <i>Cyclotella</i> , <i>Navicula</i> ; Phaeophyta: <i>Ectocarpus</i> , <i>Dictyota</i> , <i>Padina</i> , <i>Laminaria</i> , <i>Sargassum</i> .
4.	Salient features of Rhodophyta: <i>Gelidium</i> , <i>Gracilaria</i> , <i>Polysiphonia</i> ; Cyanophyta: <i>Nostoc</i> , <i>Lyngbya</i> , <i>Spirulina</i> .
<b>SECTION B</b>	
5.	Diversity of marine and fresh water algae in India. Economic importance of algae– single cell protein, pigments, lipids, and omega fatty acids. Algal blooms. Algal bio fertilizers. Cultivation of economically important seaweeds– <i>Porphyra</i> , <i>Gracilaria</i> , <i>Gelidium</i> . Mass culture of micro algae.
6.	Classification of Bryophytes given by Smith, Campbell. Ecological and economic importance of Bryophytes. Conduction in Bryophytes.
7.	Morphology, structure, reproduction and life history of Hepatocopsida: Marchantiales: <i>Marchantia</i> ; Jungermaniales: <i>Pellia</i> , <i>Porella</i> ; Anthocertopsida: <i>Anthoceros</i> .
8.	Morphology, structure, reproduction and life history of Bryopsida: Sphagnales: <i>Sphagnum</i> ; Funariales: <i>Funaria</i> ; Polytrichales: <i>Polytrichum</i> .

**Practical**

S. No	Exhibit/Experiment
1.	Examination of vegetative and reproductive morphology of Chlorophyceae: <i>Chlamydomonas</i> , <i>Tetraspora</i> , <i>Volvox</i> , <i>Chlorella</i> , <i>Scenedesmus</i> , <i>Ulva</i> , <i>Enteromorpha</i> , <i>Cladophora</i> , <i>Fritschiella</i> , <i>Oedogonium</i> , <i>Spirogyra</i> , <i>Cosmarium</i> , <i>Caulerpa</i> , <i>Chara</i> .
2.	Examination of vegetative and reproductive morphology of Bacillariophyceae:

	<i>Cyclotella, Navicula</i> ; Phaeophyceae: <i>Ectocarpus, Dictyota, Padina, Laminaria, Sargassum</i> .
3.	Examination of vegetative and reproductive morphology of Rhodophyceae: <i>Gelidium, Gracilaria, Polysiphonia</i> .
4.	Examination vegetative and reproductive morphology of Xanthophyceae: <i>Vaucheria</i> Cyanophyceae: <i>Nostoc, Lyngbya, Spirulina</i> .
5.	Field work to get acquaintance with the algae of Visakhapatnam coast and fresh water algae in and around Visakhapatnam.
6.	An examination of the external features and internal structure and reproductive organs of: <i>Riccia, Targionia, Monoclea, Plagiochasma</i> .
7.	An examination of the external features and internal structure and reproductive organs of the genera: <i>Fimbriaria, Marchantia, Pellia, Porella</i> .
8.	An examination of the external features and internal structure and reproductive organs of: <i>Anthoceros, Notothylus, Andreaea, Funaria, Polytrichum</i> .

#### Reference Books

1.	Lee RW. 2007. <b>Classification of Algae</b> .
2.	Kumar HD. 1988. <b>Introductory Phycology</b> . Affiliated East West Press Pvt. Ltd., New Delhi.
3.	Round FE. 1986. <b>The Biology of Algae</b> . Cambridge University Press, New York.
4.	Bold HC and Wyne MJ. 1978. <b>Introduction to the Algae</b> . Prentice-Hall, New Jersey.
5.	Presscot GW. 1969. <b>The Algae- a Review</b> . Houghton Mifflin Company, Boston.
6.	Morris I. 1967. <b>An Introduction to the Algae</b> . Cambridge University Press, UK.
7.	Chapman VJ. 1962. <b>The Algae</b> . Macmillan and Co Ltd., London.
8.	Lewin RA. 1962. <b>Physiology and Biochemistry of Algae</b> . Academic Press, New York.
9.	Round FE. 1962. <b>Ecology of Algae</b> . Cambridge University Press, New York
10.	Smith GE (ed) 1950. <b>Fresh Water Algae</b> . Elsevier Science, USA.
11.	Fritsch FE. 1945. <b>The Structure and Reproduction of Algae Vols. 1&amp; II</b> . Cambridge University Press, New York.
11.	Chopra RN and Kumra PK. 1988. <b>Biology of Bryophytes</b> . New Age International (P) Ltd. Publishers, New Delhi.
12.	Parihar NS. 1991. <b>Bryophyta</b> . Central Book Depot, Allahabad.



<b>13.</b>	Puri P. 1980. <b>Bryophytes</b> . Atmaram and Sons, Delhi.
<b>14.</b>	Smith GM. 1955. <b>Cryptogamic Botany Vol.II</b> . Tata McGraw Hill Publishing Co. Ltd., New Delhi.
<b>15.</b>	Kashyap S. 1929. <b>Liverworts of the Western Himalayas and Punjab Plains Part I and Part II</b> . University of Panjab, Lahore, Pakistan.



**M.Sc. Botany - Semester I**  
**B 102: BIOLOGY AND DIVERSITY OF BACTERIA, VIRUSES AND FUNGI**  
**Theory**

S. No	Unit
<b>SECTION A</b>	
1.	General account of archaeobacteria, eubacteria and cyanobacteria. Classification of eubacteria. Ultrastructure, nutrition, reproduction and economic importance of bacteria.
2.	Morphology and chemical composition of Actinomycetes, Spirochetes, Rickettsiae and Mycoplasmas.
3.	Classification of viruses. Ultrastructure and chemistry of viruses. Replication and transmission of viruses. History, origin and evolution of plant viruses. Plant viral diseases.
4.	Microbial Ecology: quorum sensing, gentrification, phosphorous solubilization, nitrogen fixation.
<b>SECTION B</b>	
5.	Classification and phylogeny of fungi. Molecular aspects in classification. Thallus organization in fungi. Ultrastructure of fungal cell. Unicellular and multicellular organization. Cell wall composition. Fungal diseases in plants and humans.
6.	General account of Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina.
7.	Reproduction in fungi: vegetative, asexual and sexual. Heterothallism, heterokaryosis and parasexuality. Nutrition in fungi: saprobic, biotrophic, and symbiotic.
8.	Fungi in industry: medicine, food, pest and weed management (biocontrol agents). Mushroom cultivation. Fermentation methods. Mycorrhiza.

**Practical**

S. No	Exhibits/ Experiments
1.	Tools of microbiology: Care and use of the microscope, Spectrophotometer, P <sup>H</sup> meter, Micrometer, Hemocytometer, Autoclave, Centrifuge, Biological safety

	cabinets, Inoculation needle and loop, Incubator, Colony counter & Lyophilizer.
2.	Differential staining: Gram staining.
3.	Differential staining: Acid fast staining.
4.	Study of bacterial growth: To prepare the growth curve of bacteria.
5.	Study of cyanobacteria: Isolation and cultivation of cyanobacteria.
6.	Isolation of rhizobia from root nodules.
7.	Cultivation of viruses in embryonated eggs.
8.	Isolation of fungi by Petri plate exposure method.
9.	Morphological study of: <i>Stemonitis</i> , <i>Saprolegnia</i> , <i>Mucor</i> , <i>Morchella</i> , <i>Aspergillus</i> , <i>Agaricus</i> , <i>Cyathus</i> , <i>Synchytrium</i> , <i>Helminthosporium</i> .
10.	Symptomatology and anatomical study of some diseased specimens: white rust, powdery mildew, green ear of bajra, rust of wheat, rust of linseed, Tikka disease of ground nut, red rot of sugarcane, blast of rice, citrus canker, tobacco mosaic disease.
<b>References Books</b>	
1.	Kaursethi I and Surinder KW 2011. <b>Text Book of Fungi and their Allies.</b> Macmillan publishers, New Delhi, India.
2.	Ram Reddy S & Reddy SM 2007. <b>Essentials of Virology.</b> Scientific publishers, Jodhpur, India.
3.	Sharma K 2005. <b>Manual of Microbiology Tools and Techniques.</b> Ane Book, New Delhi, India.
4.	Matthew RH 2004. <b>Plant virology.</b> 4 <sup>th</sup> edition. Academic press an imprint of Elsevier, California, USA.
5.	Prescott <i>et al.</i> 2003. <b>Microbiology.</b> McGraw Hill Education, New York.
6.	Aneja KR 2003. <b>Experiments in Microbiology, Plant pathology and Biotechnology.</b> New Age International publishers, New Delhi.
7.	Verma HN 2003. <b>Basics of plant Virology.</b> IBH publishing co. Pvt. Ltd., New Delhi.

8.	Mehrotra KS and Aneja KR 2003. <b>An Introduction to Mycology</b> . New Age International Publishers, New Delhi.
9.	Sullia SB and Shantharam S 2001. <b>General Microbiology</b> . Oxford and IBH publishing Co. Pvt. Ltd, New Delhi.
10.	Reddy SM and Ram Reddy S 2000. <b>Microbiology a Laboratory Manual</b> . BSC Publishers and Distributors, Hyderabad.
11.	Flint SJ, Enquist LW, Krug RM, Racaniello VR, Skalka AM 2000. <b>Principles of Virology, Molecular Biology, Pathogenesis and Control</b> . ASM press, Washington DC.
12.	Rao AS 1999. <b>Introduction to Microbiology</b> . Prentice Hall of India Pvt. Ltd., Delhi.
13.	Alexopoulos CJ, Mims CW, Blackwell M 1996. <b>Introductory Mycology</b> . 4 <sup>th</sup> edition. Replika press, North Delhi.
14.	Paul S 1995. <b>Bacteria in Biology, Biotechnology and Medicine</b> . 5 <sup>th</sup> edition. John Wiley and son Ltd., UK.
15.	Pelczar, Chan and Krieg 1993. <b>Microbiology</b> . 5 <sup>th</sup> edition. McGraw Hill Education, New York.
16.	<i>Stainer</i> RT, Ingraham JL, Wheelis ML and Painter PR 1987. <b>General Microbiology</b> . 5 <sup>th</sup> Edition. Macmillan, London.
17.	Smith KM 1968. <b>Plant viruses</b> . Elsevier, New York.
18.	Rangaswamy G 1962. <b>Bacterial Plant disease in India</b> . Asia Publishing House, Bombay.



**M.Sc. Botany - Semester I**  
**B103 CELL BIOLOGY OF PLANTS**

**Theory**

S. No	Unit
<b>SECTION A</b>	
1.	The cell theory. Origin and development of cell biology as a separate branch. Dimensions of size and weight: micron to angstrom, microgram to pictogram. Ultra structure and organization of prokaryotic and eukaryotic cells. Specialized cell types.
2.	Chemical foundation: macromolecules–structure, shape and information. Non-covalent interactions in relation to function of nucleic acids and proteins. Biochemical energetics: types of energy– thermal, electrical and radiant energy, interconvertability of energy. Laws of thermodynamics as applicable to biological systems.
3.	Cell wall:structure and functions, cell wall architecture, biogenesis and growth. Plasmodesmata: structure and function, plasmodesmata in comparison to gap junctions of animal cells. Plasma membrane: structure, models and functions. ATPases receptors, carriers, channels, pumps. Vacuole structure and function, vacuolar ATPases, transporters.
4.	Cytoskeleton: microtubules and microfilaments, their role in cell division and motility; intermediate filaments– role in providing strength. Labeled antibody technique for visualizing cytoskeleton.
<b>SECTION B</b>	
5.	Chloroplast and Mitochondria: structure and function, genome organization, nucleo-cytoplasmic interactions, RNA editing.
6.	Other organelles: structure and function– endoplasmic reticulum, Golgi apparatus lysosomes,, ribosomes, microbodies, peroxisomes.
7.	Tools in cell biology I: microscopy–working principles of light microscopy, resolution power of microscope, different types of light microscopes, stains used. Image processing methods in microscopy. Scanning electron microscopy. Transmission electron microscopy– principle of working, preparation of specimens for electron microscopy –Fixing, sectioning, spreading molecules, negative staining, shadow casting, freeze fracture and freeze etching.
8.	Tools in cell biology II: subcellular fractionation– homogenization, principle of density gradient centrifugation. Spectroscopic techniques– principle and applications

	of UV- visible, ESR. Spectrofluorimetry. Circular dichroism (CD). Nuclear magnetic resonance (NMR). Whole cell autoradiography. Radiolabeling techniques: properties of different radioisotopes used in biology, their detection and measurement, incorporation of radioisotopes in biological tissues and cells.
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### Practical

S. No	Exhibit/Experiment
1.	Electron microscopic picture of prokaryotic and eukaryotic cells.
2.	Images of cytoskeleton.
3.	Electron microscope pictures of chloroplast and mitochondria.
4.	Electron microscope pictures of endoplasmic reticulum, Golgi apparatus.
5.	Study of mitosis using acetocarmine.
6.	Isolation of mitochondria and the activity of its marker enzyme, succinate dehydrogenase (SDM).
7.	Fluorescence staining with FDA for cell viability and cell wall staining with calcofluor.
8.	Pictures of images of shadow casting, negative staining, freeze fracturing and freeze etching.
9.	Images of cells in fluorescence, phase contrast and confocal microscopy, whole cell autoradiography.
10.	Establishing sucrose density gradients.

### Reference Books

1.	Alberts B, Breyer D, Hopkin K, Johnson AD, Lewis J, Raff M, Roberts K and Watter P 2014. <b>Essential Cell Biology</b> . 4 <sup>th</sup> Edition. Garland publishers, New York.
2.	Sharp D, Ploppe G and Sikorski E 2014. <b>Lewin's Cells</b> . 3 <sup>rd</sup> Edition. Viva Books, New Delhi.
3.	Cooper GM, Hausman RE 2013. <b>The Cell – A Molecular Approach</b> . 6 <sup>th</sup> Edition. Sinauer Associates, Incorporated, USA.
4.	Karp G 2013. <b>Cell and Molecular Biology – Concepts and Experiments</b> . 7 <sup>th</sup> Edition. Wiley Global Education, USA
5.	McLennan A, Bates A, Turner P, White M 2013. <b>Bios Instant Notes in Molecular Biology</b> . 4 <sup>th</sup> Edition. Garland publishers, New York.
6.	Cowling G, Allen T 2011. <b>The Cell. A very Short Introduction</b> . Oxford University Press, USA.



7.	Alberts B, Johnson A, Lewis J, Raff M, Roberts K, Walker P 2007. <b>Molecular Biology of the Cell</b> . 5 <sup>th</sup> Edition. Garland publishers, New York.
8.	Schaffer SW 2007. <b>Mitochondria: The Dynamic Organelle</b> . 1 <sup>st</sup> Edition. Springer Verlag.
9.	Wilson J, Hunt T 2007. <b>Molecular Biology of the Cell</b> 5 <sup>th</sup> edition. <b>The Problems Book</b> . 2 <sup>nd</sup> Edition. Garland publishers, New York.
10.	Celis JE (ed) 2006. <b>Cell Biology—A Laboratory Hand Book</b> . 3 <sup>rd</sup> Edition. Elsevier, USA.
11.	Lodish H, Berk A, Kaiser CA, Kreiger M, Scott P M, Bretcher A, Ploegh H, Matsudaira P. 2004. <b>Molecular Cell Biology</b> . 5 <sup>th</sup> edition. W. H. Freeman and Company, New York.
12.	De DN 2000. <b>Plant Cell Vacuoles. An Introduction</b> . CSIRO Publication Collingwood, Australia.
13.	Krishna Murthy KV 2000. <b>Methods in Cell Wall Cytochemistry</b> . CPC Press, Boca Raton, Florida.
14.	Lodish, Berk A, Zipursky SL, Matsudaira P, Baltimore D and Darnell J 2000 <b>Molecular Cell Biology</b> . 4 <sup>th</sup> Edition. W.H. Freeman and Co., New York.
15.	Alberts B, Bray D, Lewis J, Raff M, Roberts K and Watson JD 1999. <b>Molecular Biology of the Cell</b> , Garland Publishing, New York.
16.	Kleinsmith LJ and Kish VM 1995. <b>Principles of Cell and Molecular Biology</b> . 2 <sup>nd</sup> Edition. Harper Collins College Publishers, New York, USA.
17.	Avers CJ 1986. <b>Molecular Cell Biology</b> . Addison Wesley Publishing Company USA.



**M.Sc. Botany – Semester I**  
**B 104 CYTOLOGY AND CYTOGENETICS**

**Theory**

S. No	Unit
<b>SECTION A</b>	
1.	Nucleus: structure of nuclear membrane and nuclear pore complex, nucleolus, ribosome biosynthesis. Chromatin: eu and heterochromatin, arrangement of chromatin. Molecular organization of chromatin: components, nucleosomes – composition and organization, 10 nm, 30 nm, solenoid, scaffolds. Chromosome structure: molecular organization of centromeres and telomeres. Types of chromosomes: lampbrush, polytene.
2.	Chromosome identification: karyotype analysis. Chromosome banding techniques – Q, C, G and R banding. Flowcytometry and confocal microscopy in karyotype analysis. Computer assisted karyotype analysis – chromosome microdissection and micro cloning. FISH and GISH techniques.
3.	Chromosomal structural aberrations: origin, meiosis and breeding behaviour of duplications, deficiencies, inversions and interchanges. Types of inversions. Robertsonian translocations – basic concept of complex translocation heterozygotes.
4.	Chromosomal numerical aberrations: classification of numerical aberrations. Aneuploids – trisomics (primary, secondary, tertiary), monosomics and nullisomics – meiotic behavior. Eupolyploids – origin and production of auto -and allopolyploids, meiosis in autotetraploid. Genome of tobacco and wheat as examples of allopolyploids.
<b>SECTION B</b>	
5.	Nuclear DNA content: C-value paradox, hyperchromicity, cot curves and their significance. Molecular organization of eukaryotic nuclear genome: highly repeated, middle repeated and unique sequences.
6.	Cell cycle and its regulation: the G1, S, G2 and M phases. Synchronous and asynchronous cell divisions. The measurement of duration of different phases of cell cycle using a flow cytometer. Check points in cell cycle – role of cyclins and cyclin-dependent kinases in regulation of cell cycle.
7.	The different stages of mitosis and meiosis: description of the stages. Experimental control of cell division. Significance of meiosis.

<b>8.</b>	Apoptosis: mechanism and significance. Initiation of cancer at cellular level – proto oncogenes and oncogenes; retinoblastoma and E2F proteins.
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### Practical

S. No	Exhibit/ Experiment
1.	Photographs of interphase nucleus, 10 nm, 30nm and scaffolds. Electron microscope picture of metaphase chromosome, <i>in-situ</i> hybridization of chromosome spreads showing telomeres and centromeres. rRNA synthesis –christmas tree configuration.
2.	Pictures of lampbrush and polytene chromosomes.
3.	Photographs of chromosomes with different banding patterns. Identifying homologous chromosomes from the pictures.
4.	Preparation of karyotypes in <i>Allium/ Aloe</i> (with treated root tips).Construction of idograms from pictures of karyotypes.
5.	Photographs showing meiosis in structural and numerical aberrations.
6.	Meiosis in <i>Rheo discolor</i> showing complex translocation heterozygote.
7.	Preparation of slides from <i>Allium</i> floral buds for observation and identification of stages of meiosis.
8.	C value paradox chart and Britten and Kohne's Cot curves picture.

### Reference Books

1.	Singh RJ. 2014. <b>Plant Cytogenetics</b> . 2 <sup>nd</sup> Edition. CRC Press, India.
2.	Pierce BA. 2013. <b>Genetics: A Conceptual Approach</b> . 5 <sup>th</sup> Edition. W. H. Freeman, California.
3.	William K, Cummings S, Spencer MR and Charlotte A. 2013. <b>Essentials of Genetics</b> . Pearson Books, Delhi.
4.	Hartwell L. 2011 <b>Genetics: From Genes to Genomes, Study Guide and Solution Manual</b> . 4 <sup>th</sup> Edition. Nero, McGraw Hill Publishing company, New York.
5.	Bass H and Birchler J. 2011. <b>Plant cytogenetics: Genome structure and chromosome Function</b> . Springer, New York.
6.	Ram M. 2010. <b>Cytogenetics and Genetics</b> . PHI Learning Pvt. Ltd., Delhi.
7.	Anthony J, Griffiths F, Wessig SR, Carroll SB and Doebley J. 2010. <b>Introduction to genetic analysis</b> . 10 <sup>th</sup> Edition. W. H. Freeman, California.
8.	Russel PJ. 2009. <b>Genetics–A Molecular Approach</b> . 3 <sup>rd</sup> Edition. Pearson Benjamin Cummings, San Francisco, USA.
9.	Roy D. 2009. <b>Cytogenetics</b> . Alfa Science International Ltd., UK.

10.	Brooker R. 2008. <b>Genetics, Analysis and Principles</b> . 3 <sup>rd</sup> edition. McGraw Hill Science.
11.	Gupta P.K .1995. <b>Cytogenetics</b> . Rastogi & Company, Meerut.
12.	Sybenga J. 1992. <b>Cytogenetics in Plant Breeding</b> . Springer London Ltd.
13.	David M. Prescott. 1988. <b>Cells</b> . Jones and Bartlett Publ. Boston.
14.	Swanson M and Young. 1982. <b>Cytogenetics</b> . Prentice Hall, India.
15.	Khush GS. 1973. <b>Cytogenetics of Aneuploids</b> . Academic Press, New York and London.
16.	Sybenga J. 1973. <b>General Cytogenetics</b> . North Holland and American Elsevier Publishing Co., New York.
17.	Burnham CR. 1962. <b>Discussions in Cytogenetics</b> . Burgess Publishing Co., Minnesota.



**M.Sc. Botany - Semester II**

**B 201 GENETICS**

**Theory**

<b>S. No</b>	<b>Unit</b>
<b>SECTION A</b>	
<b>1.</b>	Concept of genetic markers and their types. Mendel's experiments and theories, application of probability laws to Mendelian principles. Chi-square testing for goodness of fit. Penetrance and expressivity. Pleiotropism. Phenocopies. Codominance and incomplete dominance.
<b>2.</b>	Multiple allelism: interaction among multiple alleles, complementation test, pseudoalleles. Gene interaction and modified F <sub>2</sub> ratios in two gene interactions.
<b>3.</b>	Linkage and crossing over: identifying linkage from F <sub>2</sub> and test cross, recombination frequency and distance between genes. Linkage maps. Tetrad analysis—ordered and unordered tetrads.
<b>4.</b>	Recombination in prokaryotes: transformation, conjugation, transduction, sexduction. Mapping of genes in bacteria using transformation and conjugation (interrupted mating). Fine structure analysis of gene – Benzer's work.
<b>SECTION B</b>	
<b>5.</b>	Sex determination: chromosomal and genetic basis. Sex-linked inheritance. Sex influenced and sex limited characters. Polygenic inheritance: heritability and its measurement. QTL mapping.
<b>6.</b>	Extra chromosomal inheritance: inheritance of mitochondrial and chloroplast genes. Male sterility. Chloroplast mutations. Maternal inheritance.
<b>7.</b>	Nature of the eukaryotic gene: split gene with a promoter and terminator. Variant forms of eukaryotic gene – nested genes, overlapping genes, assembled genes, assorted genes. Multigene families— organization and significance. Transposable elements in pro- and eukaryotes: types, mechanism of transposition, significance of transposable elements.
<b>8.</b>	Mutations: types, causes and detection. Physical and chemical mutagens. Lethal, conditional, biochemical, loss of function, gain of function. Molecular basis of mutations. Spontaneity of mutations, site-directed mutagenesis. Recombination: molecular mechanism— role of rec A, B, C, D enzymes, Holliday model, site specific recombination.

### Practical

S. No	Exhibit/Experiment/Assignment
1.	Assignment on Mendel's principles, chisquare test, proabability.
2.	Assignment on dominance relationships, multiple alleles and two gene interactions.
3.	Assignment on linkage and crossing over.

### Reference Books

1.	Benajamin Pierce 2013. <b>Genetics: A Conceptual Approach.</b> 5 <sup>th</sup> Edition.W.H. Freeman and Company.
1.	Lewin B. 2000. <b>Gene VII.</b> Oxford University Press, New York, USA.
2.	Snustad DP. and Simons MJ 2000. <b>Principles of Genetics.</b> 2 <sup>nd</sup> Edition. John Wiley and Sons Inc., USA.
3.	Atherly AG, Girton JR and McDonald JF. 1999. <b>The Science of Genetics.</b> Saunders College Publishing, Fort Worth, USA.
4.	Karp G. 1999. <b>Cells and Molecular Biology: concepts and Experiments.</b> Hohn Wiley and Sons Inc., USA.
5.	Hartl DL and Jones EW. 1998. <b>Genetics: Principles and Analysis.</b> 4 <sup>th</sup> Edition. Jones and Bartlett Publishers, Massachusetts, USA.
6.	Malacinski GM and Freifelder D. 1998. <b>Essentials of Molecular Biology.</b> 3 <sup>rd</sup> Edition. Jones and Bartlet Publishers Inc., London.
7.	Russel PJ. 1998. <b>Genetics.</b> 5 <sup>th</sup> Edition. The Benjamin/ Cummings Publishing Company Inc., USA.
8.	Lewis R. 1997. <b>Human Genetics: Concepts and Applications.</b> 2 <sup>nd</sup> Edition. WCB McGraw Hill, USA.
9.	Griffiths RCL, Anthony JF, Miller JH and Suzuki DT. 1996. <b>Genetic analysis.</b> 6 <sup>th</sup> Edition. W. H. Freeman and Co., New York.





**M.Sc. Botany - Semester II**  
**B 202 MOLECULAR BIOLOGY OF PLANTS**

**Theory**

S. No	Unit
<b>SECTION A</b>	
<b>1.</b>	Composition and structure of biomolecules: carbohydrates, lipids, proteins (Ramachandran plot) domains, motifs and folds. Nucleic acids– DNA structure, A, B and Z forms of DNA. Types of small RNAs: Si RNA, micro RNA, catalytic RNA.
<b>2.</b>	DNA replication: semi-conservative, semi-discontinuous- Okazaki fragments, uni and bi directional mode of replication. RNA priming, enzymes for DNA replication– gyrase, helicase, topoisomerases and polymerases, SSBs. Mechanism of DNA replication– in prokaryotes–rolling circle and theta mode of replication, in eukaryotes– multiple replicons. Fidelity of replication. Replication at ends of chromosomes. Extrachromosomal replicons. DNA damage and repair.
<b>3.</b>	RNA synthesis and processing: transcription process in prokaryotes and eukaryotes. Transcription factors. RNA processing– mRNA processing – spliceosome, capping and tailing, processing of tRNA and rRNA.
<b>4.</b>	Protein synthesis: structure of tRNA, aminoacylation of tRNA, aminoacyl tRNA synthetases. Ribosome as a translation factory. Genetic code– codon assignment, characteristics of genetic code. Mechanism of translation in prokaryotes and eukaryotes– initiation elongation and termination. Chemical proof reading during translation. Translation inhibitors. Post translational modifications.
<b>SECTION B</b>	
<b>5.</b>	Protein sorting and targeting of proteins into nucleus, chloroplasts, mitochondria, vacuoles and peroxisomes. Protein trafficking through GERL system– signal peptide, signal recognition particle, vesicles.
<b>6.</b>	Signal transduction: signaling molecules, ligands and receptors. G protein coupled receptors. Receptor tyrosine kinases. MAP kinases. Second messengers, signal amplification, cAMPs. Ca-calmodulin pathway.
<b>7.</b>	Regulation of gene expression in prokaryotes: bacteria – Lac, arabinose ,Tryp operons, positive and negative control. Regulation in viruses–lytic and lysogenic cycles.
<b>8.</b>	Regulation of gene expression in eukaryotes: cis and trans factors. Motifs of DNA

	binding domains of trans factors–zinc fingers, leucine zippers, helix turn helix. Temporal and spatial regulation. Role of chromatin in gene expression. DNA methylation and gene imprinting. Gene silencing.
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### Practical

S. No	Exhibit/Experiment
1.	Isolation of DNA using CTAB method.
2.	Histochemical staining of carbohydrates, proteins and fats in the plant cells.
3.	Electrophoresis of seed proteins.
4.	Assignments on problems related to DNA structure, replication, transcription and translation
5.	Photographs depicting the content of theory

### Reference Books

1.	Snustad P, Simmons MJ. 2003. <b>Principles of Genetics</b> . 3 <sup>rd</sup> Edition. John Wiley and Sons, Inc, USA.
2.	Buchaman BB, Gruissem,W and Jones R. 2000. <b>Biochemistry and Molecular Biology of plants</b> : American Societies of plant physiologists, John Wiley and Sons Ltd., Maryland, U.S.A.
3.	Lewin B. 2000. <b>Genes IX</b> , Oxford University Press, New York.
5.	Lodish BA, Zipursky SL, Matsdaira P, Baltimore D and Darnell J. 2000. <b>Molecular Cell Biology</b> . 4 <sup>th</sup> Edition. W.H. Freeman and Co., New York.
6.	Alberts B, Bray D, Lewis J, Ralf M, Roberts K and Watson JD.1999. <b>Molecular Biology of the Cell</b> . Garland publishing Inc., New York.
7.	Weaver RF. 1999. <b>Molecular Biology</b> . WCB /McGraw-Hill,.
8.	Shaw CH. 1998. <b>Plant Molecular Biology. A practical approach</b> , IRL Press, Oxford.
9.	Glick BR and Thompson JE. 1992. <b>Methods in Plant Molecular Biology and Biotechnology</b> , CRC Press, Boc Raton Florida.



**M.Sc. Botany – Semester II**

**B 203 BIOLOGY AND DIVERSITY OF PTERIDOPHYTES AND GYMNOSPERMS**

**Theory**

S. No	Unit
<b>SECTION A: Pteridophytes</b>	
1.	Classification of Pteridophyta. Origin of Pteridophytes. Pteridophytes in comparison to Bryophytes and Gymnosperms. Distinguishing features of Pteridophyta. Economic importance of Pteridophytes.
2.	Morphology, anatomy and reproduction of <i>Psilotum</i> , <i>Lycopodium</i> , <i>Selaginella</i> , <i>Isoetes</i> , <i>Equisetum</i> , <i>Ophioglossum</i> , <i>Osmunda</i> , <i>Gleichenia</i> , <i>Cyathea</i> , <i>Marselia</i> , <i>Adiantum</i> , <i>Salvinia</i> and <i>Azolla</i> .
3.	General account of fossil pteridophytes–Psilopsida, Lycopsida, Sphenopsida and Pteridopsida.
4.	Evolution of stelar types in Pteridophytes. Heterospory and origin of seed habit. Evolution of the sporophyte.
<b>SECTION B: Gymnosperms</b>	
5.	The evolutionary time scale: eras, periods and epochs. General account of fossils. Types of fossil formations.
6.	Gymnosperms in comparison to ferns and seed plants. Classification of Gymnosperms and their distribution in India. Economic importance of Gymnosperms.
7.	General account of the families of Pteridospermales–Lyginopteridaceae, Medullosaceae, Caytoniaceae; Bennettitales–Cycadeodiaceae; Pentoxylales – Pentoxylaceae; Cordaitales–Cordaitaceae.
8.	Structure and reproduction in living Gymnosperms of Cycadopsida, Coniferopsida and Gnetopsida.

**Practical**

S. No	Exhibit/Experiment
1.	Examination of the external features, anatomy and reproductive structures of <i>Psilotum</i> , <i>Lycopodium</i> , <i>Selaginella</i> , <i>Isoetes</i> and <i>Equisetum</i> .
2.	Examination of the external features, anatomy and reproductive structures of <i>Ophioglossum</i> , <i>Osmunda</i> , <i>Gleichenia</i> , <i>Cyathea</i> , <i>Marselia</i> , <i>Adiantum</i> , <i>Salvinia</i> and

	<i>Azolla</i> .
3.	Observations of the slides of the following fossil plants— <i>Rhynia</i> , <i>Lepidodendron</i> , <i>Lepidocarpon</i> , <i>Miadesmia</i> , and <i>Sphenophyllum</i> .
4.	Observations of the slides fossil Pteridophytes: <i>Calamites</i> , <i>Calamostachys</i> , <i>Zygoptera</i> and <i>Etaopteris</i> .
5.	Examination of the external features, anatomy and reproductive structures of <i>Ginkgo</i> , <i>Pinus</i> , <i>Cupressus</i> and <i>Cryptomeria</i> .
6.	Examination of the external features, anatomy and reproductive structures of <i>Araucaria</i> , <i>Ephedra</i> and <i>Gnetum</i> .
7.	Study of fossil gymnosperms from prepared slides: <i>Lyginopteris</i> , <i>Lagenostoma</i> and <i>Medullosa</i> .
8.	Study of fossil gymnosperms from prepared slides: <i>Trigonocarpus</i> , <i>Conostoma</i> , <i>Heterangium</i> , <i>Cordaites</i> .

#### Reference Books

1.	Saxena P and Pathak C. 2012. <b>A Text Book of Pteridophyta.</b> , Wisdom Press, New Delhi.
2.	Sharma OP. 2006. <b>Pteridophyta.</b> MacMillan India Ltd., New Delhi.
3.	Parihar NS. 1996. <b>Biology and Morphology of Pteridophytes.</b> Central Book Depot, Allahabad.
4.	Smith GM. 1995. <b>Cryptogamic Botany. Vol. II.</b> McGraw Hill Book Company, New York.
5.	Sporne KR. 1962. <b>The Morphology of Pteridophytes.</b> Hutchinson University Library, London.
6.	Evans AJ. 1936. <b>Morphology of Vascular Plants (Lower groups).</b> McGraw Hill Book Company, New York.
7.	Biswas C and Johri BM. 1997. <b>The Gymnosperms.</b> Narosa Publishing House, New Delhi.
8.	Bhatnagar SP and Moitra A. 1996. <b>Gymnosperms.</b> New Age International Private Limited, New Delhi.
9.	Sharma OP. 1996. <b>Gymnosperms.</b> Pragati Prakashan, Meerut.
11.	Stewart WN and Rothwell GW. 1993. <b>Paleobotany and the Evolution of Plants.</b> Cambridge University Press, USA.
12.	Singh H. 1978. <b>Embryology of Gymnosperms.</b> Gebrudev Bortraeger, Berlin.

<b>13.</b>	Arnold CA. 1974. <b>An introduction to Paleobotany.</b> McGraw Hill Book Co., Inc., New York.
<b>14.</b>	Sporne KR. 1967. <b>The Morphology of Gymnosperms.</b> Hutchinson University Library, London.
<b>15.</b>	Chamberlain CJ. 1935. <b>Gymnosperms structure and evolution.</b> University of Chicago Press, USA.





## M.Sc. Botany - Semester II

### B 204 PLANT CELL, TISSUE AND ORGAN CULTURE

#### Theory

S. No	Unit
<b>SECTION A</b>	
1.	Plant cell and tissue culture: introduction, history, scope. Basic concepts of tissue of culture: tissue culture cycle, types of cultures. Concept of cellular differentiation, totipotency.
2.	Culture media: composition and effects of media components, phytohormones – effects in tissue culture. Sterilization methods.
3.	Pathways of regeneration – biochemical and molecular aspects of tissue culture cycle.
4.	Technique and applications of cryopreservation and germplasm storage.
<b>SECTION B</b>	
5.	Organogenesis and adventitious embryogenesis. Fundamental aspects of morphogenesis, somatic embryogenesis. Methods of androgenic and gynogenic haploid production-dihaploids and application in agriculture. Embryo rescue.
6.	Cell culture: establishment, plating efficiency, induction and selection of mutants. Free cell cultures: production of secondary metabolites/natural products.
7.	Somatic hybridization: protoplast isolation, fusion and culture, hybrid selection and regeneration, possibilities, achievements, limitations, merits and demerits . Cybrids. Protoplasts in genetic transformation.
8.	Applications of plant tissue culture: clonal propagation, artificial seeds and its applications, somaclonal variation and its applications.

#### Practical

S. No	Exhibit/Experiment
1.	General out lay of plant tissue culture laboratory.
2.	Preparation of media.
3.	Callus induction – carrot.
4.	Clonal propagation through meristem cultures.
5.	Embryo culture – groundnut.
6.	Anther culture – <i>Datura</i> /tobacco.
7.	Establishment of cell cultures and determination of growth pattern.
8.	Determination of plating efficiency of cell cultures.

9.	Protoplast isolation and culture.
10.	Protoplast fusion.
11.	Observation of different developmental stages of somatic embryo in embryogenic callus.
12.	Preparation of artificial seeds.

#### Reference Books

1.	Collin HA and Edwards S. 1998. <b>Plant Cell Culture</b> . Bioscientific Publishers, Oxford, UK.
2.	Callow JA, Ford-Lloyd BV and Newbury HJ. 1997. <b>Biotechnology and Plant Genetic Resources: Conservation and Use</b> . CAB International, UK.
3.	Raghavan V. 1997. <b>Molecular Biology of Flowering plants</b> . Cambridge University press, New York, USA.
4.	Bhojwani SS and Razdan MK. 1996. <b>Plant tissue culture: Theory and Practice</b> . (A revised edition). Elsevier Science Publishers, New York, USA.
5.	Jain SM, Sopory SK and Velleux RE. 1996. <b>In Vitro Haploid production in Higher Plants. Volumes 1-5</b> . Fundamental aspects and Methods Kluwer Academic Publishers, Dordrecht, Netherlands.
6.	Vasil IK and Thorpe TA. 1994. <b>Plant Cell and Tissue Culture</b> . Kluwer Academic Publishers, Dordrecht, Netherlands.
7.	Bhojwani SS. 1990. <b>Plant Tissue Culture: Applications and Limitations</b> . Elsevier Science Publishers, New York, USA.
8.	Raghavan V. 1986. <b>Embryogenesis in Angiosperms: A Developmental and Experimental Study</b> . Cambridge University Press, New York, USA.
9.	Kartha KK. 1985. <b>Cryopreservation of Plant Cells and Organs</b> . CRC Press, Boca Raton, Florida, USA.



**M.Sc. Botany – Semester III**  
**B 301 TAXONOMY OF ANGIOSPERMS AND PLANT RESOURCES**  
**UTILIZATION AND CONSERVATION**

**Theory**

S. No	Unit
<b>SECTION A</b>	
<b>1.</b>	Origin and evolution of Angiosperms. Fossil Angiosperms. Taxonomy and Systematics. Concepts of species. Taxonomic hierarchy - species, genus, family and other categories. Principles used in assessing relationship and delimitation of taxa and attribution of rank. Plant identification. Plant nomenclature – Binomial nomenclature, ICBN. Plant collection and documentation.
<b>2.</b>	Brief analysis of the features and evolutionary tendencies noticed in the following groups: Ranales, Rosales, Centrospermae, Tubiflorae, Amentiferae, Helobiales, Liliflorae and Glumiflorae.
<b>3.</b>	Taxonomic evidences: embryology, cytology and phytochemistry. Taxonomic tools: herbaria, floras, botanical gardens, biochemical and molecular techniques, computers and GIS (Geo Information Systems). Cladistics in taxonomy. Numerical taxonomy and sero taxonomy.
<b>4.</b>	Systems of Angiosperm classification: Phenetic versus Phylogenetic system. Relative merits and demerits of major systems of classification: Takhtajan, Cronquist and Thorne. Basic concepts of Molecular Systematics: Gene sequencing, Restriction site analysis, Allozymes etc., Angiosperm Phylogeny Group (APG III) classification system, Relevance of Taxonomy to conservation, sustainable utilization of bioresources and ecosystem research.
<b>SECTION B</b>	
<b>5.</b>	World centres of primary diversity of domesticated plants. The Indo-Burmese Centre, Plant Introductions and Secondary centers. Plant explorations. Origin of agriculture.
<b>6.</b>	Origin, evolution, Botany, cultivation and uses of :

	<p>1. Food Crops : Wheat, Rice</p> <p>2. Forage Crops : <i>Sorghum</i>, Red gram</p> <p>3. Fibre Crops : Cotton, Jute</p> <p>4. Oil yielding crops : Groundnut, Coconut</p> <p>5. Medicinal and aromatic crops : <i>Catharanthus</i>, <i>Withania</i>, <i>Cymbopogon</i></p>
7.	Green Revolution: benefits and adverse consequences. Ethnobotany: Introduction, concept, objectives and scope. Plant biodiversity: Concept, status in India, utilization and concerns, conservation of wild biodiversity.
8.	Principles of conservation: Strategies for conservation, <i>In-situ</i> conservation: protected areas in India- reserves, wetlands, mangroves, <i>Ex-situ</i> conservation: principles and practices. Botanical gardens. BSI, ICAR and CSIR.

### Practical

<b>Exhibits/ Experiments/ Suggested Laboratory Exercises</b>	
<b>Taxonomy</b>	
1.	Description of a specimen from representative and locally available families.
2.	Description of a species based on various specimens to study intraspecific variation: A collective exercise.
3.	Description of various species of a genus: location of key character and preparation of keys at genetic level.
4.	Location of key characters and use of keys at family level.
5.	Field trips within and around the campus; compilation of field notes and preparation of herbarium sheets of such plants, wild or cultivated, as are abundant.
6.	Training in using floras and herbaria for identification of specimens described in the class.
7.	Demonstration of the utility of secondary metabolites in the taxonomy of some appropriate genera.
8.	Comparison of different species of a genus and different genera of a family to calculate similarity coefficients and preparations of dendrograms.

<b>Plant Resources Utilization and Conservation</b>	
<b>1.</b>	<p><b>Laboratory work:</b></p> <p>1. Food crops : Wheat, Rice</p> <p>2. Forage/fodder crops : <i>Sorghum</i>, Red gram</p> <p>3. Fiber crops : Cotton, Jute</p> <p>4. Oil yielding : Groundnut, Coconut</p> <p>5. Medicinal and Aromatic plants : <i>Catharanthus</i>, <i>Withania</i>, <i>Cymbopogon</i></p>
<b>2.</b>	<p><b>Scientific visits:</b></p> <p>The students should be taken to one of the following:</p> <p>A protected areas or Biosphere reserve or national park or sanctuary. A wetland.</p> <p>A mangrove.</p> <p>NBPGR (National Bureau of Plant Genetic Resources – New Delhi). BSI.</p> <p>CSIR</p> <p>Laboratory. FRI.</p> <p>Tropical Botanical Gardens.</p>

### Reference Books

<b>Taxonomy of Angiosperms</b>	
<b>1.</b>	Mondal AK. 2011. <b>Advanced Plant Taxonomy</b> . New Central Book Agency Pvt. Ltd., Kolkata.
<b>2.</b>	Simpson MG. 2006. <b>Plant Systematics</b> . Elsevier Academic Press, California, USA.
<b>3.</b>	Nordenstam BEI, Lazily G and Kassas M. 2000. <b>Plant systematic for 2<sup>nd</sup> Century</b> . Portland Press Ltd., London.
<b>4.</b>	Takhtajan AL. 1997. <b>Diversity and classification of Flowering Plants</b> . Columbia University Press, New York.
<b>5.</b>	Zomlefer WB. 1994. <b>A Guide to flowering plant families</b> . University of California Press, USA.
<b>6.</b>	Woodland DW. 1991. <b>Contemporary Plant Systematics</b> . Prentice Hall, New Jersey.
<b>7.</b>	Stace CA. 1989. <b>Plant Taxonomy and Biosystematics</b> .2 <sup>nd</sup> Edition. Edward Arnold Ltd., London.

8.	Jones SB Jr. and Luchsinger AE. 1986. <b>Plant Systematics</b> . 2 <sup>nd</sup> Edition. McGraw Hill Book Co., New York.
9.	Radford AE. 1986. <b>Fundamentals of Plant Systematics</b> . Harper and Row Publications, USA.
10.	Heywood VH and Moore DM. 1984. <b>Current concepts in Plant Taxonomy</b> . Academic Press, London.
11.	Davis PH and Heywood VH. 1973. <b>Principles of Angiosperms Taxonomy</b> . Robert E Kreiger Pub. Co., New York.
12.	Harrison HJ. 1971. <b>New concepts in Flowering Plant Taxonomy</b> . Hieman Educational Books Ltd., London.
13.	Jones AD and Wilbins AD. 1971. <b>Variations and Adaptations in Plant species</b> . Hieman and Co., Educational Books Ltd., London.
14.	Grant V. 1971. <b>Plant Biosystematics</b> . Academic press, London.
15.	Solbrig OT. 1970. <b>Principles and Methods of Plant Biosystematics</b> . Macmillan, London.
16.	Heslop-Harrison J. 1967. <b>Plant Taxonomy</b> . English language Books Soc. and Edward Arnold Pub. Ltd., U.K.
<b>Plant Resource Utilization And Conservation</b>	
17.	Sambamurthy AVSS and Subramanyam NS. 2000. <b>Economic Botany of Crop Plants</b> . Asiatech Publishers, Inc., New Delhi.
18.	Conway G. 1999. <b>The Doubly Green Revolution: Food for All in the 21st Century</b> . Comstock Publishing Associates, New York.
19.	Pinstrup – Anderson P. et al. 1999. <b>World Food Prospects: Critical Issues for the Early 21st Century</b> . International Food Policy Research Institute, Washington DC, USA.
20.	Kocchar SL. 1998. <b>Economic Botany of the Tropics</b> . 2nd Edition. Mac Millan India Ltd., Delhi.
21.	Plant Wealth of India 1997. Special Issue of Proceedings Indian National Science Academy B-63.
22.	Sharma OP. 1996. <b>Hills Economic Botany</b> . (Late Dr. A.F. Hill, adapted by O.P. Sharma). Tata McGraw Hill Co., Ltd., New Delhi.
23.	Frankel OH, Brown AHD and Burdon JJ. 1995. <b>The conservation of Plant Diversity</b> . Cambridge University Press, Cambridge, UK.

24.	Paroda RS and Arora RK. 1991. <b>Plant Genetic Resources Conservation and Management.</b> IPGRI (Publication) South Asia Office, C/o. NBPGR Pusa Campus, New Delhi.
25.	Swaminathan MS and Kocchar SL (ed). 1989. <b>Plants and Society.</b> Mac Millan Publication Ltd., London.
26.	Thakur RS, Puri HS and Hussain A. 1989. <b>Major Medicinal Plants of India.</b> Central Institute of Medicinal and Aromatic Plants. CSIR, Lucknow.
27.	Council of Scientific & Industrial Research 1986. <b>The useful plants of India. Publications and Information Directorate.</b> CSIR, New Delhi.
28.	Baker HG. 1978. <b>Plants and Civilization.</b> 3 <sup>rd</sup> Edition. C.A. Wadsworth, Belmont.
29.	Chrispeels MJ and Sadava D. 1977. <b>Plants, Food and People.</b> W.H. Freeman and Co., San Francisco, USA.
30.	Schery RW. 1972. <b>Plants for Man.</b> 2 <sup>nd</sup> Edition. Englewood Cliffs, New Jersey.
31.	Raw materials I - XII Revised Vol. I-III (1985-1992) supplement (2000).





## M.Sc. Botany – Semester III

### B302 PLANT REPRODUCTION

#### Theory:

Male Gametophyte: Structure of anthers; microsporogenesis; role of tapetum; pollen development, sperm dimorphism; pollen embryo sacs and compound pollen grains.

Female Gametophyte: Ovule development; megasporogenesis, organisation of the embryo sac; ultra structure of the embryo sac cells.

Pollination, Pollen-pistil interaction: Structure of the pistil; pollen-stigma interactions; Sporophytic and Gametophytic self-incompatibility, different methods to overcome self-incompatibility.

Fertilization: Pollen germination; pollen tube growth and guidance; Entry of pollen tube into the embryo sac; pollen tube discharge, syngamy and triple fusion; polyspermy and hetero fertilization.

Post-fertilisation events: Endosperm development; Types of Endosperm; Functions; Endosperm and embryo relationships.

Embryo development: Johanson and Soueges systems; Types.

Polyembryony; apomixis; parthenocarpy - outlines only.

Seed Dormancy: Seed dormancy; overcoming seed dormancy.

Outlines of Experimental Embryology – Anther culture, ovary culture, ovule culture; embryo culture; Invitro fertilisation.

Applications of Angiosperm Embryology (Agricultural, Horticultural and Taxonomic Considerations).

**Suggested Laboratory Exercises:**

Study of microsporogenesis and gametogenesis in sections of anthers.

Tests for pollen viability using stains and invitro germination.

Embryo sac development through examination of permanent, stained serial sections.

Study of nuclear and cellular endosperm through dissections and staining.

Isolation of different stages of embryo development from suitable seeds.

### **Suggested readings:**

1. Bhojwani, S.S and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4<sup>th</sup> revised and enlarged edition) Vikas Publishing House, New Delhi;
2. Leins, P., Tucker, S.C. and Endress. P.K. 1988. Aspects of Floral Development. J. Cramer, Germany;
3. Procter, M. and Yeo, P. 1973. The Pollination of Flowers. William Collins Sons, London;
4. Pulliah, T., Lakshminarayana, K. and Hanumantha Rao, B., 2008. Plant Reproduction, Scientific Publishers, Jodhpur, India;
5. Raghavan, V. 1997. Molecular Embryology of Flowering Plants. Cambridge University Press, Cambridge;
6. Raghavan, V. 1999. Developmental Biology of Flowering Plants. Springer – Verlag, New York;
7. Sedgely, M. and Griffin, A.R. 1989. Sexual Reproduction of Tree Crops, Academic Press, London;
8. Shivanna, K.R. and Swahney, V.K. (Eds.) 1997. Pollen Biotechnology for Crop Production and Improvement. Cambridge University Press, Cambridge;
9. Shivanna, K.R. and Rangaswamy, N.S. 1992. Pollen Biology, A Laboratory Manual. Springer-Verlag, Berlin;
10. Shivanna, K.R. and Johri, B.M.1985. The Angiosperm Pollen Structure and Function, Wiley Eastern Ltd., New Delhi;
11. The Plant Cell. Special Issue on Reproductive Biology of plants, Vol.5 (10) 1993. The American Society of Plant Physiologists, Rockville, Maryland, USA.



**M.Sc. Botany - Semester III**

**B 303 PLANT ECOLOGY**

**Theory**

<b>S. No</b>	<b>Unit</b>
<b>SECTION A</b>	
1.	The environment: physical environment, biotic environment and abiotic environment. Ecology and human welfare. Climate, soil and vegetation patterns of the world: life zones, major biomes, vegetation and soil types of the world.
2.	Habitat and niche: concept of habitat and niche, niche width and overlap, fundamental and realized niche, resource partitioning, character displacement.
3.	Population Ecology: characteristics of a population, population growth curves, population regulation, life history strategies (r and k selection), concept of meta population, demes and dispersal, interdemec extinctions, age structured population.
4.	Species interactions: types of interactions, interspecific competition, herbivory, carnivory. Ecological succession: types, mechanisms, changes involved in succession, concept of climax. Hydrosere and Xerosere
<b>SECTION B</b>	
5.	Community ecology: nature of communities, community structure and attributes, levels of species diversity and its measurement, edges and ecotones, community classification.
6.	Ecosystem: structure and function. Energy dynamics. Mineral cycling (carbon, nitrogen and phosphorus). Primary production and decomposition. Structure and function of some Indian ecosystems– Terrestrial (forest, grassland) and aquatic (fresh water, marine, estuarine).
7.	Biogeography: Major terrestrial biomes. Theories of island biogeography. Biogeographical zones of India.
8.	Applied ecology: Environmental pollution – air, water and soil, kinds, sources, quality parameters. Effects on plant ecosystems. Climate change – green house gases, ozone layer and ozone hole, consequences of climate change. Methods for mitigation of climate change: physical, chemical and biological. Biodiversity status, monitoring and documentation, major drivers of biodiversity change, biodiversity management approaches. Conservation biology: principles of conservation, major approaches to management. Indian case studies on

conservation, management strategy (Biosphere reserves, Project tiger).

### Practical

#### Exhibits/ Experiments/ Suggested Laboratory Exercises

<b>1.</b>	To study the stratification of plants in botanical gardens.
<b>2.</b>	To prepare life forms of botanical gardens of college campus. Compare the biological spectrum of college campus with normal biological spectrum.
<b>3.</b>	To estimate the frequency of plants in the college campus.
<b>4.</b>	To estimate the relative frequency of plants in the college campus.
<b>5.</b>	To estimate the density of a plant species in the college campus.
<b>6.</b>	To estimate the relative density of a plant species in college campus.
<b>7.</b>	To determine the minimal size and number of quadrats required for reliable estimate of biomass in grass land.
<b>8.</b>	To determine the basal area of a plant species in the campus.
<b>9.</b>	To determine the important value index (IVI) of plant species in the campus.
<b>10.</b>	To estimate IVI of the plant species in a woodland using point center quarter methods.
<b>11.</b>	To determine plant diversity indices (Shamon - Wiener) continuum of dominance, species richness, equitability and biodiversity of species in the campus.
<b>12.</b>	To estimate rate of carbon dioxide evolution from different soils using soda lime or alkali absorption method.
<b>13.</b>	To study environmental impact of a given developmental activity using check list as a EIA method.
<b>14.</b>	Enumeration in pond ecosystems.
<b>15.</b>	To study the composition of woodland ecosystem.
<b>16.</b>	Demonstration of chemical energy stored in leaves which was the transformed from radiation energy.
<b>17.</b>	Estimation of biomass of cropland plots.

<b>18.</b>	Estimation of chlorophyll.
<b>19.</b>	Determination of leaf area index methods with plain graph sheets.
<b>20.</b>	To determine the water holding capacity of soil collected from different locations

#### Reference Books

<b>1.</b>	American Public Health Association American Water Works Association. 2013. <b>Standard Methods for the Examination of Water and Waste Water.</b> General Books LLC, USA.
<b>2.</b>	Sharma PD. 2007. <b>Ecology and Environment.</b> Rastogi Publications, Meerut.
<b>3.</b>	Sharma PD. 2001. <b>Ecology and Environment.</b> Rastogi Publications, Meerut.
<b>4.</b>	Smith RL. 1996. <b>Ecology and field Biology.</b> Harper Collins, New York.
<b>5.</b>	Sokal RR and Rohit FJ. 1995. <b>Biometry.</b> W.H. Freeman and Co., New York.
<b>6.</b>	Batra NK. 1992. <b>Treatise on Plant Ecology.</b> Pradeep Publications, Delhi.
<b>7.</b>	CJ. 1989. <b>Ecological Methodology.</b> Harper and Row, New York, USA.
<b>8.</b>	Ludwig JA and Reynolds JF. 1988. <b>Statistical Ecology.</b> Wiley, New York.
<b>9.</b>	Magurran AE. 1988. <b>Ecological Diversity and its measurement.</b> Croom Helm, UK.
<b>10.</b>	Moore PD and Chapman SB. 1986. <b>Methods in Plant Ecology.</b> Blackwell Scientific, Oxford, UK.
<b>11.</b>	Pielow EC. 1984. <b>The interpretation of Ecological Data.</b> John and Wiley Sons, USA.
<b>12.</b>	Muller – Dombois D and Ellenberg H. 1974. <b>Aims and Methods of Vegetation Ecology.</b> Blackburn Press, New Jersey.
<b>13.</b>	Odum PE. 1971. <b>Fundamentals of Ecology.</b> 3 <sup>rd</sup> Edition. W. B. Saunders, Philadelphia.
<b>14.</b>	Dansemmire RF. 1968. <b>Plant Communities.</b> Horpes and Row, New York.
<b>15.</b>	Misra R. 1968. <b>Ecology Work Book.</b> Oxford and IBH Publishing Co., New Delhi.
<b>16.</b>	Ambasht RS and Ambasht NK. <b>A Text Book Plant Ecology.</b> CBS Publishers and distributors, New Delhi.





**M.Sc. Botany – Semester III**  
**B 304 PLANT PHYSIOLOGY**

**Theory**

S. No	Unit
<b>SECTION A</b>	
<b>1.</b>	Plant water relations: free energy and chemical potential, osmotic potential, water potential and its determination, active and passive absorption of water, stomatal physiology and mechanisms of stomatal opening and closing, Soil-plant-atmosphere-continuum concept (SPAC), mechanism of water transport.
<b>2.</b>	Mineral nutrition: passive and active uptake of ions, translocation of minerals in plants, essential elements: their functions and symptoms of mineral deficiency, importance of foliar nutrition and use of chelates in agriculture, root microbe interactions in facilitating nutrient uptake, mechanism of assimilate translocation.
<b>3.</b>	The flowering process: phytochrome: structure, photochemical and biochemical properties, role in photomorphogenesis. Photoperiodism and its significance, mechanisms of floral induction. Vernalization. Morphological, biochemical and metabolic changes accompanying seed germination.
<b>4.</b>	Plant growth regulators and elicitors: biosynthesis, physiological effects and mechanism of action of auxins, gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, polyamines, jasmonic acid and salicylic acid. Role of plant growth regulators in agriculture. Hormone receptors.
<b>SECTION B</b>	
<b>5.</b>	Fundamental of Enzymology: General aspects, allosteric mechanism, regulatory and active sites, isozymes, kinetics of enzymatic catalysis, Michaelis-Menten Equation and its significance, Mechanism of enzyme action.
<b>6.</b>	Photochemistry and Photosynthesis: General concepts and historical back ground, evolution of photosynthetic apparatus, Redox reactions, photosynthetic pigments and light harvesting complexes, photo-oxidation of water, mechanisms of electron and proton transport, structure, synthesis and function of ATP, carbon assimilation-the Calvin's cycle, photorespiration and its significance, the C <sub>4</sub> cycle and CAM pathway, biosynthesis of starch and sucrose, physiological and ecological considerations.
<b>7.</b>	Respiration and Lipid metabolism : Plant respiration, glycolysis, the TCA cycle, electron

	transport and ATP synthesis, pentose phosphate pathway, glyoxylate cycle, alternative oxidase system, structure and function of lipids, fatty acid biosynthesis of membrane lipids, structural lipids and storage lipids and their catabolism. Nitrogen fixation and nitrogen metabolism: Biological nitrogen fixation, nodule formation and nod factors, biosynthesis of amino acids and proteins, mechanism of nitrate uptake and reduction.
<b>8.</b>	Stress Physiology: Plant responses to biotic and abiotic stress, mechanisms of biotic and abiotic stress tolerance, water deficit and drought resistance, salinity stress, metal toxicity, heat stress and oxidative stress.

### **Practical**

<b>Exhibits/ Experiments/ Suggested Laboratory Exercises</b>	
<b>1.</b>	Determination of osmotic potential.
<b>2.</b>	Determination of water potential.
<b>3.</b>	Demonstration of osmosis.
<b>4.</b>	Determination of root pressure.
<b>5.</b>	Effects of high and low temperatures upon the permeability of the cytoplasmic membranes.
<b>6.</b>	Determination of suction force due to transpiration.
<b>7.</b>	Stomatal frequency and stomatal index of leaves.
<b>8.</b>	Rate of transpiration in leaves by cobalt chloride paper method.
<b>9.</b>	Determination of amylase activity
<b>10.</b>	Extraction and separation of chloroplast pigments by paper chromatographic method
<b>11.</b>	Determine chlorophyll a / chlorophyll b contents in C <sub>3</sub> and C <sub>4</sub> plants by spectrophotometric method
<b>12.</b>	Determination of Hill reaction
<b>13.</b>	Determination of rate of Aerobic respiration by continuous current method
<b>14.</b>	Determination of rate of Anaerobic respiration by continuous current method
<b>15.</b>	Determination of catalase activity
<b>16.</b>	Demonstration of Polyphenol oxidase
<b>17.</b>	Determination of reducing sugars

18.	Estimation of free acids in Bryophyllum in terms of milliequivalents of NaOH
19.	Extraction and estimation of seed proteins depending upon the solubility
20.	SDS – PAGE for soluble proteins extracted from the given plant materials
21.	Separation of isozymes esterase, peroxidase by native polyacrylamide gel electrophoresis
22.	Effect of Light quality on the rate of Photosynthesis
23.	Effect of CO <sub>2</sub> concentration on the rate of Photosynthesis
24.	Estimation of Starch by gravimetric method
25.	Demonstration of Starch hydrolysis
26.	Separation of Chloroplast pigments by chemical method
27.	Separation of amino acids and carbohydrates through two dimensional chromatographic method

#### Reference books

1.	Sinha SK 2014. <b>A text book of Plant Physiology</b> . Centrum Press, New Delhi.
2.	Seema Yadav 2014. <b>Plant Physiology</b> . SBW publishers, New Delhi.
3.	Heribert H and Kazuo S (eds) 2010. <b>Plant responses to abiotic stress. Series Topics in Current Genetics, Vol 4</b> . Springer, Berlin.
4.	Philip Stewart and Schine Gobig 2011. <b>Plant Physiology</b> . CRC Press.
5.	Moore TC. 2011. <b>Biochemistry and Physiology of Plant Hormones</b> . Springer, New York.
6.	Hooykaas PJJ, Hall MA and Libbenga KR (ed) 1999. <b>Biochemistry and Molecular Biology of Plant Hormones</b> . Elsevier, Amsterdam, Netherlands.
7.	Taiz L and Zeiger E. 1998. <b>Plant Physiology</b> . 2 <sup>nd</sup> Edition. Sinauer Associates including Publishers, Massachusetts, USA.
8.	Wisthoff P. 1998. <b>Molecular Plant Development from Gene to Plant</b> . Oxford University Press, Oxford, UK.
9.	Thomas and Vince – Prue D. 1997. <b>PhotoPeriodism in Plants</b> . 2 <sup>nd</sup> Edition. Academic Press, Sandeigo, USA.
10.	Hopkins WG. 1995. <b>Introduction to Plant Physiology</b> . John Wiley & Sons Including New York, USA.
11.	Mohr H and Schopfer P. 1995. <b>Plant Physiology</b> . Springer-Verlag, New York.

12.	Salisbury FB and Ross CW. 1992. <b>Plant Physiology</b> . 4 <sup>th</sup> Edition. Wordsworth Publishing Company, California, USA.
13.	Noggle GR and Fritz GJ. 1991. <b>Introductory plant physiology</b> . 2 <sup>nd</sup> Edition. Prentice hall of India Limited, New Delhi.
14.	Davies PJ (ed) 1987. <b>Plant hormones and their role in Plant Growth and Development</b> . Mertinus Nijhoff Publishers, Netherlands.
15.	Witham FH and Devlin RM. 1986. <b>Plant Physiology</b> . CBS Publishers and Distributors, Bangalore.
16.	Wilkins MD. 1987. <b>Advanced Plant Physiology</b> . English Language Book Society, Longman Scientific and Technical, Harlow, UK.
17.	Bewley JD and Black M. 1982. <b>Physiology and Biochemistry of seed in relation to germination and dormancy. Volume 1 and 2</b> . Springer – Verlag, Berlin.
18.	Khan AA. 1982. <b>The Physiology and Biochemistry of Seed Development, Dormancy and Germination</b> . Elsevier, Amsterdam, Netherlands.
19.	Ting IP. 1982. <b>Plant Physiology</b> . Addison-Wesley, Reading, MA.
20.	Murthy HNK. 1981. <b>Plant growth substances including applications in Agriculture</b> . Tata McGraw Hill Publishing Company Ltd., New Delhi.
21.	Kramer PM and Kozlowski TT. 1980. <b>Physiology of Woody Plants</b> . Academic Press, New York.
22.	Hewitt EJ and Smith TA. 1975. <b>Plant Mineral Nutrition</b> . English University Press,
23.	Meyer AM and Poljakoff-Mayber A. 1975. <b>The germination of Seeds</b> . Pergamon Press, Canada.
24.	Hess D. 1974. <b>Plant Physiology</b> . Narosa Publishing House, New Delhi.
25.	Audus LJ. 1972. <b>Plant Growth Substances. Volume 1</b> . Chemistry and Physiology. Leonard Hill, UK.
26.	Slayter RO. 1967. <b>Plant Water Relationships</b> . Academic Press, London
27.	Hillman WS. 1963. <b>Physiology of Flowering</b> . Holt, Reinhart and Winston, New York.



## M.Sc. Botany - Semester IV

### B 401 GENETIC ENGINEERING OF PLANTS AND MICROBES

#### Theory

S.No	Unit
<b>SECTION A</b>	
1.	Basics of rDNA technology: restriction enzymes–types, nomenclature, mechanism of action. Methodology of rDNA molecule synthesis–joining overlapping ends, blunt end joining, polylinkers. Vectors–features. Cloning vectors– plasmids, viral DNA, cosmids, bacterial and yeast artificial chromosomes(BACs and YACs). Expression vectors.
2.	Bacterial transformation. <i>In-vitro</i> packaging. Recognition of transformants–antibiotic resistance, <i>Lac Z</i> gene based selection. Genomic library, cDNA library.
3.	Methods of gene transfer in plants: electroporation, gene gun, <i>Agrobacterium</i> mediated– binary and co integrative vector based. Chloroplast transformation.
4.	Classical examples of successful cases of transgenic plants– fungal, bacterial, viral and insect tolerance (BT and proteinase inhibitors), herbicide tolerance, abiotic stress tolerance, male sterility– Barnase-Barstar. Quality improvement –golden rice, late ripening tomatoes (Flavr Savr).
<b>SECTION B</b>	
5.	Techniques in genetic engineering I: Blotting techniques– Southern, Northern and Western blotting, radioactive and non-radioactive labeling, detection of hybridization. <i>In-situ</i> hybridization– technique, radioactive and non-radioactive probes, enzyme and fluorescence detection methods (FISH), applications of the technique. PCR– technique, types, applications. DNA sequencing– basic principle of Sanger’s method, automated DNA sequencing, high throughput DNA sequencing.
6.	Techniques in genetic engineering II: DNA fingerprinting–hybridization based (RFLP), PCR based (RAPD, AFLP). Restriction mapping. Microarray technique and its applications. Sequencing genomes–whole genome sequencing, shot gun sequencing. Next generation sequencing– 454 sequencing.
7.	Plant growth promoting bacteria – nitrogen fixers, siderophores, phytohormone production. Genetic improvement of industrially important microbes for production of useful products – biopesticides, biofertilizers, antibiotics. Intellectual Property Rights, farmer’s rights. Patents. Ethical and environmental issues in genetic engineering.

8.	Bioinformatics: Scope. Data bases– types, Genbank, PIR, PDB. An account of NCBI. Web based tools for sequence searches –BLAST. Genome projects, genome annotation, gene annotation, features of the genome of <i>Arabidopsis</i> , rice. Genomics– structural genomics, comparative genomics, functional genomics. Molecular phylogeny and phylogenetic trees. Metagenomics.
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#### **Practicals**

<b>S. No</b>	<b>Exhibit/Experiment</b>
1.	Isolation of plasmid DNA
2.	Bacterial transformation and identification of transformation
3.	Plant DNA isolation
4.	Restriction enzyme digestion and gel electrophoresis
5.	Assignments on the syllabus
6.	Pictorial demonstration of the various techniques

#### **Reference Books**

1.	Glick BR, Pasternak JJ and Patten CL. 2010. <b>Molecular Biotechnology Principles and Applications of rDNA</b> . ASM Press, USA.
2.	Attwood TK, Smith DJP and Phukan S. 2009. <b>Introduction to Bioinformatics</b> . Pearson Education Ltd., UK.
3.	Sateesh MK. 2008. <b>Bioethics and Biosafety</b> . I K International Pvt. Ltd., Bangalore.
4.	Channarayappa. 2007. <b>Molecular Biotechnology Principles and practices</b> . Taylor and Francis, UK.
5.	Watson JD. 2007. <b>Recombinant DNA: Genes and Genomes: A short course</b> . W. H. Freeman, USA.
6.	Primrose SB and Twyman RM. 2006. <b>Principles of Genome Analysis and Genomics</b> . Blackwell publishers, USA.
7.	Lewin B. 2004. <b>Genes VIII</b> . Pearson Prentice Hall, New Jersey.
8.	Chawla HS. 2002. <b>Introduction to Plant Biotechnology</b> . Oxford and I B H Publishers, USA.





**M.Sc. Botany – Semester IV**  
**B 402 EVOLUTION AND PLANT BREEDING**

**Theory**

S. No	Unit
<b>SECTION A</b>	
<b>1.</b>	Origin of life and unicellular evolution: Origin of basic biological molecules, abiotic synthesis of monomers and polymers , concept of Oparin and Haldane, experiment of Miller (1953). The first cell – evolution of prokaryote, RNA world. Origin of eukaryotic cells– Endosymbiont theory, evolution of unicellular eukaryotes, anaerobic and aerobic metabolism.
<b>2.</b>	Theories of organic evolution: Lamarckism, Darwinism–concepts of variation, adaptation, struggle, fitness and natural selection, Synthetic theory, phyletic gradualism, punctuated equilibrium, concepts of neutral evolution.
<b>3.</b>	Molecular evolution: molecular divergence and molecular clocks–protein and nucleotide sequence analysis, gene duplication and divergence. Hardy-Weinberg equilibrium and its applications.
<b>4.</b>	Plant breeding: history, objectives, activities, important achievements and undesirable consequences. Organizations for crop improvement in India: ICAR, Agricultural universities, Central institutes for crop improvement, All India coordinated programmes. Plant Introduction, domestication and acclimatization.
<b>SECTION B</b>	
<b>5.</b>	Methods of breeding self pollinated crops: Mass selection, Pureline selection, Pedigree method, Bulk method, Backcross method, Multiline varieties.
<b>6.</b>	Methods of breeding cross pollinated plants: Bulk Selection, Recurrent selection, Synthetic varieties, Hybridization. Inbreeding depression and Heterosis – genetic and molecular basis.
<b>7.</b>	Breeding of vegetatively propagated crops. Role of apomixis in plant breeding. Mutation breeding.
<b>8.</b>	Biostatistical methods: basic concept of parametric and non-parametric methods. Graphical representation. Measures of central tendency and dispersion. Probability distributions–Binomial, Poisson and Normal distributions. Concepts of confidence intervals, types of error, levels of significance. Regression and correlation; t-test. ANOVA. Basic introduction to multivariate statistics.

### Practical

1.	Problems based on Hardy Weinberg law
2.	Line diagrams showing the plan of different methods of breeding self pollinated crops- Mass selection, Pureline selection, Pedigree method,
3.	Line diagrams showing the plan of different methods of breeding cross pollinated crops- Bulk Selection, Recurrent selection.
4.	Methods of hybridization in rice, sorghum, bajra, cotton in standing crop in the field.
5.	Assignments with problems for computing measures of central tendency and dispersion- mean, median and mode, standard deviation and standard error.
6.	Assignment with problems for computing correlation and regression coefficients.
7.	Assignment with problems for implementing t test.
8.	Assignment with problems for computing ANOVA.

### References

1.	Singh BD. 2012. <b>Plant Breeding: Principles and Methods</b> . Kalyani Publishers, Delhi.
2.	Stickberger MW. 1985. <b>Genetics</b> . McMillan, New York.
3.	Frey KJ. 1981. <b>Plant Breeding II</b> . Iowa State University Press, Oxford.
4.	Jones DA and Wilkins DA. 1971. <b>Variation and adaptation in plant species</b> . Heinemann Educational Books Ltd., London.
5.	Stebbins GL. 1971. <b>Chromosomal evolution in Higher Plants</b> . Edward Arnold Publishers Ltd., London.
6.	Poehlman JM and Borthakur D. 1969. <b>Breeding Asian field crops: With Special Reference to Crops of India</b> . Oxford and IBH Pub. Co., Delhi.
7.	Briggs FN and Knowles PF. 1967. <b>Introduction to Plant Breeding</b> . Reinhold Pub. Corp., New York.
8.	Brewbaker JL. 1964. <b>Agricultural Genetics</b> . Prentice-Hall, New Jersey, USA.
9.	Allard RW. 1961. <b>Principles of Plant Breeding</b> , 2 <sup>nd</sup> Edition. John Wiley and Sons Inc., New York.



**M.Sc. Botany - Semester IV**

**B 403 PLANT PATHOLOGY**

**Theory**

<b>S. No</b>	<b>Unit</b>
<b>SECTION A</b>	
<b>1.</b>	Importance of plant diseases, classification of plant diseases, causes of plant diseases, symptoms of plant diseases, post harvest diseases. Dispersal of plant pathogens- active and passive.
<b>2.</b>	Infection phenomena – pre penetration, penetration and post penetration. Factors affecting infection. Effect of environment on plant disease development – temperature, humidity and light.
<b>3.</b>	Molecular basics of host pathogen interactions (fungi, bacteria & viruses) and genetic engineering for disease resistance. Defense mechanisms in plants: pre-and post-infectious defense mechanisms, phytoalexins.
<b>4.</b>	Role of enzymes in plant diseases – pectic, macerating, cellulolytic, lignolytic, proteolytic, lypolytic enzymes and hemicellulases, inactivation of enzymes.
<b>SECTION B</b>	
<b>5.</b>	Role of toxins in plant diseases – Phytotoxins, vivo toxins, host specific patho toxins & non specific patho toxins.
<b>6.</b>	Control of plant diseases: Cultural practices: field & crop sanitation, crop rotation; Chemical control: systematic & non systematic fungicides; Biological control. microbial pesticides.  Plant diseases management through host resistance: vertical, horizontal, monogenic, polygenic, specific & general resistance. Development of resistant varieties.
<b>7.</b>	Symptoms, etiology, epidemiology & control measures with reference to the following:  Fungal diseases – Club root of crucifers, Damping off of seedlings. Leaf spot of

	turmeric, Ergot of bajra, Powdery mildew of Cucurbits, Whip smut of sugarcane, Grain smut of <i>Sorghum</i> , Bean rust, Coffee rust, Blast disease of rice, Wilt of cotton, Tikka disease of ground nut.
8.	Bacterial diseases – Citrus Canker, Angular leaf spot of cotton, Bacterial leaf Blight of rice, Brown rot of potatoes. Viral and phytoplasma diseases – Grassy shoot diseases of sugarcane, Little leaf of brinjal, Rice tungro.

### Practical

S. No	Exhibits/ Experiments
1.	Study of symptoms, microscopic examination of diseased parts and identification of the pathogens involved in different plant diseases  Fungal diseases–Club root of crucifers, Damping off of seedlings. Leaf spot of turmeric, Ergot of bajra, Powdery mildew of Cucurbits, Whip smut of sugarcane, Grain smut of <i>Sorghum</i> , Bean rust, Coffee rust, Blast disease of rice, Wilt of cotton, Tikka disease of ground nut.  Bacterial diseases–Citrus Canker, Angular leaf spot of cotton, Bacterial leaf Blight of rice, Brown rot of potatoes.  Viral and phytoplasma diseases – Grassy shoot disease of sugarcane, Little leaf of brinjal, rice tungro.
2.	Isolation of fungal pathogens from leaves.
3.	Isolation of fungal pathogens from soil.
4.	Extraction of pectolytic enzymes from a pathogen.
5.	Extraction of cellulase enzyme from a pathogen.
6.	Isolation of plant pathogen– bacteria.
7.	Isolation (purification) of plant viruses.

### Reference Books

1.	Ravichandra NG. 2013. <b>Fundamentals of Plant Pathology</b> . PHI Learning Pvt. Ltd., Delhi.
2.	Ronald PC. 2007. <b>Plant-Pathogen Interactions: Methods in Molecular Biology</b> . Humana Press, New Jersey.

3.	Mehrotra RS.2006. <b>Plant pathology</b> . Tata McGraw Hill Publishing Co. Ltd., New Delhi.
4.	Sharma PD. 2004. <b>Plant pathology</b> . Rastogi Publications, New Delhi.
	Bilgrami S and Dubey HC. 1998. <b>A text book of modern Plant pathology</b> . Sangam Books Ltd., Mumbai.
5.	Stacey G and Keen TN. (ed). 1996. <b>Plant Microbe Interactions. Vols. I-III</b> . Chapman and Hall, New York; <b>Vol. IV</b> . APS Press, St. Paul, Minnesota.
6.	Singh RS. 1990. <b>Plant diseases</b> . Oxford and IBH Publishing Co., New Delhi.
7.	Butler EJ. 1973. <b>Fungi and diseases in plants</b> . Periodical Expert Book Agency, Delhi.
8.	Roberts D and Boothroyd CW. 1973. <b>Fundamentals of Plant pathology</b> . W. H. Freeman and Co., Ltd., New York.
9.	Rangaswamy G. 1972. <b>Disease of crop plants in India</b> . Prentice Hall of India, New Delhi.
10.	Strobell GA and Mathre DE. 1970. <b>Outline of Plant pathology</b> . D. Van Nostrand-Reinhold Co., New York.
11.	Matthews REF. 1970. <b>Plant virology</b> . Academic Press, New York.
12.	Agrios GN. 1969. <b>Plant Pathology</b> . Academic Press, New York.
13.	Walker JC. 1969. <b>Plant pathology</b> . McGraw Hill Book Co., New York.
14.	Wheeler BEJ.1969. <b>An introduction of Plant diseases</b> . John Wiley and Sons Ltd., New York.
15.	Smith KM. 1968. <b>Plant viruses</b> . Methuen, London.
16.	Mundkar BB.1967. <b>Fungi and Plant diseases</b> . McMillan and Co. Ltd., Calcutta.
17.	Wood RKS.1967. <b>Physiological Plant Pathology</b> . Blackwell Scientific Publications, Oxford.
18.	Kelman A. 1967. <b>Source Book of Laboratory Exercise in Plant Pathology</b> . W. H. Freeman, New York.
19.	Rangaswamy G. 1962. <b>Bacterial Plant Diseases in India</b> . Asia Publishing House,

	Bombay.
<b>20.</b>	Horsfall JC and Diamond AE.1960. <b>Plant Pathology – An Advanced Treatise – 3 volumes.</b> Academic Press, New York.
<b>21.</b>	Goodman et al.1957. <b>Biochemistry and Physiology of Infections and Plant Diseases.</b> Princeton, Van Nostrand, Belgium.
<b>22.</b>	Plank JEV.1953. <b>Plant Diseases – Epidemics and Control.</b> Academic Press, New York.





**M.Sc. Botany - Semester IV**  
**B 404 CROP PHYSIOLOGY AND BIOTECHNOLOGY**

**Theory**

S. No	Unit
<b>SECTION A</b>	
1.	Crop Physiology: Molecular biology of light reactions. Photosynthetic pathways.
2.	Mechanism of Photorespiration. Biotechnological strategies to improve photosynthesis, yield components. Source – sink relationships.
3.	Stress Physiology: Physiology and molecular biology of stress tolerance in response to water, salt and heavy metal stress.
4.	Methods in biotechnology: Tissue culture techniques in crop improvement, Protoplasts and cell fusion.
<b>SECTION B</b>	
5.	Recombinant DNA technology: basic principles of recombinant DNA technique. Techniques of transferring genes into plants.
6.	Potentials of Biotechnology: Molecular mechanism to confer herbicide resistance in crop plants. Genetic engineering to improve plant disease resistance.
7.	Genetic manipulation of crops for insect resistance, Genetic engineering of seed proteins and oils.
8.	Bioinformatics: Fundamentals of Genomics and Proteomics. PCR and its application in crop improvement, Principles of microarray technology and its applications.

**Practical**

S. No	Exhibit/Experiment
1.	Exercise-1: Chlorophyll absorption spectrum and quantitative determinations, assay of Hill reaction in isolated chloroplast. Crop growth analysis.
2.	Exercise-2: Determination of CO <sub>2</sub> compensation points in some crop plants, Estimation of carbohydrate, protein and nucleic acid contents in plants.
3.	Exercise-3: Determination of the activities of some enzymes associated with Carbohydrates and protein metabolism.
4.	Exercise-4: Effect of nitrogen and potassium on the growth and yield of crop plants.
5.	Exercise-5: Leaf anatomy in relation to diversity in photosynthetic pathways.
6.	Exercise-6: Effect of water and salt stress on the accumulation of proteins.
7.	Exercise-7: Estimation of nitrogen, phosphorus and potassium.

8.	Exercise-8: Experiments to study the effect of water and salt stress on seed germination and seedling development.
9.	Exercise-9: Experiments to study the weed control using some common herbicides.
10.	Exercise-10: Polyacrylamide gel electrophoresis of proteins.
11.	Exercise-11: Isolation of DNA.
12.	Exercise-12: Polymerase chain reaction.
13.	Exercise-13: Isolation of explants, establishment and maintenance of callus; Sub-culture of callus. Study of Somaclonal variation.
14.	Exercise-14: Isolation and culture of single cells.
15.	Exercise-15: Experiments on herbicide resistance and disease resistance in plants.

#### Reference Books

1.	Lebowitz RJ. 1995. <b>Plant Biotechnology, a laboratory manual</b> . Wm. C. Brown Publishers, Qubuque.
2.	Murray Meo – young. 1995. <b>Comprehensive Biotechnology. Vol . 1</b> . Pergamon Press Oxford.
3.	Marshall G and Walters O (ed) 1994. <b>Molecular Biology in Crop Protection</b> . Champman and Hall.
4.	Old RW and Primrose SB. 1994. <b>Principles of gene manipulation</b> . Blackwell Science.
5.	Salunkhe DK, Bhatt NR and Desai BB. 1990. <b>Post Harvest Biotechnology of Flowers and Ornamental Plants</b> . N. Bayopokash, Calcutta
6.	Davies KE. (ed) 1988. <b>Genome Analysis</b> . IRI Press, Oxford.
7.	Pierik RIM. 1987. <b>Invitro Culture of Higher Plants</b> . Martinus Nihoff Publishers Dordrecht.
8.	Primrose SB. 1987. <b>Molecular Biotechnology</b> . Blackwell Scientific Publications,
9.	Day PR. 1986. <b>Biotechnology and Crop Improvement and Protection</b> . BCPC Publications.
10.	Mantell SH and Smith N (ed) 1983. <b>Plant Biotechnology</b> . Cambridge University Press, Cambridge.
11.	Noggle GR and Fritz GJ. 1977. <b>Introductory plant physiology</b> .
12.	Reinert J and Bajaj YPS. 1977. <b>Plant Cell, Tissue and Organ Culture</b> . Springer – verlag, Berlin.
13.	Lange OI, Kappen L and Schule DD. 1976. <b>Water and Plant Life</b> .

<b>14.</b>	Burris RH and Black CC (ed) 1975. <b>CO<sub>2</sub> Metabolism and Productivity of Plants.</b>
<b>15.</b>	Evans IT. 1975. <b>Crop Physiology.</b>
<b>16.</b>	Major AM and Mayber P. 1975. <b>The germination of seeds.</b> 2 <sup>nd</sup> Edition.
<b>17.</b>	Mayber PA and Gele J. (ed) 1975. <b>Plants in Saline Environments.</b>
<b>18.</b>	Ashston and Crafts A. 1973. <b>Mode of Action of Herbicides.</b>
<b>19.</b>	Epstein E. 1972. <b>Mineral Nutrition of Plants: Principles and Perspectives.</b>
<b>20.</b>	Fogg GK. 1972. <b>Photosynthesis.</b>
<b>21.</b>	Hillman WS. 1972. <b>The Physiology of Flowering</b>
<b>22.</b>	Kozlowski TT. (ed) 1972. <b>Seed Biology. 3 Vols.</b>
<b>23.</b>	Levitt J. 1972. <b>Response of Plants to Environmental Stresses.</b>
<b>24.</b>	Hatch MD, Osmond CB and Slatyer RO (ed) 1971. <b>Photosynthesis and Photorespiration.</b>
<b>25.</b>	Gregory RPF. 1971. <b>Biochemistry of Photosynthesis.</b>
<b>26.</b>	Zelitch I. 1971. <b>Photosynthesis, Photorespiration and Plant Productivity.</b>
<b>27.</b>	Gollek B. (ed) 1970. <b>Structure and Function of Plant Cells in Saline Habitats.</b>
<b>28.</b>	Kozlowski TT. (ed) 1968. <b>Water Deficit and Plant Growth.</b>
<b>29.</b>	<b>Annual Review of Plant Physiology.</b> 1950. Vol. – Annual Reviews Inc., Stanford.

**M.Sc. Botany – Semester I**  
**B101: BIOLOGY AND DIVERSITY OF ALGAE AND BRYOPHYTES**  
**Theory**

S. No	Unit
<b>SECTION A</b>	
1.	Criteria employed in classification of algae. Classification given by Fritsch, Bold and Wynne, Lee. Thallus organization, reproduction and life cycles in algae.
2.	Range of thallus structure, reproduction, life histories of Chlorophyceae with special reference to the genera: <i>Chlamydomonas</i> , <i>Tetraspora</i> , <i>Volvox</i> , <i>Chlorella</i> , <i>Scenedesmus</i> , <i>Ulva</i> , <i>Enteromorpha</i> , <i>Cladophora</i> , <i>Fritschiella</i> , <i>Oedogonium</i> , <i>Spirogyra</i> , <i>Cosmarium</i> , <i>Caulerpa</i> , <i>Chara</i> .
3.	Salient features of Protochlorophyta; Xanthophyta: <i>Vaucheria</i> . Bacillariophyta: <i>Cyclotella</i> , <i>Navicula</i> ; Phaeophyta: <i>Ectocarpus</i> , <i>Dictyota</i> , <i>Padina</i> , <i>Laminaria</i> , <i>Sargassum</i> .
4.	Salient features of Rhodophyta: <i>Gelidium</i> , <i>Gracilaria</i> , <i>Polysiphonia</i> ; Cyanophyta: <i>Nostoc</i> , <i>Lyngbya</i> , <i>Spirulina</i> .
<b>SECTION B</b>	
5.	Diversity of marine and fresh water algae in India. Economic importance of algae– single cell protein, pigments, lipids, and omega fatty acids. Algal blooms. Algal bio fertilizers. Cultivation of economically important seaweeds– <i>Porphyra</i> , <i>Gracilaria</i> , <i>Gelidium</i> . Mass culture of micro algae.
6.	Classification of Bryophytes given by Smith, Campbell. Ecological and economic importance of Bryophytes. Conduction in Bryophytes.
7.	Morphology, structure, reproduction and life history of Hepatocopsida: Marchantiales: <i>Marchantia</i> ; Jungermaniales: <i>Pellia</i> , <i>Porella</i> ; Anthocertopsida: <i>Anthoceros</i> .
8.	Morphology, structure, reproduction and life history of Bryopsida: Sphagnales: <i>Sphagnum</i> ; Funariales: <i>Funaria</i> ; Polytrichales: <i>Polytrichum</i> .

**Practical**

S. No	Exhibit/Experiment
1.	Examination of vegetative and reproductive morphology of Chlorophyceae: <i>Chlamydomonas</i> , <i>Tetraspora</i> , <i>Volvox</i> , <i>Chlorella</i> , <i>Scenedesmus</i> , <i>Ulva</i> , <i>Enteromorpha</i> , <i>Cladophora</i> , <i>Fritschiella</i> , <i>Oedogonium</i> , <i>Spirogyra</i> , <i>Cosmarium</i> , <i>Caulerpa</i> , <i>Chara</i> .
2.	Examination of vegetative and reproductive morphology of Bacillariophyceae:

	<i>Cyclotella, Navicula</i> ; Phaeophyceae: <i>Ectocarpus, Dictyota, Padina, Laminaria, Sargassum</i> .
3.	Examination of vegetative and reproductive morphology of Rhodophyceae: <i>Gelidium, Gracilaria, Polysiphonia</i> .
4.	Examination vegetative and reproductive morphology of Xanthophyceae: <i>Vaucheria</i> Cyanophyceae: <i>Nostoc, Lyngbya, Spirulina</i> .
5.	Field work to get acquaintance with the algae of Visakhapatnam coast and fresh water algae in and around Visakhapatnam.
6.	An examination of the external features and internal structure and reproductive organs of: <i>Riccia, Targionia, Monoclea, Plagiochasma</i> .
7.	An examination of the external features and internal structure and reproductive organs of the genera: <i>Fimbriaria, Marchantia, Pellia, Porella</i> .
8.	An examination of the external features and internal structure and reproductive organs of: <i>Anthoceros, Notothylus, Andreaea, Funaria, Polytrichum</i> .

#### Reference Books

1.	Lee RW. 2007. <b>Classification of Algae</b> .
2.	Kumar HD. 1988. <b>Introductory Phycology</b> . Affiliated East West Press Pvt. Ltd., New Delhi.
3.	Round FE. 1986. <b>The Biology of Algae</b> . Cambridge University Press, New York.
4.	Bold HC and Wyne MJ. 1978. <b>Introduction to the Algae</b> . Prentice-Hall, New Jersey.
5.	Presscot GW. 1969. <b>The Algae- a Review</b> . Houghton Mifflin Company, Boston.
6.	Morris I. 1967. <b>An Introduction to the Algae</b> . Cambridge University Press, UK.
7.	Chapman VJ. 1962. <b>The Algae</b> . Macmillan and Co Ltd., London.
8.	Lewin RA. 1962. <b>Physiology and Biochemistry of Algae</b> . Academic Press, New York.
9.	Round FE. 1962. <b>Ecology of Algae</b> . Cambridge University Press, New York
10.	Smith GE (ed) 1950. <b>Fresh Water Algae</b> . Elsevier Science, USA.
11.	Fritsch FE. 1945. <b>The Structure and Reproduction of Algae Vols. 1&amp; II</b> . Cambridge University Press, New York.
11.	Chopra RN and Kumra PK. 1988. <b>Biology of Bryophytes</b> . New Age International (P) Ltd. Publishers, New Delhi.
12.	Parihar NS. 1991. <b>Bryophyta</b> . Central Book Depot, Allahabad.

<b>13.</b>	Puri P. 1980. <b>Bryophytes</b> . Atmaram and Sons, Delhi.
<b>14.</b>	Smith GM. 1955. <b>Cryptogamic Botany Vol.II</b> . Tata McGraw Hill Publishing Co. Ltd., New Delhi.
<b>15.</b>	Kashyap S. 1929. <b>Liverworts of the Western Himalayas and Punjab Plains Part I and Part II</b> . University of Panjab, Lahore, Pakistan.





**M.Sc. Botany - Semester I**  
**B 102: BIOLOGY AND DIVERSITY OF BACTERIA, VIRUSES AND FUNGI**  
**Theory**

S. No	Unit
<b>SECTION A</b>	
1.	General account of archaeobacteria, eubacteria and cyanobacteria. Classification of eubacteria. Ultrastructure, nutrition, reproduction and economic importance of bacteria.
2.	Morphology and chemical composition of Actinomycetes, Spirochetes, Rickettsiae and Mycoplasmas.
3.	Classification of viruses. Ultrastructure and chemistry of viruses. Replication and transmission of viruses. History, origin and evolution of plant viruses. Plant viral diseases.
4.	Microbial Ecology: quorum sensing, gentrification, phosphorous solubilization, nitrogen fixation.
<b>SECTION B</b>	
5.	Classification and phylogeny of fungi. Molecular aspects in classification. Thallus organization in fungi. Ultrastructure of fungal cell. Unicellular and multicellular organization. Cell wall composition. Fungal diseases in plants and humans.
6.	General account of Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina.
7.	Reproduction in fungi: vegetative, asexual and sexual. Heterothallism, heterokaryosis and parasexuality. Nutrition in fungi: saprobic, biotrophic, and symbiotic.
8.	Fungi in industry: medicine, food, pest and weed management (biocontrol agents). Mushroom cultivation. Fermentation methods. Mycorrhiza.

**Practical**

S. No	Exhibits/ Experiments
1.	Tools of microbiology: Care and use of the microscope, Spectrophotometer, P <sup>H</sup> meter, Micrometer, Hemocytometer, Autoclave, Centrifuge, Biological safety

	cabinets, Inoculation needle and loop, Incubator, Colony counter & Lyophilizer.
2.	Differential staining: Gram staining.
3.	Differential staining: Acid fast staining.
4.	Study of bacterial growth: To prepare the growth curve of bacteria.
5.	Study of cyanobacteria: Isolation and cultivation of cyanobacteria.
6.	Isolation of rhizobia from root nodules.
7.	Cultivation of viruses in embryonated eggs.
8.	Isolation of fungi by Petri plate exposure method.
9.	Morphological study of: <i>Stemonitis</i> , <i>Saprolegnia</i> , <i>Mucor</i> , <i>Morchella</i> , <i>Aspergillus</i> , <i>Agaricus</i> , <i>Cyathus</i> , <i>Synchytrium</i> , <i>Helminthosporium</i> .
10.	Symptomatology and anatomical study of some diseased specimens: white rust, powdery mildew, green ear of bajra, rust of wheat, rust of linseed, Tikka disease of ground nut, red rot of sugarcane, blast of rice, citrus canker, tobacco mosaic disease.
<b>References Books</b>	
1.	Kaursethi I and Surinder KW 2011. <b>Text Book of Fungi and their Allies</b> . Macmillan publishers, New Delhi, India.
2.	Ram Reddy S & Reddy SM 2007. <b>Essentials of Virology</b> . Scientific publishers, Jodhpur, India.
3.	Sharma K 2005. <b>Manual of Microbiology Tools and Techniques</b> . Ane Book, New Delhi, India.
4.	Matthew RH 2004. <b>Plant virology</b> . 4 <sup>th</sup> edition. Academic press an imprint of Elsevier, California, USA.
5.	Prescott <i>et al.</i> 2003. <b>Microbiology</b> . McGraw Hill Education, New York.
6.	Aneja KR 2003. <b>Experiments in Microbiology, Plant pathology and Biotechnology</b> . New Age International publishers, New Delhi.
7.	Verma HN 2003. <b>Basics of plant Virology</b> . IBH publishing co. Pvt. Ltd., New Delhi.

8.	Mehrotra KS and Aneja KR 2003. <b>An Introduction to Mycology</b> . New Age International Publishers, New Delhi.
9.	Sullia SB and Shantharam S 2001. <b>General Microbiology</b> . Oxford and IBH publishing Co. Pvt. Ltd, New Delhi.
10.	Reddy SM and Ram Reddy S 2000. <b>Microbiology a Laboratory Manual</b> . BSC Publishers and Distributors, Hyderabad.
11.	Flint SJ, Enquist LW, Krug RM, Racaniello VR, Skalka AM 2000. <b>Principles of Virology, Molecular Biology, Pathogenesis and Control</b> . ASM press, Washington DC.
12.	Rao AS 1999. <b>Introduction to Microbiology</b> . Prentice Hall of India Pvt. Ltd., Delhi.
13.	Alexopoulos CJ, Mims CW, Blackwell M 1996. <b>Introductory Mycology</b> . 4 <sup>th</sup> edition. Replika press, North Delhi.
14.	Paul S 1995. <b>Bacteria in Biology, Biotechnology and Medicine</b> . 5 <sup>th</sup> edition. John Wiley and son Ltd., UK.
15.	Pelczar, Chan and Krieg 1993. <b>Microbiology</b> . 5 <sup>th</sup> edition. McGraw Hill Education, New York.
16.	<i>Stainer</i> RT, Ingraham JL, Wheelis ML and Painter PR 1987. <b>General Microbiology</b> . 5 <sup>th</sup> Edition. Macmillan, London.
17.	Smith KM 1968. <b>Plant viruses</b> . Elsevier, New York.
18.	Rangaswamy G 1962. <b>Bacterial Plant disease in India</b> . Asia Publishing House, Bombay.



**M.Sc. Botany - Semester I**  
**B103 CELL BIOLOGY OF PLANTS**

**Theory**

S. No	Unit
<b>SECTION A</b>	
1.	The cell theory. Origin and development of cell biology as a separate branch. Dimensions of size and weight: micron to angstrom, microgram to pictogram. Ultra structure and organization of prokaryotic and eukaryotic cells. Specialized cell types.
2.	Chemical foundation: macromolecules–structure, shape and information. Non-covalent interactions in relation to function of nucleic acids and proteins. Biochemical energetics: types of energy– thermal, electrical and radiant energy, interconvertability of energy. Laws of thermodynamics as applicable to biological systems.
3.	Cell wall:structure and functions, cell wall architecture, biogenesis and growth. Plasmodesmata: structure and function, plasmodesmata in comparison to gap junctions of animal cells. Plasma membrane: structure, models and functions. ATPases receptors, carriers, channels, pumps. Vacuole structure and function, vacuolar ATPases, transporters.
4.	Cytoskeleton: microtubules and microfilaments, their role in cell division and motility; intermediate filaments– role in providing strength. Labeled antibody technique for visualizing cytoskeleton.
<b>SECTION B</b>	
5.	Chloroplast and Mitochondria: structure and function, genome organization, nucleo-cytoplasmic interactions, RNA editing.
6.	Other organelles: structure and function– endoplasmic reticulum, Golgi apparatus lysosomes,, ribosomes, microbodies, peroxisomes.
7.	Tools in cell biology I: microscopy–working principles of light microscopy, resolution power of microscope, different types of light microscopes, stains used. Image processing methods in microscopy. Scanning electron microscopy. Transmission electron microscopy– principle of working, preparation of specimens for electron microscopy –Fixing, sectioning, spreading molecules, negative staining, shadow casting, freeze fracture and freeze etching.
8.	Tools in cell biology II: subcellular fractionation– homogenization, principle of density gradient centrifugation. Spectroscopic techniques– principle and applications

	of UV- visible, ESR. Spectrofluorimetry. Circular dichroism (CD). Nuclear magnetic resonance (NMR). Whole cell autoradiography. Radiolabeling techniques: properties of different radioisotopes used in biology, their detection and measurement, incorporation of radioisotopes in biological tissues and cells.
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### Practical

S. No	Exhibit/Experiment
1.	Electron microscopic picture of prokaryotic and eukaryotic cells.
2.	Images of cytoskeleton.
3.	Electron microscope pictures of chloroplast and mitochondria.
4.	Electron microscope pictures of endoplasmic reticulum, Golgi apparatus.
5.	Study of mitosis using acetocarmine.
6.	Isolation of mitochondria and the activity of its marker enzyme, succinate dehydrogenase (SDM).
7.	Fluorescence staining with FDA for cell viability and cell wall staining with calcofluor.
8.	Pictures of images of shadow casting, negative staining, freeze fracturing and freeze etching.
9.	Images of cells in fluorescence, phase contrast and confocal microscopy, whole cell autoradiography.
10.	Establishing sucrose density gradients.

### Reference Books

1.	Alberts B, Breyer D, Hopkin K, Johnson AD, Lewis J, Raff M, Roberts K and Watter P 2014. <b>Essential Cell Biology</b> . 4 <sup>th</sup> Edition. Garland publishers, New York.
2.	Sharp D, Ploppe G and Sikorski E 2014. <b>Lewin's Cells</b> . 3 <sup>rd</sup> Edition. Viva Books, New Delhi.
3.	Cooper GM, Hausman RE 2013. <b>The Cell – A Molecular Approach</b> . 6 <sup>th</sup> Edition. Sinauer Associates, Incorporated, USA.
4.	Karp G 2013. <b>Cell and Molecular Biology – Concepts and Experiments</b> . 7 <sup>th</sup> Edition. Wiley Global Education, USA
5.	McLennan A, Bates A, Turner P, White M 2013. <b>Bios Instant Notes in Molecular Biology</b> . 4 <sup>th</sup> Edition. Garland publishers, New York.
6.	Cowling G, Allen T 2011. <b>The Cell. A very Short Introduction</b> . Oxford University Press, USA.

7.	Alberts B, Johnson A, Lewis J, Raff M, Roberts K, Walker P 2007. <b>Molecular Biology of the Cell</b> . 5 <sup>th</sup> Edition. Garland publishers, New York.
8.	Schaffer SW 2007. <b>Mitochondria: The Dynamic Organelle</b> . 1 <sup>st</sup> Edition. Springer Verlag.
9.	Wilson J, Hunt T 2007. <b>Molecular Biology of the Cell</b> 5 <sup>th</sup> edition. <b>The Problems Book</b> . 2 <sup>nd</sup> Edition. Garland publishers, New York.
10.	Celis JE (ed) 2006. <b>Cell Biology—A Laboratory Hand Book</b> . 3 <sup>rd</sup> Edition. Elsevier, USA.
11.	Lodish H, Berk A, Kaiser CA, Kreiger M, Scott P M, Bretcher A, Ploegh H, Matsudaira P. 2004. <b>Molecular Cell Biology</b> . 5 <sup>th</sup> edition. W. H. Freeman and Company, New York.
12.	De DN 2000. <b>Plant Cell Vacuoles. An Introduction</b> . CSIRO Publication Collingwood, Australia.
13.	Krishna Murthy KV 2000. <b>Methods in Cell Wall Cytochemistry</b> . CPC Press, Boca Raton, Florida.
14.	Lodish, Berk A, Zipursky SL, Matsudaira P, Baltimore D and Darnell J 2000 <b>Molecular Cell Biology</b> . 4 <sup>th</sup> Edition. W.H. Freeman and Co., New York.
15.	Alberts B, Bray D, Lewis J, Raff M, Roberts K and Watson JD 1999. <b>Molecular Biology of the Cell</b> , Garland Publishing, New York.
16.	Kleinsmith LJ and Kish VM 1995. <b>Principles of Cell and Molecular Biology</b> . 2 <sup>nd</sup> Edition. Harper Collins College Publishers, New York, USA.
17.	Avers CJ 1986. <b>Molecular Cell Biology</b> . Addison Wesley Publishing Company USA.





**M.Sc. Botany – Semester I**  
**B 104 CYTOLOGY AND CYTOGENETICS**

**Theory**

S. No	Unit
<b>SECTION A</b>	
<b>1.</b>	Nucleus: structure of nuclear membrane and nuclear pore complex, nucleolus, ribosome biosynthesis. Chromatin: eu and heterochromatin, arrangement of chromatin. Molecular organization of chromatin: components, nucleosomes – composition and organization, 10 nm, 30 nm, solenoid, scaffolds. Chromosome structure: molecular organization of centromeres and telomeres. Types of chromosomes: lampbrush, polytene.
<b>2.</b>	Chromosome identification: karyotype analysis. Chromosome banding techniques – Q, C, G and R banding. Flowcytometry and confocal microscopy in karyotype analysis. Computer assisted karyotype analysis – chromosome microdissection and micro cloning. FISH and GISH techniques.
<b>3.</b>	Chromosomal structural aberrations: origin, meiosis and breeding behaviour of duplications, deficiencies, inversions and interchanges. Types of inversions. Robertsonian translocations – basic concept of complex translocation heterozygotes.
<b>4.</b>	Chromosomal numerical aberrations: classification of numerical aberrations. Aneuploids – trisomics (primary, secondary, tertiary), monosomics and nullisomics – meiotic behavior. Eupolyploids – origin and production of auto -and allopolyploids, meiosis in autotetraploid. Genome of tobacco and wheat as examples of allopolyploids.
<b>SECTION B</b>	
<b>5.</b>	Nuclear DNA content: C-value paradox, hyperchromicity, cot curves and their significance. Molecular organization of eukaryotic nuclear genome: highly repeated, middle repeated and unique sequences.
<b>6.</b>	Cell cycle and its regulation: the G1, S, G2 and M phases. Synchronous and asynchronous cell divisions. The measurement of duration of different phases of cell cycle using a flow cytometer. Check points in cell cycle – role of cyclins and cyclin-dependent kinases in regulation of cell cycle.
<b>7.</b>	The different stages of mitosis and meiosis: description of the stages. Experimental control of cell division. Significance of meiosis.

8.	Apoptosis: mechanism and significance. Initiation of cancer at cellular level – proto oncogenes and oncogenes; retinoblastoma and E2F proteins.
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### Practical

S. No	Exhibit/ Experiment
1.	Photographs of interphase nucleus, 10 nm, 30nm and scaffolds. Electron microscope picture of metaphase chromosome, <i>in-situ</i> hybridization of chromosome spreads showing telomeres and centromeres. rRNA synthesis –christmas tree configuration.
2.	Pictures of lampbrush and polytene chromosomes.
3.	Photographs of chromosomes with different banding patterns. Identifying homologous chromosomes from the pictures.
4.	Preparation of karyotypes in <i>Allium/ Aloe</i> (with treated root tips).Construction of idograms from pictures of karyotypes.
5.	Photographs showing meiosis in structural and numerical aberrations.
6.	Meiosis in <i>Rheo discolor</i> showing complex translocation heterozygote.
7.	Preparation of slides from <i>Allium</i> floral buds for observation and identification of stages of meiosis.
8.	C value paradox chart and Britten and Kohne's Cot curves picture.

### Reference Books

1.	Singh RJ. 2014. <b>Plant Cytogenetics</b> . 2 <sup>nd</sup> Edition. CRC Press, India.
2.	Pierce BA. 2013. <b>Genetics: A Conceptual Approach</b> . 5 <sup>th</sup> Edition. W. H. Freeman, California.
3.	William K, Cummings S, Spencer MR and Charlotte A. 2013. <b>Essentials of Genetics</b> . Pearson Books, Delhi.
4.	Hartwell L. 2011 <b>Genetics: From Genes to Genomes, Study Guide and Solution Manual</b> . 4 <sup>th</sup> Edition. Nero, McGraw Hill Publishing company, New York.
5.	Bass H and Birchler J. 2011. <b>Plant cytogenetics: Genome structure and chromosome Function</b> . Springer, New York.
6.	Ram M. 2010. <b>Cytogenetics and Genetics</b> . PHI Learning Pvt. Ltd., Delhi.
7.	Anthony J, Griffiths F, Wessig SR, Carroll SB and Doebley J. 2010. <b>Introduction to genetic analysis</b> . 10 <sup>th</sup> Edition. W. H. Freeman, California.
8.	Russel PJ. 2009. <b>Genetics–A Molecular Approach</b> . 3 <sup>rd</sup> Edition. Pearson Benjamin Cummings, San Francisco, USA.
9.	Roy D. 2009. <b>Cytogenetics</b> . Alfa Science International Ltd., UK.

10.	Brooker R. 2008. <b>Genetics, Analysis and Principles</b> . 3 <sup>rd</sup> edition. McGraw Hill Science.
11.	Gupta P.K .1995. <b>Cytogenetics</b> . Rastogi & Company, Meerut.
12.	Sybenga J. 1992. <b>Cytogenetics in Plant Breeding</b> . Springer London Ltd.
13.	David M. Prescott. 1988. <b>Cells</b> . Jones and Bartlett Publ. Boston.
14.	Swanson M and Young. 1982. <b>Cytogenetics</b> . Prentice Hall, India.
15.	Khush GS. 1973. <b>Cytogenetics of Aneuploids</b> . Academic Press, New York and London.
16.	Sybenga J. 1973. <b>General Cytogenetics</b> . North Holland and American Elsevier Publishing Co., New York.
17.	Burnham CR. 1962. <b>Discussions in Cytogenetics</b> . Burgess Publishing Co., Minnesota.



**M.Sc. Botany - Semester II**

**B 201 GENETICS**

**Theory**

<b>S. No</b>	<b>Unit</b>
<b>SECTION A</b>	
<b>1.</b>	Concept of genetic markers and their types. Mendel's experiments and theories, application of probability laws to Mendelian principles. Chi-square testing for goodness of fit. Penetrance and expressivity. Pleiotropism. Phenocopies. Codominance and incomplete dominance.
<b>2.</b>	Multiple allelism: interaction among multiple alleles, complementation test, pseudoalleles. Gene interaction and modified F <sub>2</sub> ratios in two gene interactions.
<b>3.</b>	Linkage and crossing over: identifying linkage from F <sub>2</sub> and test cross, recombination frequency and distance between genes. Linkage maps. Tetrad analysis—ordered and unordered tetrads.
<b>4.</b>	Recombination in prokaryotes: transformation, conjugation, transduction, sexduction. Mapping of genes in bacteria using transformation and conjugation (interrupted mating). Fine structure analysis of gene – Benzer's work.
<b>SECTION B</b>	
<b>5.</b>	Sex determination: chromosomal and genetic basis. Sex-linked inheritance. Sex influenced and sex limited characters. Polygenic inheritance: heritability and its measurement. QTL mapping.
<b>6.</b>	Extra chromosomal inheritance: inheritance of mitochondrial and chloroplast genes. Male sterility. Chloroplast mutations. Maternal inheritance.
<b>7.</b>	Nature of the eukaryotic gene: split gene with a promoter and terminator. Variant forms of eukaryotic gene – nested genes, overlapping genes, assembled genes, assorted genes. Multigene families— organization and significance. Transposable elements in pro- and eukaryotes: types, mechanism of transposition, significance of transposable elements.
<b>8.</b>	Mutations: types, causes and detection. Physical and chemical mutagens. Lethal, conditional, biochemical, loss of function, gain of function. Molecular basis of mutations. Spontaneity of mutations, site-directed mutagenesis. Recombination: molecular mechanism— role of rec A, B, C, D enzymes, Holliday model, site specific recombination.

### Practical

S. No	Exhibit/Experiment/Assignment
1.	Assignment on Mendel's principles, chisquare test, proabability.
2.	Assignment on dominance relationships, multiple alleles and two gene interactions.
3.	Assignment on linkage and crossing over.

### Reference Books

1.	Benajamin Pierce 2013. <b>Genetics: A Conceptual Approach.</b> 5 <sup>th</sup> Edition.W.H. Freeman and Company.
1.	Lewin B. 2000. <b>Gene VII.</b> Oxford University Press, New York, USA.
2.	Snustad DP. and Simons MJ 2000. <b>Principles of Genetics.</b> 2 <sup>nd</sup> Edition. John Wiley and Sons Inc., USA.
3.	Atherly AG, Girton JR and McDonald JF. 1999. <b>The Science of Genetics.</b> Saunders College Publishing, Fort Worth, USA.
4.	Karp G. 1999. <b>Cells and Molecular Biology: concepts and Experiments.</b> Hohn Wiley and Sons Inc., USA.
5.	Hartl DL and Jones EW. 1998. <b>Genetics: Principles and Analysis.</b> 4 <sup>th</sup> Edition. Jones and Bartlett Publishers, Massachusetts, USA.
6.	Malacinski GM and Freifelder D. 1998. <b>Essentials of Molecular Biology.</b> 3 <sup>rd</sup> Edition. Jones and Bartlet Publishers Inc., London.
7.	Russel PJ. 1998. <b>Genetics.</b> 5 <sup>th</sup> Edition. The Benjamin/ Cummings Publishing Company Inc., USA.
8.	Lewis R. 1997. <b>Human Genetics: Concepts and Applications.</b> 2 <sup>nd</sup> Edition. WCB McGraw Hill, USA.
9.	Griffiths RCL, Anthony JF, Miller JH and Suzuki DT. 1996. <b>Genetic analysis.</b> 6 <sup>th</sup> Edition. W. H. Freeman and Co., New York.



**M.Sc. Botany - Semester II**  
**B 202 MOLECULAR BIOLOGY OF PLANTS**

**Theory**

S. No	Unit
<b>SECTION A</b>	
<b>1.</b>	Composition and structure of biomolecules: carbohydrates, lipids, proteins (Ramachandran plot) domains, motifs and folds. Nucleic acids– DNA structure, A, B and Z forms of DNA. Types of small RNAs: Si RNA, micro RNA, catalytic RNA.
<b>2.</b>	DNA replication: semi-conservative, semi-discontinuous- Okazaki fragments, uni and bi directional mode of replication. RNA priming, enzymes for DNA replication– gyrase, helicase, topoisomerases and polymerases, SSBs. Mechanism of DNA replication– in prokaryotes–rolling circle and theta mode of replication, in eukaryotes– multiple replicons. Fidelity of replication. Replication at ends of chromosomes. Extrachromosomal replicons. DNA damage and repair.
<b>3.</b>	RNA synthesis and processing: transcription process in prokaryotes and eukaryotes. Transcription factors. RNA processing– mRNA processing – spliceosome, capping and tailing, processing of tRNA and rRNA.
<b>4.</b>	Protein synthesis: structure of tRNA, aminoacylation of tRNA, aminoacyl tRNA synthetases. Ribosome as a translation factory. Genetic code– codon assignment, characteristics of genetic code. Mechanism of translation in prokaryotes and eukaryotes– initiation elongation and termination. Chemical proof reading during translation. Translation inhibitors. Post translational modifications.
<b>SECTION B</b>	
<b>5.</b>	Protein sorting and targeting of proteins into nucleus, chloroplasts, mitochondria, vacuoles and peroxisomes. Protein trafficking through GERL system– signal peptide, signal recognition particle, vesicles.
<b>6.</b>	Signal transduction: signaling molecules, ligands and receptors. G protein coupled receptors. Receptor tyrosine kinases. MAP kinases. Second messengers, signal amplification, cAMPs. Ca-calmodulin pathway.
<b>7.</b>	Regulation of gene expression in prokaryotes: bacteria – Lac, arabinose ,Tryp operons, positive and negative control. Regulation in viruses–lytic and lysogenic cycles.
<b>8.</b>	Regulation of gene expression in eukaryotes: cis and trans factors. Motifs of DNA



	binding domains of trans factors–zinc fingers, leucine zippers, helix turn helix. Temporal and spatial regulation. Role of chromatin in gene expression. DNA methylation and gene imprinting. Gene silencing.
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### Practical

S. No	Exhibit/Experiment
1.	Isolation of DNA using CTAB method.
2.	Histochemical staining of carbohydrates, proteins and fats in the plant cells.
3.	Electrophoresis of seed proteins.
4.	Assignments on problems related to DNA structure, replication, transcription and translation
5.	Photographs depicting the content of theory

### Reference Books

1.	Snustad P, Simmons MJ. 2003. <b>Principles of Genetics</b> . 3 <sup>rd</sup> Edition. John Wiley and Sons, Inc, USA.
2.	Buchaman BB, Gruissem,W and Jones R. 2000. <b>Biochemistry and Molecular Biology of plants</b> : American Societies of plant physiologists, John Wiley and Sons Ltd., Maryland, U.S.A.
3.	Lewin B. 2000. <b>Genes IX</b> , Oxford University Press, New York.
5.	Lodish BA, Zipursky SL, Matsdaira P, Baltimore D and Darnell J. 2000. <b>Molecular Cell Biology</b> . 4 <sup>th</sup> Edition. W.H. Freeman and Co., New York.
6.	Alberts B, Bray D, Lewis J, Ralf M, Roberts K and Watson JD.1999. <b>Molecular Biology of the Cell</b> . Garland publishing Inc., New York.
7.	Weaver RF. 1999. <b>Molecular Biology</b> . WCB /McGraw-Hill,.
8.	Shaw CH. 1998. <b>Plant Molecular Biology. A practical approach</b> , IRL Press, Oxford.
9.	Glick BR and Thompson JE. 1992. <b>Methods in Plant Molecular Biology and Biotechnology</b> , CRC Press, Boc Raton Florida.



**M.Sc. Botany – Semester II**

**B 203 BIOLOGY AND DIVERSITY OF PTERIDOPHYTES AND GYMNOSPERMS**

**Theory**

S. No	Unit
<b>SECTION A: Pteridophytes</b>	
1.	Classification of Pteridophyta. Origin of Pteridophytes. Pteridophytes in comparison to Bryophytes and Gymnosperms. Distinguishing features of Pteridophyta. Economic importance of Pteridophytes.
2.	Morphology, anatomy and reproduction of <i>Psilotum</i> , <i>Lycopodium</i> , <i>Selaginella</i> , <i>Isoetes</i> , <i>Equisetum</i> , <i>Ophioglossum</i> , <i>Osmunda</i> , <i>Gleichenia</i> , <i>Cyathea</i> , <i>Marselia</i> , <i>Adiantum</i> , <i>Salvinia</i> and <i>Azolla</i> .
3.	General account of fossil pteridophytes–Psilopsida, Lycopsida, Sphenopsida and Pteridopsida.
4.	Evolution of stelar types in Pteridophytes. Heterospory and origin of seed habit. Evolution of the sporophyte.
<b>SECTION B: Gymnosperms</b>	
5.	The evolutionary time scale: eras, periods and epochs. General account of fossils. Types of fossil formations.
6.	Gymnosperms in comparison to ferns and seed plants. Classification of Gymnosperms and their distribution in India. Economic importance of Gymnosperms.
7.	General account of the families of Pteridospermales–Lyginopteridaceae, Meduloisaceae, Caytoniaceae; Bennettitales–Cycadeodiaceae; Pentoxylales – Pentoxylaceae; Cordaitales–Cordaitaceae.
8.	Structure and reproduction in living Gymnosperms of Cycadopsida, Coniferopsida and Gnetopsida.

**Practical**

S. No	Exhibit/Experiment
1.	Examination of the external features, anatomy and reproductive structures of <i>Psilotum</i> , <i>Lycopodium</i> , <i>Selaginella</i> , <i>Isoetes</i> and <i>Equisetum</i> .
2.	Examination of the external features, anatomy and reproductive structures of <i>Ophioglossum</i> , <i>Osmunda</i> , <i>Gleichenla</i> , <i>Cyathea</i> , <i>Marselia</i> , <i>Adiantum</i> , <i>Salvinla</i> and

	<i>Azolla</i> .
3.	Observations of the slides of the following fossil plants— <i>Rhynia</i> , <i>Lepidodendron</i> , <i>Lepidocarpon</i> , <i>Miadesmia</i> , and <i>Sphenophyllum</i> .
4.	Observations of the slides fossil Pteridophytes: <i>Calamites</i> , <i>Calamostachys</i> , <i>Zygoptera</i> and <i>Etaopteris</i> .
5.	Examination of the external features, anatomy and reproductive structures of <i>Ginkgo</i> , <i>Pinus</i> , <i>Cupressus</i> and <i>Cryptomeria</i> .
6.	Examination of the external features, anatomy and reproductive structures of <i>Araucaria</i> , <i>Ephedra</i> and <i>Gnetum</i> .
7.	Study of fossil gymnosperms from prepared slides: <i>Lyginopteris</i> , <i>Lagenostoma</i> and <i>Medullosa</i> .
8.	Study of fossil gymnosperms from prepared slides: <i>Trigonocarpus</i> , <i>Conostoma</i> , <i>Heterangium</i> , <i>Cordaites</i> .

#### Reference Books

1.	Saxena P and Pathak C. 2012. <b>A Text Book of Pteridophyta.</b> , Wisdom Press, New Delhi.
2.	Sharma OP. 2006. <b>Pteridophyta.</b> MacMillan India Ltd., New Delhi.
3.	Parihar NS. 1996. <b>Biology and Morphology of Pteridophytes.</b> Central Book Depot, Allahabad.
4.	Smith GM. 1995. <b>Cryptogamic Botany. Vol. II.</b> McGraw Hill Book Company, New York.
5.	Sporne KR. 1962. <b>The Morphology of Pteridophytes.</b> Hutchinson University Library, London.
6.	Evans AJ. 1936. <b>Morphology of Vascular Plants (Lower groups).</b> McGraw Hill Book Company, New York.
7.	Biswas C and Johri BM. 1997. <b>The Gymnosperms.</b> Narosa Publishing House, New Delhi.
8.	Bhatnagar SP and Moitra A. 1996. <b>Gymnosperms.</b> New Age International Private Limited, New Delhi.
9.	Sharma OP. 1996. <b>Gymnosperms.</b> Pragati Prakashan, Meerut.
11.	Stewart WN and Rothwell GW. 1993. <b>Paleobotany and the Evolution of Plants.</b> Cambridge University Press, USA.
12.	Singh H. 1978. <b>Embryology of Gymnosperms.</b> Gebrudev Bortraeger, Berlin.

<b>13.</b>	Arnold CA. 1974. <b>An introduction to Paleobotany.</b> McGraw Hill Book Co., Inc., New York.
<b>14.</b>	Sporne KR. 1967. <b>The Morphology of Gymnosperms.</b> Hutchinson University Library, London.
<b>15.</b>	Chamberlain CJ. 1935. <b>Gymnosperms structure and evolution.</b> University of Chicago Press, USA.



## M.Sc. Botany - Semester II

### B 204 PLANT CELL, TISSUE AND ORGAN CULTURE

#### Theory

S. No	Unit
<b>SECTION A</b>	
1.	Plant cell and tissue culture: introduction, history, scope. Basic concepts of tissue of culture: tissue culture cycle, types of cultures. Concept of cellular differentiation, totipotency.
2.	Culture media: composition and effects of media components, phytohormones – effects in tissue culture. Sterilization methods.
3.	Pathways of regeneration – biochemical and molecular aspects of tissue culture cycle.
4.	Technique and applications of cryopreservation and germplasm storage.
<b>SECTION B</b>	
5.	Organogenesis and adventitious embryogenesis. Fundamental aspects of morphogenesis, somatic embryogenesis. Methods of androgenic and gynogenic haploid production-dihaploids and application in agriculture. Embryo rescue.
6.	Cell culture: establishment, plating efficiency, induction and selection of mutants. Free cell cultures: production of secondary metabolites/natural products.
7.	Somatic hybridization: protoplast isolation, fusion and culture, hybrid selection and regeneration, possibilities, achievements, limitations, merits and demerits . Cybrids. Protoplasts in genetic transformation.
8.	Applications of plant tissue culture: clonal propagation, artificial seeds and its applications, somaclonal variation and its applications.

#### Practical

S. No	Exhibit/Experiment
1.	General out lay of plant tissue culture laboratory.
2.	Preparation of media.
3.	Callus induction – carrot.
4.	Clonal propagation through meristem cultures.
5.	Embryo culture – groundnut.
6.	Anther culture – <i>Datura</i> /tobacco.
7.	Establishment of cell cultures and determination of growth pattern.
8.	Determination of plating efficiency of cell cultures.

9.	Protoplast isolation and culture.
10.	Protoplast fusion.
11.	Observation of different developmental stages of somatic embryo in embryogenic callus.
12.	Preparation of artificial seeds.

#### Reference Books

1.	Collin HA and Edwards S. 1998. <b>Plant Cell Culture</b> . Bioscientific Publishers, Oxford, UK.
2.	Callow JA, Ford-Lloyd BV and Newbury HJ. 1997. <b>Biotechnology and Plant Genetic Resources: Conservation and Use</b> . CAB International, UK.
3.	Raghavan V. 1997. <b>Molecular Biology of Flowering plants</b> . Cambridge University press, New York, USA.
4.	Bhojwani SS and Razdan MK. 1996. <b>Plant tissue culture: Theory and Practice</b> . (A revised edition). Elsevier Science Publishers, New York, USA.
5.	Jain SM, Sopory SK and Velleux RE. 1996. <b>In Vitro Haploid production in Higher Plants. Volumes 1-5</b> . Fundamental aspects and Methods Kluwer Academic Publishers, Dordrecht, Netherlands.
6.	Vasil IK and Thorpe TA. 1994. <b>Plant Cell and Tissue Culture</b> . Kluwer Academic Publishers, Dordrecht, Netherlands.
7.	Bhojwani SS. 1990. <b>Plant Tissue Culture: Applications and Limitations</b> . Elsevier Science Publishers, New York, USA.
8.	Raghavan V. 1986. <b>Embryogenesis in Angiosperms: A Developmental and Experimental Study</b> . Cambridge University Press, New York, USA.
9.	Kartha KK. 1985. <b>Cryopreservation of Plant Cells and Organs</b> . CRC Press, Boca Raton, Florida, USA.





**M.Sc. Botany – Semester III**  
**B 301 TAXONOMY OF ANGIOSPERMS AND PLANT RESOURCES**  
**UTILIZATION AND CONSERVATION**

**Theory**

S. No	Unit
<b>SECTION A</b>	
<b>1.</b>	Origin and evolution of Angiosperms. Fossil Angiosperms. Taxonomy and Systematics. Concepts of species. Taxonomic hierarchy - species, genus, family and other categories. Principles used in assessing relationship and delimitation of taxa and attribution of rank. Plant identification. Plant nomenclature – Binomial nomenclature, ICBN. Plant collection and documentation.
<b>2.</b>	Brief analysis of the features and evolutionary tendencies noticed in the following groups: Ranales, Rosales, Centrospermae, Tubiflorae, Amentiferae, Helobiales, Liliflorae and Glumiflorae.
<b>3.</b>	Taxonomic evidences: embryology, cytology and phytochemistry. Taxonomic tools: herbaria, floras, botanical gardens, biochemical and molecular techniques, computers and GIS (Geo Information Systems). Cladistics in taxonomy. Numerical taxonomy and sero taxonomy.
<b>4.</b>	Systems of Angiosperm classification: Phenetic versus Phylogenetic system. Relative merits and demerits of major systems of classification: Takhtajan, Cronquist and Thorne. Basic concepts of Molecular Systematics: Gene sequencing, Restriction site analysis, Allozymes etc., Angiosperm Phylogeny Group (APG III) classification system, Relevance of Taxonomy to conservation, sustainable utilization of bioresources and ecosystem research.
<b>SECTION B</b>	
<b>5.</b>	World centres of primary diversity of domesticated plants. The Indo-Burmese Centre, Plant Introductions and Secondary centers. Plant explorations. Origin of agriculture.
<b>6.</b>	Origin, evolution, Botany, cultivation and uses of :

	<p>1. Food Crops : Wheat, Rice</p> <p>2. Forage Crops : <i>Sorghum</i>, Red gram</p> <p>3. Fibre Crops : Cotton, Jute</p> <p>4. Oil yielding crops : Groundnut, Coconut</p> <p>5. Medicinal and aromatic crops : <i>Catharanthus</i>, <i>Withania</i>, <i>Cymbopogon</i></p>
7.	Green Revolution: benefits and adverse consequences. Ethnobotany: Introduction, concept, objectives and scope. Plant biodiversity: Concept, status in India, utilization and concerns, conservation of wild biodiversity.
8.	Principles of conservation: Strategies for conservation, <i>In-situ</i> conservation: protected areas in India- reserves, wetlands, mangroves, <i>Ex-situ</i> conservation: principles and practices. Botanical gardens. BSI, ICAR and CSIR.

### Practical

<b>Exhibits/ Experiments/ Suggested Laboratory Exercises</b>	
<b>Taxonomy</b>	
1.	Description of a specimen from representative and locally available families.
2.	Description of a species based on various specimens to study intraspecific variation: A collective exercise.
3.	Description of various species of a genus: location of key character and preparation of keys at genetic level.
4.	Location of key characters and use of keys at family level.
5.	Field trips within and around the campus; compilation of field notes and preparation of herbarium sheets of such plants, wild or cultivated, as are abundant.
6.	Training in using floras and herbaria for identification of specimens described in the class.
7.	Demonstration of the utility of secondary metabolites in the taxonomy of some appropriate genera.
8.	Comparison of different species of a genus and different genera of a family to calculate similarity coefficients and preparations of dendrograms.

<b>Plant Resources Utilization and Conservation</b>	
<b>1.</b>	<p><b>Laboratory work:</b></p> <p>1. Food crops : Wheat, Rice</p> <p>2. Forage/fodder crops : <i>Sorghum</i>, Red gram</p> <p>3. Fiber crops : Cotton, Jute</p> <p>4. Oil yielding : Groundnut, Coconut</p> <p>5. Medicinal and Aromatic plants : <i>Catharanthus</i>, <i>Withania</i>, <i>Cymbopogon</i></p>
<b>2.</b>	<p><b>Scientific visits:</b></p> <p>The students should be taken to one of the following:</p> <p>A protected areas or Biosphere reserve or national park or sanctuary. A wetland.</p> <p>A mangrove.</p> <p>NBPGR (National Bureau of Plant Genetic Resources – New Delhi). BSI.</p> <p>CSIR</p> <p>Laboratory. FRI.</p> <p>Tropical Botanical Gardens.</p>

### Reference Books

<b>Taxonomy of Angiosperms</b>	
<b>1.</b>	Mondal AK. 2011. <b>Advanced Plant Taxonomy</b> . New Central Book Agency Pvt. Ltd., Kolkata.
<b>2.</b>	Simpson MG. 2006. <b>Plant Systematics</b> . Elsevier Academic Press, California, USA.
<b>3.</b>	Nordenstam BEI, Lazily G and Kassas M. 2000. <b>Plant systematic for 2<sup>nd</sup> Century</b> . Portland Press Ltd., London.
<b>4.</b>	Takhtajan AL. 1997. <b>Diversity and classification of Flowering Plants</b> . Columbia University Press, New York.
<b>5.</b>	Zomlefer WB. 1994. <b>A Guide to flowering plant families</b> . University of California Press, USA.
<b>6.</b>	Woodland DW. 1991. <b>Contemporary Plant Systematics</b> . Prentice Hall, New Jersey.
<b>7.</b>	Stace CA. 1989. <b>Plant Taxonomy and Biosystematics</b> .2 <sup>nd</sup> Edition. Edward Arnold Ltd., London.

8.	Jones SB Jr. and Luchsinger AE. 1986. <b>Plant Systematics</b> . 2 <sup>nd</sup> Edition. McGraw Hill Book Co., New York.
9.	Radford AE. 1986. <b>Fundamentals of Plant Systematics</b> . Harper and Row Publications, USA.
10.	Heywood VH and Moore DM. 1984. <b>Current concepts in Plant Taxonomy</b> . Academic Press, London.
11.	Davis PH and Heywoos VH. 1973. <b>Principles of Angiosperms Taxonomy</b> . Robert E Kreiger Pub. Co., New York.
12.	Harrison HJ. 1971. <b>New concepts in Flowering Plant Taxonomy</b> . Hieman Educational Books Ltd., London.
13.	Jones AD and Wilbins AD. 1971. <b>Variations and Adaptations in Plant species</b> . Hiemen and Co., Educational Books Ltd., London.
14.	Grant V. 1971. <b>Plant Biosystematics</b> . Academic press, London.
15.	Solbrig OT. 1970. <b>Principles and Methods of Plant Biosystematics</b> . Macmillan, London.
16.	Heslop-Harrison J. 1967. <b>Plant Taxonomy</b> . English language Books Soc. and Edward Arnold Pub. Ltd., U.K.
<b>Plant Resource Utilization And Conservation</b>	
17.	Sambamurthy AVSS and Subramanyam NS. 2000. <b>Economic Botany of Crop Plants</b> . Asiatech Publishers, Inc., New Delhi.
18.	Conway G. 1999. <b>The Doubly Green Revolution: Food for All in the 21st Century</b> . Comstock Publishing Associates, New York.
19.	Pinstrup – Anderson P. et al. 1999. <b>World Food Prospects: Critical Issues for the Early 21st Century</b> . International Food Policy Research Institute, Washington DC, USA.
20.	Kocchar SL. 1998. <b>Economic Botany of the Tropics</b> . 2nd Edition. Mac Millan India Ltd., Delhi.
21.	Plant Wealth of India 1997. Special Issue of Proceedings Indian National Science Academy B-63.
22.	Sharma OP. 1996. <b>Hills Economic Botany</b> . (Late Dr. A.F. Hill, adapted by O.P. Sharms). Tata McGraw Hill Co., Ltd., New Delhi.
23.	Frankel OH, Brown AHD and Burdon JJ. 1995. <b>The conservation of Plant Diversity</b> . Cambridge University Press, Cambridge, UK.

24.	Paroda RS and Arora RK. 1991. <b>Plant Genetic Resources Conservation and Management.</b> IPGRI (Publication) South Asia Office, C/o. NBPGR Pusa Campus, New Delhi.
25.	Swaminathan MS and Kocchar SL (ed). 1989. <b>Plants and Society.</b> Mac Millan Publication Ltd., London.
26.	Thakur RS, Puri HS and Hussain A. 1989. <b>Major Medicinal Plants of India.</b> Central Institute of Medicinal and Aromatic Plants. CSIR, Lucknow.
27.	Council of Scientific & Industrial Research 1986. <b>The useful plants of India. Publications and Information Directorate.</b> CSIR, New Delhi.
28.	Baker HG. 1978. <b>Plants and Civilization.</b> 3 <sup>rd</sup> Edition. C.A. Wadsworth, Belmont.
29.	Chrispeels MJ and Sadava D. 1977. <b>Plants, Food and People.</b> W.H. Freeman and Co., San Francisco, USA.
30.	Schery RW. 1972. <b>Plants for Man.</b> 2 <sup>nd</sup> Edition. Englewood Cliffs, New Jersey.
31.	Raw materials I - XII Revised Vol. I-III (1985-1992) supplement (2000).



## M.Sc. Botany – Semester III

### B302 PLANT REPRODUCTION

#### Theory:

Male Gametophyte: Structure of anthers; microsporogenesis; role of tapetum; pollen development, sperm dimorphism; pollen embryo sacs and compound pollen grains.

Female Gametophyte: Ovule development; megasporogenesis, organisation of the embryo sac; ultra structure of the embryo sac cells.

Pollination, Pollen-pistil interaction: Structure of the pistil; pollen-stigma interactions; Sporophytic and Gametophytic self-incompatibility, different methods to overcome self-incompatibility.

Fertilization: Pollen germination; pollen tube growth and guidance; Entry of pollen tube into the embryo sac; pollen tube discharge, syngamy and triple fusion; polyspermy and hetero fertilization.

Post-fertilisation events: Endosperm development; Types of Endosperm; Functions; Endosperm and embryo relationships.

Embryo development: Johanson and Soueges systems; Types.

Polyembryony; apomixis; parthenocarpy - outlines only.

Seed Dormancy: Seed dormancy; overcoming seed dormancy.

Outlines of Experimental Embryology – Anther culture, ovary culture, ovule culture; embryo culture; Invitro fertilisation.

Applications of Angiosperm Embryology (Agricultural, Horticultural and Taxonomic Considerations).



**Suggested Laboratory Exercises:**

Study of microsporogenesis and gametogenesis in sections of anthers.

Tests for pollen viability using stains and invitro germination.

Embryo sac development through examination of permanent, stained serial sections.

Study of nuclear and cellular endosperm through dissections and staining.

Isolation of different stages of embryo development from suitable seeds.

### **Suggested readings:**

1. Bhojwani, S.S and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4<sup>th</sup> revised and enlarged edition) Vikas Publishing House, New Delhi;
2. Leins, P., Tucker, S.C. and Endress. P.K. 1988. Aspects of Floral Development. J. Cramer, Germany;
3. Procter, M. and Yeo, P. 1973. The Pollination of Flowers. William Collins Sons, London;
4. Pulliah, T., Lakshminarayana, K. and Hanumantha Rao, B., 2008. Plant Reproduction, Scientific Publishers, Jodhpur, India;
5. Raghavan, V. 1997. Molecular Embryology of Flowering Plants. Cambridge University Press, Cambridge;
6. Raghavan, V. 1999. Developmental Biology of Flowering Plants. Springer – Verlag, New York;
7. Sedgely, M. and Griffin, A.R. 1989. Sexual Reproduction of Tree Crops, Academic Press, London;
8. Shivanna, K.R. and Swahney, V.K. (Eds.) 1997. Pollen Biotechnology for Crop Production and Improvement. Cambridge University Press, Cambridge;
9. Shivanna, K.R. and Rangaswamy, N.S. 1992. Pollen Biology, A Laboratory Manual. Springer-Verlag, Berlin;
10. Shivanna, K.R. and Johri, B.M.1985. The Angiosperm Pollen Structure and Function, Wiley Eastern Ltd., New Delhi;
11. The Plant Cell. Special Issue on Reproductive Biology of plants, Vol.5 (10) 1993. The American Society of Plant Physiologists, Rockville, Maryland, USA.



**M.Sc. Botany - Semester III**

**B 303 PLANT ECOLOGY**

**Theory**

<b>S. No</b>	<b>Unit</b>
<b>SECTION A</b>	
1.	The environment: physical environment, biotic environment and abiotic environment. Ecology and human welfare. Climate, soil and vegetation patterns of the world: life zones, major biomes, vegetation and soil types of the world.
2.	Habitat and niche: concept of habitat and niche, niche width and overlap, fundamental and realized niche, resource partitioning, character displacement.
3.	Population Ecology: characteristics of a population, population growth curves, population regulation, life history strategies (r and k selection), concept of meta population, demes and dispersal, interdemec extinctions, age structured population.
4.	Species interactions: types of interactions, interspecific competition, herbivory, carnivory. Ecological succession: types, mechanisms, changes involved in succession, concept of climax. Hydrosere and Xerosere
<b>SECTION B</b>	
5.	Community ecology: nature of communities, community structure and attributes, levels of species diversity and its measurement, edges and ecotones, community classification.
6.	Ecosystem: structure and function. Energy dynamics. Mineral cycling (carbon, nitrogen and phosphorus). Primary production and decomposition. Structure and function of some Indian ecosystems– Terrestrial (forest, grassland) and aquatic (fresh water, marine, estuarine).
7.	Biogeography: Major terrestrial biomes. Theories of island biogeography. Biogeographical zones of India.
8.	Applied ecology: Environmental pollution – air, water and soil, kinds, sources, quality parameters. Effects on plant ecosystems. Climate change – green house gases, ozone layer and ozone hole, consequences of climate change. Methods for mitigation of climate change: physical, chemical and biological. Biodiversity status, monitoring and documentation, major drivers of biodiversity change, biodiversity management approaches. Conservation biology: principles of conservation, major approaches to management. Indian case studies on

conservation, management strategy (Biosphere reserves, Project tiger).

### Practical

#### Exhibits/ Experiments/ Suggested Laboratory Exercises

<b>1.</b>	To study the stratification of plants in botanical gardens.
<b>2.</b>	To prepare life forms of botanical gardens of college campus. Compare the biological spectrum of college campus with normal biological spectrum.
<b>3.</b>	To estimate the frequency of plants in the college campus.
<b>4.</b>	To estimate the relative frequency of plants in the college campus.
<b>5.</b>	To estimate the density of a plant species in the college campus.
<b>6.</b>	To estimate the relative density of a plant species in college campus.
<b>7.</b>	To determine the minimal size and number of quadrats required for reliable estimate of biomass in grass land.
<b>8.</b>	To determine the basal area of a plant species in the campus.
<b>9.</b>	To determine the important value index (IVI) of plant species in the campus.
<b>10.</b>	To estimate IVI of the plant species in a woodland using point center quarter methods.
<b>11.</b>	To determine plant diversity indices (Shamon - Wiener) continuum of dominance, species richness, equitability and biodiversity of species in the campus.
<b>12.</b>	To estimate rate of carbon dioxide evolution from different soils using soda lime or alkali absorption method.
<b>13.</b>	To study environmental impact of a given developmental activity using check list as a EIA method.
<b>14.</b>	Enumeration in pond ecosystems.
<b>15.</b>	To study the composition of woodland ecosystem.
<b>16.</b>	Demonstration of chemical energy stored in leaves which was the transformed from radiation energy.
<b>17.</b>	Estimation of biomass of cropland plots.

<b>18.</b>	Estimation of chlorophyll.
<b>19.</b>	Determination of leaf area index methods with plain graph sheets.
<b>20.</b>	To determine the water holding capacity of soil collected from different locations

#### Reference Books

<b>1.</b>	American Public Health Association American Water Works Association. 2013. <b>Standard Methods for the Examination of Water and Waste Water.</b> General Books LLC, USA.
<b>2.</b>	Sharma PD. 2007. <b>Ecology and Environment.</b> Rastogi Publications, Meerut.
<b>3.</b>	Sharma PD. 2001. <b>Ecology and Environment.</b> Rastogi Publications, Meerut.
<b>4.</b>	Smith RL. 1996. <b>Ecology and field Biology.</b> Harper Collins, New York.
<b>5.</b>	Sokal RR and Rohit FJ. 1995. <b>Biometry.</b> W.H. Freeman and Co., New York.
<b>6.</b>	Batra NK. 1992. <b>Treatise on Plant Ecology.</b> Pradeep Publications, Delhi.
<b>7.</b>	CJ. 1989. <b>Ecological Methodology.</b> Harper and Row, New York, USA.
<b>8.</b>	Ludwig JA and Reynolds JF. 1988. <b>Statistical Ecology.</b> Wiley, New York.
<b>9.</b>	Magurran AE. 1988. <b>Ecological Diversity and its measurement.</b> Croom Helm, UK.
<b>10.</b>	Moore PD and Chapman SB. 1986. <b>Methods in Plant Ecology.</b> Blackwell Scientific, Oxford, UK.
<b>11.</b>	Pielow EC. 1984. <b>The interpretation of Ecological Data.</b> John and Wiley Sons, USA.
<b>12.</b>	Muller – Dombois D and Ellenberg H. 1974. <b>Aims and Methods of Vegetation Ecology.</b> Blackburn Press, New Jersey.
<b>13.</b>	Odum PE. 1971. <b>Fundamentals of Ecology.</b> 3 <sup>rd</sup> Edition. W. B. Saunders, Philadelphia.
<b>14.</b>	Dansemmire RF. 1968. <b>Plant Communities.</b> Horpes and Row, New York.
<b>15.</b>	Misra R. 1968. <b>Ecology Work Book.</b> Oxford and IBH Publishing Co., New Delhi.
<b>16.</b>	Ambasht RS and Ambasht NK. <b>A Text Book Plant Ecology.</b> CBS Publishers and distributors, New Delhi.



**M.Sc. Botany – Semester III**  
**B 304 PLANT PHYSIOLOGY**

**Theory**

S. No	Unit
<b>SECTION A</b>	
<b>1.</b>	Plant water relations: free energy and chemical potential, osmotic potential, water potential and its determination, active and passive absorption of water, stomatal physiology and mechanisms of stomatal opening and closing, Soil-plant-atmosphere-continuum concept (SPAC), mechanism of water transport.
<b>2.</b>	Mineral nutrition: passive and active uptake of ions, translocation of minerals in plants, essential elements: their functions and symptoms of mineral deficiency, importance of foliar nutrition and use of chelates in agriculture, root microbe interactions in facilitating nutrient uptake, mechanism of assimilate translocation.
<b>3.</b>	The flowering process: phytochrome: structure, photochemical and biochemical properties, role in photomorphogenesis. Photoperiodism and its significance, mechanisms of floral induction. Vernalization. Morphological, biochemical and metabolic changes accompanying seed germination.
<b>4.</b>	Plant growth regulators and elicitors: biosynthesis, physiological effects and mechanism of action of auxins, gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, polyamines, jasmonic acid and salicylic acid. Role of plant growth regulators in agriculture. Hormone receptors.
<b>SECTION B</b>	
<b>5.</b>	Fundamental of Enzymology: General aspects, allosteric mechanism, regulatory and active sites, isozymes, kinetics of enzymatic catalysis, Michaelis-Menten Equation and its significance, Mechanism of enzyme action.
<b>6.</b>	Photochemistry and Photosynthesis: General concepts and historical back ground, evolution of photosynthetic apparatus, Redox reactions, photosynthetic pigments and light harvesting complexes, photo-oxidation of water, mechanisms of electron and proton transport, structure, synthesis and function of ATP, carbon assimilation-the Calvin's cycle, photorespiration and its significance, the C <sub>4</sub> cycle and CAM pathway, biosynthesis of starch and sucrose, physiological and ecological considerations.
<b>7.</b>	Respiration and Lipid metabolism : Plant respiration, glycolysis, the TCA cycle, electron



	transport and ATP synthesis, pentose phosphate pathway, glyoxylate cycle, alternative oxidase system, structure and function of lipids, fatty acid biosynthesis of membrane lipids, structural lipids and storage lipids and their catabolism. Nitrogen fixation and nitrogen metabolism: Biological nitrogen fixation, nodule formation and nod factors, biosynthesis of amino acids and proteins, mechanism of nitrate uptake and reduction.
<b>8.</b>	Stress Physiology: Plant responses to biotic and abiotic stress, mechanisms of biotic and abiotic stress tolerance, water deficit and drought resistance, salinity stress, metal toxicity, heat stress and oxidative stress.

### Practical

<b>Exhibits/ Experiments/ Suggested Laboratory Exercises</b>	
<b>1.</b>	Determination of osmotic potential.
<b>2.</b>	Determination of water potential.
<b>3.</b>	Demonstration of osmosis.
<b>4.</b>	Determination of root pressure.
<b>5.</b>	Effects of high and low temperatures upon the permeability of the cytoplasmic membranes.
<b>6.</b>	Determination of suction force due to transpiration.
<b>7.</b>	Stomatal frequency and stomatal index of leaves.
<b>8.</b>	Rate of transpiration in leaves by cobalt chloride paper method.
<b>9.</b>	Determination of amylase activity
<b>10.</b>	Extraction and separation of chloroplast pigments by paper chromatographic method
<b>11.</b>	Determine chlorophyll a / chlorophyll b contents in C <sub>3</sub> and C <sub>4</sub> plants by spectrophotometric method
<b>12.</b>	Determination of Hill reaction
<b>13.</b>	Determination of rate of Aerobic respiration by continuous current method
<b>14.</b>	Determination of rate of Anaerobic respiration by continuous current method
<b>15.</b>	Determination of catalase activity
<b>16.</b>	Demonstration of Polyphenol oxidase
<b>17.</b>	Determination of reducing sugars

18.	Estimation of free acids in Bryophyllum in terms of milliequivalents of NaOH
19.	Extraction and estimation of seed proteins depending upon the solubility
20.	SDS – PAGE for soluble proteins extracted from the given plant materials
21.	Separation of isozymes esterase, peroxidase by native polyacrylamide gel electrophoresis
22.	Effect of Light quality on the rate of Photosynthesis
23.	Effect of CO <sub>2</sub> concentration on the rate of Photosynthesis
24.	Estimation of Starch by gravimetric method
25.	Demonstration of Starch hydrolysis
26.	Separation of Chloroplast pigments by chemical method
27.	Separation of amino acids and carbohydrates through two dimensional chromatographic method

#### Reference books

1.	Sinha SK 2014. <b>A text book of Plant Physiology</b> . Centrum Press, New Delhi.
2.	Seema Yadav 2014. <b>Plant Physiology</b> . SBW publishers, New Delhi.
3.	Heribert H and Kazuo S (eds) 2010. <b>Plant responses to abiotic stress. Series Topics in Current Genetics, Vol 4</b> . Springer, Berlin.
4.	Philip Stewart and Schine Gobig 2011. <b>Plant Physiology</b> . CRC Press.
5.	Moore TC. 2011. <b>Biochemistry and Physiology of Plant Hormones</b> . Springer, New York.
6.	Hooykaas PJJ, Hall MA and Libbenga KR (ed) 1999. <b>Biochemistry and Molecular Biology of Plant Hormones</b> . Elsevier, Amsterdam, Netherlands.
7.	Taiz L and Zeiger E. 1998. <b>Plant Physiology</b> . 2 <sup>nd</sup> Edition. Sinauer Associates including Publishers, Massachusetts, USA.
8.	Wisthoff P. 1998. <b>Molecular Plant Development from Gene to Plant</b> . Oxford University Press, Oxford, UK.
9.	Thomas and Vince – Prue D. 1997. <b>PhotoPeriodism in Plants</b> . 2 <sup>nd</sup> Edition. Academic Press, Sandeigo, USA.
10.	Hopkins WG. 1995. <b>Introduction to Plant Physiology</b> . John Wiley & Sons Including New York, USA.
11.	Mohr H and Schopfer P. 1995. <b>Plant Physiology</b> . Springer-Verlag, New York.

12.	Salisbury FB and Ross CW. 1992. <b>Plant Physiology</b> . 4 <sup>th</sup> Edition. Wordsworth Publishing Company, California, USA.
13.	Noggle GR and Fritz GJ. 1991. <b>Introductory plant physiology</b> . 2 <sup>nd</sup> Edition. Prentice hall of India Limited, New Delhi.
14.	Davies PJ (ed) 1987. <b>Plant hormones and their role in Plant Growth and Development</b> . Mertinus Nijhoff Publishers, Netherlands.
15.	Witham FH and Devlin RM. 1986. <b>Plant Physiology</b> . CBS Publishers and Distributors, Bangalore.
16.	Wilkins MD. 1987. <b>Advanced Plant Physiology</b> . English Language Book Society, Longman Scientific and Technical, Harlow, UK.
17.	Bewley JD and Black M. 1982. <b>Physiology and Biochemistry of seed in relation to germination and dormancy. Volume 1 and 2</b> . Springer – Verlag, Berlin.
18.	Khan AA. 1982. <b>The Physiology and Biochemistry of Seed Development, Dormancy and Germination</b> . Elsevier, Amsterdam, Netherlands.
19.	Ting IP. 1982. <b>Plant Physiology</b> . Addison-Wesley, Reading, MA.
20.	Murthy HNK. 1981. <b>Plant growth substances including applications in Agriculture</b> . Tata McGraw Hill Publishing Company Ltd., New Delhi.
21.	Kramer PM and Kozlowski TT. 1980. <b>Physiology of Woody Plants</b> . Academic Press, New York.
22.	Hewitt EJ and Smith TA. 1975. <b>Plant Mineral Nutrition</b> . English University Press,
23.	Meyer AM and Poljakoff-Mayber A. 1975. <b>The germination of Seeds</b> . Pergamon Press, Canada.
24.	Hess D. 1974. <b>Plant Physiology</b> . Narosa Publishing House, New Delhi.
25.	Audus LJ. 1972. <b>Plant Growth Substances. Volume 1</b> . Chemistry and Physiology. Leonard Hill, UK.
26.	Slayter RO. 1967. <b>Plant Water Relationships</b> . Academic Press, London
27.	Hillman WS. 1963. <b>Physiology of Flowering</b> . Holt, Reinhart and Winston, New York.



## M.Sc. Botany - Semester IV

### B 401 GENETIC ENGINEERING OF PLANTS AND MICROBES

#### Theory

S.No	Unit
<b>SECTION A</b>	
1.	Basics of rDNA technology: restriction enzymes–types, nomenclature, mechanism of action. Methodology of rDNA molecule synthesis–joining overlapping ends, blunt end joining, polylinkers. Vectors–features. Cloning vectors– plasmids, viral DNA, cosmids, bacterial and yeast artificial chromosomes(BACs and YACs). Expression vectors.
2.	Bacterial transformation. <i>In-vitro</i> packaging. Recognition of transformants–antibiotic resistance, <i>Lac Z</i> gene based selection. Genomic library, cDNA library.
3.	Methods of gene transfer in plants: electroporation, gene gun, <i>Agrobacterium</i> mediated– binary and co integrative vector based. Chloroplast transformation.
4.	Classical examples of successful cases of transgenic plants– fungal, bacterial, viral and insect tolerance (BT and proteinase inhibitors), herbicide tolerance, abiotic stress tolerance, male sterility– Barnase-Barstar. Quality improvement –golden rice, late ripening tomatoes (Flavr Savr).
<b>SECTION B</b>	
5.	Techniques in genetic engineering I: Blotting techniques– Southern, Northern and Western blotting, radioactive and non-radioactive labeling, detection of hybridization. <i>In-situ</i> hybridization– technique, radioactive and non-radioactive probes, enzyme and fluorescence detection methods (FISH), applications of the technique. PCR– technique, types, applications. DNA sequencing– basic principle of Sanger’s method, automated DNA sequencing, high throughput DNA sequencing.
6.	Techniques in genetic engineering II: DNA fingerprinting–hybridization based (RFLP), PCR based (RAPD, AFLP). Restriction mapping. Microarray technique and its applications. Sequencing genomes–whole genome sequencing, shot gun sequencing. Next generation sequencing– 454 sequencing.
7.	Plant growth promoting bacteria – nitrogen fixers, siderophores, phytohormone production. Genetic improvement of industrially important microbes for production of useful products – biopesticides, biofertilizers, antibiotics. Intellectual Property Rights, farmer’s rights. Patents. Ethical and environmental issues in genetic engineering.

8.	Bioinformatics: Scope. Data bases– types, Genbank, PIR, PDB. An account of NCBI. Web based tools for sequence searches –BLAST. Genome projects, genome annotation, gene annotation, features of the genome of <i>Arabidopsis</i> , rice. Genomics– structural genomics, comparative genomics, functional genomics. Molecular phylogeny and phylogenetic trees. Metagenomics.
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#### **Practicals**

<b>S. No</b>	<b>Exhibit/Experiment</b>
1.	Isolation of plasmid DNA
2.	Bacterial transformation and identification of transformation
3.	Plant DNA isolation
4.	Restriction enzyme digestion and gel electrophoresis
5.	Assignments on the syllabus
6.	Pictorial demonstration of the various techniques

#### **Reference Books**

1.	Glick BR, Pasternak JJ and Patten CL. 2010. <b>Molecular Biotechnology Principles and Applications of rDNA</b> . ASM Press, USA.
2.	Attwood TK, Smith DJP and Phukan S. 2009. <b>Introduction to Bioinformatics</b> . Pearson Education Ltd., UK.
3.	Sateesh MK. 2008. <b>Bioethics and Biosafety</b> . I K International Pvt. Ltd., Bangalore.
4.	Channarayappa. 2007. <b>Molecular Biotechnology Principles and practices</b> . Taylor and Francis, UK.
5.	Watson JD. 2007. <b>Recombinant DNA: Genes and Genomes: A short course</b> . W. H. Freeman, USA.
6.	Primrose SB and Twyman RM. 2006. <b>Principles of Genome Analysis and Genomics</b> . Blackwell publishers, USA.
7.	Lewin B. 2004. <b>Genes VIII</b> . Pearson Prentice Hall, New Jersey.
8.	Chawla HS. 2002. <b>Introduction to Plant Biotechnology</b> . Oxford and I B H Publishers, USA.



**M.Sc. Botany – Semester IV**  
**B 402 EVOLUTION AND PLANT BREEDING**

**Theory**

S. No	Unit
<b>SECTION A</b>	
<b>1.</b>	Origin of life and unicellular evolution: Origin of basic biological molecules, abiotic synthesis of monomers and polymers , concept of Oparin and Haldane, experiment of Miller (1953). The first cell – evolution of prokaryote, RNA world. Origin of eukaryotic cells– Endosymbiont theory, evolution of unicellular eukaryotes, anaerobic and aerobic metabolism.
<b>2.</b>	Theories of organic evolution: Lamarckism, Darwinism–concepts of variation, adaptation, struggle, fitness and natural selection, Synthetic theory, phyletic gradualism, punctuated equilibrium, concepts of neutral evolution.
<b>3.</b>	Molecular evolution: molecular divergence and molecular clocks–protein and nucleotide sequence analysis, gene duplication and divergence. Hardy-Weinberg equilibrium and its applications.
<b>4.</b>	Plant breeding: history, objectives, activities, important achievements and undesirable consequences. Organizations for crop improvement in India: ICAR, Agricultural universities, Central institutes for crop improvement, All India coordinated programmes. Plant Introduction, domestication and acclimatization.
<b>SECTION B</b>	
<b>5.</b>	Methods of breeding self pollinated crops: Mass selection, Pureline selection, Pedigree method, Bulk method, Backcross method, Multiline varieties.
<b>6.</b>	Methods of breeding cross pollinated plants: Bulk Selection, Recurrent selection, Synthetic varieties, Hybridization. Inbreeding depression and Heterosis – genetic and molecular basis.
<b>7.</b>	Breeding of vegetatively propagated crops. Role of apomixis in plant breeding. Mutation breeding.
<b>8.</b>	Biostatistical methods: basic concept of parametric and non-parametric methods. Graphical representation. Measures of central tendency and dispersion. Probability distributions–Binomial, Poisson and Normal distributions. Concepts of confidence intervals, types of error, levels of significance. Regression and correlation; t-test. ANOVA. Basic introduction to multivariate statistics.



### Practical

1.	Problems based on Hardy Weinberg law
2.	Line diagrams showing the plan of different methods of breeding self pollinated crops- Mass selection, Pureline selection, Pedigree method,
3.	Line diagrams showing the plan of different methods of breeding cross pollinated crops- Bulk Selection, Recurrent selection.
4.	Methods of hybridization in rice, sorghum, bajra, cotton in standing crop in the field.
5.	Assignments with problems for computing measures of central tendency and dispersion- mean, median and mode, standard deviation and standard error.
6.	Assignment with problems for computing correlation and regression coefficients.
7.	Assignment with problems for implementing t test.
8.	Assignment with problems for computing ANOVA.

### References

1.	Singh BD. 2012. <b>Plant Breeding: Principles and Methods</b> . Kalyani Publishers, Delhi.
2.	Stickberger MW. 1985. <b>Genetics</b> . McMillan, New York.
3.	Frey KJ. 1981. <b>Plant Breeding II</b> . Iowa State University Press, Oxford.
4.	Jones DA and Wilkins DA. 1971. <b>Variation and adaptation in plant species</b> . Heinemann Educational Books Ltd., London.
5.	Stebbins GL. 1971. <b>Chromosomal evolution in Higher Plants</b> . Edward Arnold Publishers Ltd., London.
6.	Poehlman JM and Borthakur D. 1969. <b>Breeding Asian field crops: With Special Reference to Crops of India</b> . Oxford and IBH Pub. Co., Delhi.
7.	Briggs FN and Knowles PF. 1967. <b>Introduction to Plant Breeding</b> . Reinhold Pub. Corp., New York.
8.	Brewbaker JL. 1964. <b>Agricultural Genetics</b> . Prentice-Hall, New Jersey, USA.
9.	Allard RW. 1961. <b>Principles of Plant Breeding</b> , 2 <sup>nd</sup> Edition. John Wiley and Sons Inc., New York.



**M.Sc. Botany - Semester IV**

**B 403 PLANT PATHOLOGY**

**Theory**

<b>S. No</b>	<b>Unit</b>
<b>SECTION A</b>	
<b>1.</b>	Importance of plant diseases, classification of plant diseases, causes of plant diseases, symptoms of plant diseases, post harvest diseases. Dispersal of plant pathogens- active and passive.
<b>2.</b>	Infection phenomena – pre penetration, penetration and post penetration. Factors affecting infection. Effect of environment on plant disease development – temperature, humidity and light.
<b>3.</b>	Molecular basics of host pathogen interactions (fungi, bacteria & viruses) and genetic engineering for disease resistance. Defense mechanisms in plants: pre-and post-infectious defense mechanisms, phytoalexins.
<b>4.</b>	Role of enzymes in plant diseases – pectic, macerating, cellulolytic, lignolytic, proteolytic, lypolytic enzymes and hemicellulases, inactivation of enzymes.
<b>SECTION B</b>	
<b>5.</b>	Role of toxins in plant diseases – Phytotoxins, vivo toxins, host specific patho toxins & non specific patho toxins.
<b>6.</b>	Control of plant diseases: Cultural practices: field & crop sanitation, crop rotation; Chemical control: systematic & non systematic fungicides; Biological control. microbial pesticides.  Plant diseases management through host resistance: vertical, horizontal, monogenic, polygenic, specific & general resistance. Development of resistant varieties.
<b>7.</b>	Symptoms, etiology, epidemiology & control measures with reference to the following:  Fungal diseases – Club root of crucifers, Damping off of seedlings. Leaf spot of

	turmeric, Ergot of bajra, Powdery mildew of Cucurbits, Whip smut of sugarcane, Grain smut of <i>Sorghum</i> , Bean rust, Coffee rust, Blast disease of rice, Wilt of cotton, Tikka disease of ground nut.
8.	Bacterial diseases – Citrus Canker, Angular leaf spot of cotton, Bacterial leaf Blight of rice, Brown rot of potatoes. Viral and phytoplasma diseases – Grassy shoot diseases of sugarcane, Little leaf of brinjal, Rice tungro.

### Practical

S. No	Exhibits/ Experiments
1.	<p>Study of symptoms, microscopic examination of diseased parts and identification of the pathogens involved in different plant diseases</p> <p>Fungal diseases–Club root of crucifers, Damping off of seedlings. Leaf spot of turmeric, Ergot of bajra, Powdery mildew of Cucurbits, Whip smut of sugarcane, Grain smut of <i>Sorghum</i>, Bean rust, Coffee rust, Blast disease of rice, Wilt of cotton, Tikka disease of ground nut.</p> <p>Bacterial diseases–Citrus Canker, Angular leaf spot of cotton, Bacterial leaf Blight of rice, Brown rot of potatoes.</p> <p>Viral and phytoplasma diseases – Grassy shoot disease of sugarcane, Little leaf of brinjal, rice tungro.</p>
2.	Isolation of fungal pathogens from leaves.
3.	Isolation of fungal pathogens from soil.
4.	Extraction of pectolytic enzymes from a pathogen.
5.	Extraction of cellulase enzyme from a pathogen.
6.	Isolation of plant pathogen– bacteria.
7.	Isolation (purification) of plant viruses.

### Reference Books

1.	Ravichandra NG. 2013. <b>Fundamentals of Plant Pathology</b> . PHI Learning Pvt. Ltd., Delhi.
2.	Ronald PC. 2007. <b>Plant-Pathogen Interactions: Methods in Molecular Biology</b> . Humana Press, New Jersey.

3.	Mehrotra RS.2006. <b>Plant pathology</b> . Tata McGraw Hill Publishing Co. Ltd., New Delhi.
4.	Sharma PD. 2004. <b>Plant pathology</b> . Rastogi Publications, New Delhi.
	Bilgrami S and Dubey HC. 1998. <b>A text book of modern Plant pathology</b> . Sangam Books Ltd., Mumbai.
5.	Stacey G and Keen TN. (ed). 1996. <b>Plant Microbe Interactions. Vols. I-III</b> . Chapman and Hall, New York; <b>Vol. IV</b> . APS Press, St. Paul, Minnesota.
6.	Singh RS. 1990. <b>Plant diseases</b> . Oxford and IBH Publishing Co., New Delhi.
7.	Butler EJ. 1973. <b>Fungi and diseases in plants</b> . Periodical Expert Book Agency, Delhi.
8.	Roberts D and Boothroyd CW. 1973. <b>Fundamentals of Plant pathology</b> . W. H. Freeman and Co., Ltd., New York.
9.	Rangaswamy G. 1972. <b>Disease of crop plants in India</b> . Prentice Hall of India, New Delhi.
10.	Strobell GA and Mathre DE. 1970. <b>Outline of Plant pathology</b> . D. Van Nostrand-Reinhold Co., New York.
11.	Matthews REF. 1970. <b>Plant virology</b> . Academic Press, New York.
12.	Agrios GN. 1969. <b>Plant Pathology</b> . Academic Press, New York.
13.	Walker JC. 1969. <b>Plant pathology</b> . McGraw Hill Book Co., New York.
14.	Wheeler BEJ.1969. <b>An introduction of Plant diseases</b> . John Wiley and Sons Ltd., New York.
15.	Smith KM. 1968. <b>Plant viruses</b> . Methuen, London.
16.	Mundkar BB.1967. <b>Fungi and Plant diseases</b> . McMillan and Co. Ltd., Calcutta.
17.	Wood RKS.1967. <b>Physiological Plant Pathology</b> . Blackwell Scientific Publications, Oxford.
18.	Kelman A. 1967. <b>Source Book of Laboratory Exercise in Plant Pathology</b> . W. H. Freeman, New York.
19.	Rangaswamy G. 1962. <b>Bacterial Plant Diseases in India</b> . Asia Publishing House,

	Bombay.
<b>20.</b>	Horsfall JC and Diamond AE.1960. <b>Plant Pathology – An Advanced Treatise – 3 volumes.</b> Academic Press, New York.
<b>21.</b>	Goodman et al.1957. <b>Biochemistry and Physiology of Infections and Plant Diseases.</b> Princeton, Van Nostrand, Belgium.
<b>22.</b>	Plank JEV.1953. <b>Plant Diseases – Epidemics and Control.</b> Academic Press, New York.



**M.Sc. Botany - Semester IV**  
**B 404 CROP PHYSIOLOGY AND BIOTECHNOLOGY**

**Theory**

S. No	Unit
<b>SECTION A</b>	
1.	Crop Physiology: Molecular biology of light reactions. Photosynthetic pathways.
2.	Mechanism of Photorespiration. Biotechnological strategies to improve photosynthesis, yield components. Source – sink relationships.
3.	Stress Physiology: Physiology and molecular biology of stress tolerance in response to water, salt and heavy metal stress.
4.	Methods in biotechnology: Tissue culture techniques in crop improvement, Protoplasts and cell fusion.
<b>SECTION B</b>	
5.	Recombinant DNA technology: basic principles of recombinant DNA technique. Techniques of transferring genes into plants.
6.	Potentials of Biotechnology: Molecular mechanism to confer herbicide resistance in crop plants. Genetic engineering to improve plant disease resistance.
7.	Genetic manipulation of crops for insect resistance, Genetic engineering of seed proteins and oils.
8.	Bioinformatics: Fundamentals of Genomics and Proteomics. PCR and its application in crop improvement, Principles of microarray technology and its applications.

**Practical**

S. No	Exhibit/Experiment
1.	Exercise-1: Chlorophyll absorption spectrum and quantitative determinations, assay of Hill reaction in isolated chloroplast. Crop growth analysis.
2.	Exercise-2: Determination of CO <sub>2</sub> compensation points in some crop plants, Estimation of carbohydrate, protein and nucleic acid contents in plants.
3.	Exercise-3: Determination of the activities of some enzymes associated with Carbohydrates and protein metabolism.
4.	Exercise-4: Effect of nitrogen and potassium on the growth and yield of crop plants.
5.	Exercise-5: Leaf anatomy in relation to diversity in photosynthetic pathways.
6.	Exercise-6: Effect of water and salt stress on the accumulation of proteins.
7.	Exercise-7: Estimation of nitrogen, phosphorus and potassium.



8.	Exercise-8: Experiments to study the effect of water and salt stress on seed germination and seedling development.
9.	Exercise-9: Experiments to study the weed control using some common herbicides.
10.	Exercise-10: Polyacrylamide gel electrophoresis of proteins.
11.	Exercise-11: Isolation of DNA.
12.	Exercise-12: Polymerase chain reaction.
13.	Exercise-13: Isolation of explants, establishment and maintenance of callus; Sub-culture of callus. Study of Somaclonal variation.
14.	Exercise-14: Isolation and culture of single cells.
15.	Exercise-15: Experiments on herbicide resistance and disease resistance in plants.

#### Reference Books

1.	Lebowitz RJ. 1995. <b>Plant Biotechnology, a laboratory manual.</b> Wm. C. Brown Publishers, Qubuque.
2.	Murray Meo – young. 1995. <b>Comprehensive Biotechnology. Vol . 1.</b> Pergamon Press Oxford.
3.	Marshall G and Walters O (ed) 1994. <b>Molecular Biology in Crop Protection.</b> Champman and Hall.
4.	Old RW and Primrose SB. 1994. <b>Principles of gene manipulation.</b> Blackwell Science.
5.	Salunkhe DK, Bhatt NR and Desai BB. 1990. <b>Post Harvest Biotechnology of Flowers and Ornamental Plants.</b> N. Bayopokash, Calcutta
6.	Davies KE. (ed) 1988. <b>Genome Analysis.</b> IRI Press, Oxford.
7.	Pierik RIM. 1987. <b>Invitro Culture of Higher Plants.</b> Martinus Nihoff Publishers Dordrecht.
8.	Primrose SB. 1987. <b>Molecular Biotechnology.</b> Blackwell Scientific Publications,
9.	Day PR. 1986. <b>Biotechnology and Crop Improvement and Protection.</b> BCPC Publications.
10.	Mantell SH and Smith N (ed) 1983. <b>Plant Biotechnology.</b> Cambridge University Press, Cambridge.
11.	Noggle GR and Fritz GJ. 1977. <b>Introductory plant physiology.</b>
12.	Reinert J and Bajaj YPS. 1977. <b>Plant Cell, Tissue and Organ Culture.</b> Springer – verlag, Berlin.
13.	Lange OI, Kappen L and Schule DD. 1976. <b>Water and Plant Life.</b>

<b>14.</b>	Burris RH and Black CC (ed) 1975. <b>CO<sub>2</sub> Metabolism and Productivity of Plants.</b>
<b>15.</b>	Evans IT. 1975. <b>Crop Physiology.</b>
<b>16.</b>	Major AM and Mayber P. 1975. <b>The germination of seeds.</b> 2 <sup>nd</sup> Edition.
<b>17.</b>	Mayber PA and Gele J. (ed) 1975. <b>Plants in Saline Environments.</b>
<b>18.</b>	Ashston and Crafts A. 1973. <b>Mode of Action of Herbicides.</b>
<b>19.</b>	Epstein E. 1972. <b>Mineral Nutrition of Plants: Principles and Perspectives.</b>
<b>20.</b>	Fogg GK. 1972. <b>Photosynthesis.</b>
<b>21.</b>	Hillman WS. 1972. <b>The Physiology of Flowering</b>
<b>22.</b>	Kozlowski TT. (ed) 1972. <b>Seed Biology. 3 Vols.</b>
<b>23.</b>	Levitt J. 1972. <b>Response of Plants to Environmental Stresses.</b>
<b>24.</b>	Hatch MD, Osmond CB and Slatyer RO (ed) 1971. <b>Photosynthesis and Photorespiration.</b>
<b>25.</b>	Gregory RPF. 1971. <b>Biochemistry of Photosynthesis.</b>
<b>26.</b>	Zelitch I. 1971. <b>Photosynthesis, Photorespiration and Plant Productivity.</b>
<b>27.</b>	Gollek B. (ed) 1970. <b>Structure and Function of Plant Cells in Saline Habitats.</b>
<b>28.</b>	Kozlowski TT. (ed) 1968. <b>Water Deficit and Plant Growth.</b>
<b>29.</b>	<b>Annual Review of Plant Physiology.</b> 1950. Vol. – Annual Reviews Inc., Stanford.

**M.Sc. Botany – Semester I**  
**B101: BIOLOGY AND DIVERSITY OF ALGAE AND BRYOPHYTES**  
**Theory**

S. No	Unit
<b>SECTION A</b>	
1.	Criteria employed in classification of algae. Classification given by Fritsch, Bold and Wynne, Lee. Thallus organization, reproduction and life cycles in algae.
2.	Range of thallus structure, reproduction, life histories of Chlorophyceae with special reference to the genera: <i>Chlamydomonas</i> , <i>Tetraspora</i> , <i>Volvox</i> , <i>Chlorella</i> , <i>Scenedesmus</i> , <i>Ulva</i> , <i>Enteromorpha</i> , <i>Cladophora</i> , <i>Fritschiella</i> , <i>Oedogonium</i> , <i>Spirogyra</i> , <i>Cosmarium</i> , <i>Caulerpa</i> , <i>Chara</i> .
3.	Salient features of Protochlorophyta; Xanthophyta: <i>Vaucheria</i> . Bacillariophyta: <i>Cyclotella</i> , <i>Navicula</i> ; Phaeophyta: <i>Ectocarpus</i> , <i>Dictyota</i> , <i>Padina</i> , <i>Laminaria</i> , <i>Sargassum</i> .
4.	Salient features of Rhodophyta: <i>Gelidium</i> , <i>Gracilaria</i> , <i>Polysiphonia</i> ; Cyanophyta: <i>Nostoc</i> , <i>Lyngbya</i> , <i>Spirulina</i> .
<b>SECTION B</b>	
5.	Diversity of marine and fresh water algae in India. Economic importance of algae– single cell protein, pigments, lipids, and omega fatty acids. Algal blooms. Algal bio fertilizers. Cultivation of economically important seaweeds– <i>Porphyra</i> , <i>Gracilaria</i> , <i>Gelidium</i> . Mass culture of micro algae.
6.	Classification of Bryophytes given by Smith, Campbell. Ecological and economic importance of Bryophytes. Conduction in Bryophytes.
7.	Morphology, structure, reproduction and life history of Hepatocopsida: Marchantiales: <i>Marchantia</i> ; Jungermaniales: <i>Pellia</i> , <i>Porella</i> ; Anthocertopsida: <i>Anthoceros</i> .
8.	Morphology, structure, reproduction and life history of Bryopsida: Sphagnales: <i>Sphagnum</i> ; Funariales: <i>Funaria</i> ; Polytrichales: <i>Polytrichum</i> .

**Practical**

S. No	Exhibit/Experiment
1.	Examination of vegetative and reproductive morphology of Chlorophyceae: <i>Chlamydomonas</i> , <i>Tetraspora</i> , <i>Volvox</i> , <i>Chlorella</i> , <i>Scenedesmus</i> , <i>Ulva</i> , <i>Enteromorpha</i> , <i>Cladophora</i> , <i>Fritschiella</i> , <i>Oedogonium</i> , <i>Spirogyra</i> , <i>Cosmarium</i> , <i>Caulerpa</i> , <i>Chara</i> .
2.	Examination of vegetative and reproductive morphology of Bacillariophyceae:

	<i>Cyclotella, Navicula</i> ; Phaeophyceae: <i>Ectocarpus, Dictyota, Padina, Laminaria, Sargassum</i> .
3.	Examination of vegetative and reproductive morphology of Rhodophyceae: <i>Gelidium, Gracilaria, Polysiphonia</i> .
4.	Examination vegetative and reproductive morphology of Xanthophyceae: <i>Vaucheria</i> Cyanophyceae: <i>Nostoc, Lyngbya, Spirulina</i> .
5.	Field work to get acquaintance with the algae of Visakhapatnam coast and fresh water algae in and around Visakhapatnam.
6.	An examination of the external features and internal structure and reproductive organs of: <i>Riccia, Targionia, Monoclea, Plagiochasma</i> .
7.	An examination of the external features and internal structure and reproductive organs of the genera: <i>Fimbriaria, Marchantia, Pellia, Porella</i> .
8.	An examination of the external features and internal structure and reproductive organs of: <i>Anthoceros, Notothylus, Andreaea, Funaria, Polytrichum</i> .

#### Reference Books

1.	Lee RW. 2007. <b>Classification of Algae</b> .
2.	Kumar HD. 1988. <b>Introductory Phycology</b> . Affiliated East West Press Pvt. Ltd., New Delhi.
3.	Round FE. 1986. <b>The Biology of Algae</b> . Cambridge University Press, New York.
4.	Bold HC and Wyne MJ. 1978. <b>Introduction to the Algae</b> . Prentice-Hall, New Jersey.
5.	Presscot GW. 1969. <b>The Algae- a Review</b> . Houghton Mifflin Company, Boston.
6.	Morris I. 1967. <b>An Introduction to the Algae</b> . Cambridge University Press, UK.
7.	Chapman VJ. 1962. <b>The Algae</b> . Macmillan and Co Ltd., London.
8.	Lewin RA. 1962. <b>Physiology and Biochemistry of Algae</b> . Academic Press, New York.
9.	Round FE. 1962. <b>Ecology of Algae</b> . Cambridge University Press, New York
10.	Smith GE (ed) 1950. <b>Fresh Water Algae</b> . Elsevier Science, USA.
11.	Fritsch FE. 1945. <b>The Structure and Reproduction of Algae Vols. 1&amp; II</b> . Cambridge University Press, New York.
11.	Chopra RN and Kumra PK. 1988. <b>Biology of Bryophytes</b> . New Age International (P) Ltd. Publishers, New Delhi.
12.	Parihar NS. 1991. <b>Bryophyta</b> . Central Book Depot, Allahabad.

<b>13.</b>	Puri P. 1980. <b>Bryophytes</b> . Atmaram and Sons, Delhi.
<b>14.</b>	Smith GM. 1955. <b>Cryptogamic Botany Vol.II</b> . Tata McGraw Hill Publishing Co. Ltd., New Delhi.
<b>15.</b>	Kashyap S. 1929. <b>Liverworts of the Western Himalayas and Punjab Plains Part I and Part II</b> . University of Panjab, Lahore, Pakistan.



**M.Sc. Botany - Semester I**  
**B 102: BIOLOGY AND DIVERSITY OF BACTERIA, VIRUSES AND FUNGI**  
**Theory**

S. No	Unit
<b>SECTION A</b>	
1.	General account of archaeobacteria, eubacteria and cyanobacteria. Classification of eubacteria. Ultrastructure, nutrition, reproduction and economic importance of bacteria.
2.	Morphology and chemical composition of Actinomycetes, Spirochetes, Rickettsiae and Mycoplasmas.
3.	Classification of viruses. Ultrastructure and chemistry of viruses. Replication and transmission of viruses. History, origin and evolution of plant viruses. Plant viral diseases.
4.	Microbial Ecology: quorum sensing, gentrification, phosphorous solubilization, nitrogen fixation.
<b>SECTION B</b>	
5.	Classification and phylogeny of fungi. Molecular aspects in classification. Thallus organization in fungi. Ultrastructure of fungal cell. Unicellular and multicellular organization. Cell wall composition. Fungal diseases in plants and humans.
6.	General account of Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina.
7.	Reproduction in fungi: vegetative, asexual and sexual. Heterothallism, heterokaryosis and parasexuality. Nutrition in fungi: saprobic, biotrophic, and symbiotic.
8.	Fungi in industry: medicine, food, pest and weed management (biocontrol agents). Mushroom cultivation. Fermentation methods. Mycorrhiza.

**Practical**

S. No	Exhibits/ Experiments
1.	Tools of microbiology: Care and use of the microscope, Spectrophotometer, P <sup>H</sup> meter, Micrometer, Hemocytometer, Autoclave, Centrifuge, Biological safety

	cabinets, Inoculation needle and loop, Incubator, Colony counter & Lyophilizer.
2.	Differential staining: Gram staining.
3.	Differential staining: Acid fast staining.
4.	Study of bacterial growth: To prepare the growth curve of bacteria.
5.	Study of cyanobacteria: Isolation and cultivation of cyanobacteria.
6.	Isolation of rhizobia from root nodules.
7.	Cultivation of viruses in embryonated eggs.
8.	Isolation of fungi by Petri plate exposure method.
9.	Morphological study of: <i>Stemonitis</i> , <i>Saprolegnia</i> , <i>Mucor</i> , <i>Morchella</i> , <i>Aspergillus</i> , <i>Agaricus</i> , <i>Cyathus</i> , <i>Synchytrium</i> , <i>Helminthosporium</i> .
10.	Symptomatology and anatomical study of some diseased specimens: white rust, powdery mildew, green ear of bajra, rust of wheat, rust of linseed, Tikka disease of ground nut, red rot of sugarcane, blast of rice, citrus canker, tobacco mosaic disease.
<b>References Books</b>	
1.	Kaursethi I and Surinder KW 2011. <b>Text Book of Fungi and their Allies</b> . Macmillan publishers, New Delhi, India.
2.	Ram Reddy S & Reddy SM 2007. <b>Essentials of Virology</b> . Scientific publishers, Jodhpur, India.
3.	Sharma K 2005. <b>Manual of Microbiology Tools and Techniques</b> . Ane Book, New Delhi, India.
4.	Matthew RH 2004. <b>Plant virology</b> . 4 <sup>th</sup> edition. Academic press an imprint of Elsevier, California, USA.
5.	Prescott <i>et al.</i> 2003. <b>Microbiology</b> . McGraw Hill Education, New York.
6.	Aneja KR 2003. <b>Experiments in Microbiology, Plant pathology and Biotechnology</b> . New Age International publishers, New Delhi.
7.	Verma HN 2003. <b>Basics of plant Virology</b> . IBH publishing co. Pvt. Ltd., New Delhi.



8.	Mehrotra KS and Aneja KR 2003. <b>An Introduction to Mycology</b> . New Age International Publishers, New Delhi.
9.	Sullia SB and Shantharam S 2001. <b>General Microbiology</b> . Oxford and IBH publishing Co. Pvt. Ltd, New Delhi.
10.	Reddy SM and Ram Reddy S 2000. <b>Microbiology a Laboratory Manual</b> . BSC Publishers and Distributors, Hyderabad.
11.	Flint SJ, Enquist LW, Krug RM, Racaniello VR, Skalka AM 2000. <b>Principles of Virology, Molecular Biology, Pathogenesis and Control</b> . ASM press, Washington DC.
12.	Rao AS 1999. <b>Introduction to Microbiology</b> . Prentice Hall of India Pvt. Ltd., Delhi.
13.	Alexopoulos CJ, Mims CW, Blackwell M 1996. <b>Introductory Mycology</b> . 4 <sup>th</sup> edition. Replika press, North Delhi.
14.	Paul S 1995. <b>Bacteria in Biology, Biotechnology and Medicine</b> . 5 <sup>th</sup> edition. John Wiley and son Ltd., UK.
15.	Pelczar, Chan and Krieg 1993. <b>Microbiology</b> . 5 <sup>th</sup> edition. McGraw Hill Education, New York.
16.	<i>Stainer</i> RT, Ingraham JL, Wheelis ML and Painter PR 1987. <b>General Microbiology</b> . 5 <sup>th</sup> Edition. Macmillan, London.
17.	Smith KM 1968. <b>Plant viruses</b> . Elsevier, New York.
18.	Rangaswamy G 1962. <b>Bacterial Plant disease in India</b> . Asia Publishing House, Bombay.



**M.Sc. Botany - Semester I**  
**B103 CELL BIOLOGY OF PLANTS**

**Theory**

S. No	Unit
<b>SECTION A</b>	
1.	The cell theory. Origin and development of cell biology as a separate branch. Dimensions of size and weight: micron to angstrom, microgram to pictogram. Ultra structure and organization of prokaryotic and eukaryotic cells. Specialized cell types.
2.	Chemical foundation: macromolecules–structure, shape and information. Non-covalent interactions in relation to function of nucleic acids and proteins. Biochemical energetics: types of energy– thermal, electrical and radiant energy, interconvertability of energy. Laws of thermodynamics as applicable to biological systems.
3.	Cell wall:structure and functions, cell wall architecture, biogenesis and growth. Plasmodesmata: structure and function, plasmodesmata in comparison to gap junctions of animal cells. Plasma membrane: structure, models and functions. ATPases receptors, carriers, channels, pumps. Vacuole structure and function, vacuolar ATPases, transporters.
4.	Cytoskeleton: microtubules and microfilaments, their role in cell division and motility; intermediate filaments– role in providing strength. Labeled antibody technique for visualizing cytoskeleton.
<b>SECTION B</b>	
5.	Chloroplast and Mitochondria: structure and function, genome organization, nucleo-cytoplasmic interactions, RNA editing.
6.	Other organelles: structure and function– endoplasmic reticulum, Golgi apparatus lysosomes,, ribosomes, microbodies, peroxisomes.
7.	Tools in cell biology I: microscopy–working principles of light microscopy, resolution power of microscope, different types of light microscopes, stains used. Image processing methods in microscopy. Scanning electron microscopy. Transmission electron microscopy– principle of working, preparation of specimens for electron microscopy –Fixing, sectioning, spreading molecules, negative staining, shadow casting, freeze fracture and freeze etching.
8.	Tools in cell biology II: subcellular fractionation– homogenization, principle of density gradient centrifugation. Spectroscopic techniques– principle and applications

	of UV- visible, ESR. Spectrofluorimetry. Circular dichroism (CD). Nuclear magnetic resonance (NMR). Whole cell autoradiography. Radiolabeling techniques: properties of different radioisotopes used in biology, their detection and measurement, incorporation of radioisotopes in biological tissues and cells.
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### Practical

S. No	Exhibit/Experiment
1.	Electron microscopic picture of prokaryotic and eukaryotic cells.
2.	Images of cytoskeleton.
3.	Electron microscope pictures of chloroplast and mitochondria.
4.	Electron microscope pictures of endoplasmic reticulum, Golgi apparatus.
5.	Study of mitosis using acetocarmine.
6.	Isolation of mitochondria and the activity of its marker enzyme, succinate dehydrogenase (SDM).
7.	Fluorescence staining with FDA for cell viability and cell wall staining with calcofluor.
8.	Pictures of images of shadow casting, negative staining, freeze fracturing and freeze etching.
9.	Images of cells in fluorescence, phase contrast and confocal microscopy, whole cell autoradiography.
10.	Establishing sucrose density gradients.

### Reference Books

1.	Alberts B, Breyer D, Hopkin K, Johnson AD, Lewis J, Raff M, Roberts K and Watter P 2014. <b>Essential Cell Biology</b> . 4 <sup>th</sup> Edition. Garland publishers, New York.
2.	Sharp D, Ploppe G and Sikorski E 2014. <b>Lewin's Cells</b> . 3 <sup>rd</sup> Edition. Viva Books, New Delhi.
3.	Cooper GM, Hausman RE 2013. <b>The Cell – A Molecular Approach</b> . 6 <sup>th</sup> Edition. Sinauer Associates, Incorporated, USA.
4.	Karp G 2013. <b>Cell and Molecular Biology – Concepts and Experiments</b> . 7 <sup>th</sup> Edition. Wiley Global Education, USA
5.	McLennan A, Bates A, Turner P, White M 2013. <b>Bios Instant Notes in Molecular Biology</b> . 4 <sup>th</sup> Edition. Garland publishers, New York.
6.	Cowling G, Allen T 2011. <b>The Cell. A very Short Introduction</b> . Oxford University Press, USA.

7.	Alberts B, Johnson A, Lewis J, Raff M, Roberts K, Walker P 2007. <b>Molecular Biology of the Cell</b> . 5 <sup>th</sup> Edition. Garland publishers, New York.
8.	Schaffer SW 2007. <b>Mitochondria: The Dynamic Organelle</b> . 1 <sup>st</sup> Edition. Springer Verlag.
9.	Wilson J, Hunt T 2007. <b>Molecular Biology of the Cell</b> 5 <sup>th</sup> edition. <b>The Problems Book</b> . 2 <sup>nd</sup> Edition. Garland publishers, New York.
10.	Celis JE (ed) 2006. <b>Cell Biology—A Laboratory Hand Book</b> . 3 <sup>rd</sup> Edition. Elsevier, USA.
11.	Lodish H, Berk A, Kaiser CA, Kreiger M, Scott P M, Bretcher A, Ploegh H, Matsudaira P. 2004. <b>Molecular Cell Biology</b> . 5 <sup>th</sup> edition. W. H. Freeman and Company, New York.
12.	De DN 2000. <b>Plant Cell Vacuoles. An Introduction</b> . CSIRO Publication Collingwood, Australia.
13.	Krishna Murthy KV 2000. <b>Methods in Cell Wall Cytochemistry</b> . CPC Press, Boca Raton, Florida.
14.	Lodish, Berk A, Zipursky SL, Matsudaira P, Baltimore D and Darnell J 2000 <b>Molecular Cell Biology</b> . 4 <sup>th</sup> Edition. W.H. Freeman and Co., New York.
15.	Alberts B, Bray D, Lewis J, Raff M, Roberts K and Watson JD 1999. <b>Molecular Biology of the Cell</b> , Garland Publishing, New York.
16.	Kleinsmith LJ and Kish VM 1995. <b>Principles of Cell and Molecular Biology</b> . 2 <sup>nd</sup> Edition. Harper Collins College Publishers, New York, USA.
17.	Avers CJ 1986. <b>Molecular Cell Biology</b> . Addison Wesley Publishing Company USA.



**M.Sc. Botany – Semester I**  
**B 104 CYTOLOGY AND CYTOGENETICS**

**Theory**

S. No	Unit
<b>SECTION A</b>	
<b>1.</b>	Nucleus: structure of nuclear membrane and nuclear pore complex, nucleolus, ribosome biosynthesis. Chromatin: eu and heterochromatin, arrangement of chromatin. Molecular organization of chromatin: components, nucleosomes – composition and organization, 10 nm, 30 nm, solenoid, scaffolds. Chromosome structure: molecular organization of centromeres and telomeres. Types of chromosomes: lampbrush, polytene.
<b>2.</b>	Chromosome identification: karyotype analysis. Chromosome banding techniques – Q, C, G and R banding. Flowcytometry and confocal microscopy in karyotype analysis. Computer assisted karyotype analysis – chromosome microdissection and micro cloning. FISH and GISH techniques.
<b>3.</b>	Chromosomal structural aberrations: origin, meiosis and breeding behaviour of duplications, deficiencies, inversions and interchanges. Types of inversions. Robertsonian translocations – basic concept of complex translocation heterozygotes.
<b>4.</b>	Chromosomal numerical aberrations: classification of numerical aberrations. Aneuploids – trisomics (primary, secondary, tertiary), monosomics and nullisomics – meiotic behavior. Eupolyploids – origin and production of auto -and allopolyploids, meiosis in autotetraploid. Genome of tobacco and wheat as examples of allopolyploids.
<b>SECTION B</b>	
<b>5.</b>	Nuclear DNA content: C-value paradox, hyperchromicity, cot curves and their significance. Molecular organization of eukaryotic nuclear genome: highly repeated, middle repeated and unique sequences.
<b>6.</b>	Cell cycle and its regulation: the G1, S, G2 and M phases. Synchronous and asynchronous cell divisions. The measurement of duration of different phases of cell cycle using a flow cytometer. Check points in cell cycle – role of cyclins and cyclin-dependent kinases in regulation of cell cycle.
<b>7.</b>	The different stages of mitosis and meiosis: description of the stages. Experimental control of cell division. Significance of meiosis.

8.	Apoptosis: mechanism and significance. Initiation of cancer at cellular level – proto oncogenes and oncogenes; retinoblastoma and E2F proteins.
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### Practical

S. No	Exhibit/ Experiment
1.	Photographs of interphase nucleus, 10 nm, 30nm and scaffolds. Electron microscope picture of metaphase chromosome, <i>in-situ</i> hybridization of chromosome spreads showing telomeres and centromeres. rRNA synthesis –christmas tree configuration.
2.	Pictures of lampbrush and polytene chromosomes.
3.	Photographs of chromosomes with different banding patterns. Identifying homologous chromosomes from the pictures.
4.	Preparation of karyotypes in <i>Allium/ Aloe</i> (with treated root tips).Construction of idograms from pictures of karyotypes.
5.	Photographs showing meiosis in structural and numerical aberrations.
6.	Meiosis in <i>Rheo discolor</i> showing complex translocation heterozygote.
7.	Preparation of slides from <i>Allium</i> floral buds for observation and identification of stages of meiosis.
8.	C value paradox chart and Britten and Kohne's Cot curves picture.

### Reference Books

1.	Singh RJ. 2014. <b>Plant Cytogenetics</b> . 2 <sup>nd</sup> Edition. CRC Press, India.
2.	Pierce BA. 2013. <b>Genetics: A Conceptual Approach</b> . 5 <sup>th</sup> Edition. W. H. Freeman, California.
3.	William K, Cummings S, Spencer MR and Charlotte A. 2013. <b>Essentials of Genetics</b> . Pearson Books, Delhi.
4.	Hartwell L. 2011 <b>Genetics: From Genes to Genomes, Study Guide and Solution Manual</b> . 4 <sup>th</sup> Edition. Nero, McGraw Hill Publishing company, New York.
5.	Bass H and Birchler J. 2011. <b>Plant cytogenetics: Genome structure and chromosome Function</b> . Springer, New York.
6.	Ram M. 2010. <b>Cytogenetics and Genetics</b> . PHI Learning Pvt. Ltd., Delhi.
7.	Anthony J, Griffiths F, Wessig SR, Carroll SB and Doebley J. 2010. <b>Introduction to genetic analysis</b> . 10 <sup>th</sup> Edition. W. H. Freeman, California.
8.	Russel PJ. 2009. <b>Genetics–A Molecular Approach</b> . 3 <sup>rd</sup> Edition. Pearson Benjamin Cummings, San Francisco, USA.
9.	Roy D. 2009. <b>Cytogenetics</b> . Alfa Science International Ltd., UK.



10.	Brooker R. 2008. <b>Genetics, Analysis and Principles</b> . 3 <sup>rd</sup> edition. McGraw Hill Science.
11.	Gupta P.K .1995. <b>Cytogenetics</b> . Rastogi & Company, Meerut.
12.	Sybenga J. 1992. <b>Cytogenetics in Plant Breeding</b> . Springer London Ltd.
13.	David M. Prescott. 1988. <b>Cells</b> . Jones and Bartlett Publ. Boston.
14.	Swanson M and Young. 1982. <b>Cytogenetics</b> . Prentice Hall, India.
15.	Khush GS. 1973. <b>Cytogenetics of Aneuploids</b> . Academic Press, New York and London.
16.	Sybenga J. 1973. <b>General Cytogenetics</b> . North Holland and American Elsevier Publishing Co., New York.
17.	Burnham CR. 1962. <b>Discussions in Cytogenetics</b> . Burgess Publishing Co., Minnesota.



**M.Sc. Botany - Semester II**

**B 201 GENETICS**

**Theory**

<b>S. No</b>	<b>Unit</b>
<b>SECTION A</b>	
<b>1.</b>	Concept of genetic markers and their types. Mendel's experiments and theories, application of probability laws to Mendelian principles. Chi-square testing for goodness of fit. Penetrance and expressivity. Pleiotropism. Phenocopies. Codominance and incomplete dominance.
<b>2.</b>	Multiple allelism: interaction among multiple alleles, complementation test, pseudoalleles. Gene interaction and modified F <sub>2</sub> ratios in two gene interactions.
<b>3.</b>	Linkage and crossing over: identifying linkage from F <sub>2</sub> and test cross, recombination frequency and distance between genes. Linkage maps. Tetrad analysis—ordered and unordered tetrads.
<b>4.</b>	Recombination in prokaryotes: transformation, conjugation, transduction, sexduction. Mapping of genes in bacteria using transformation and conjugation (interrupted mating). Fine structure analysis of gene – Benzer's work.
<b>SECTION B</b>	
<b>5.</b>	Sex determination: chromosomal and genetic basis. Sex-linked inheritance. Sex influenced and sex limited characters. Polygenic inheritance: heritability and its measurement. QTL mapping.
<b>6.</b>	Extra chromosomal inheritance: inheritance of mitochondrial and chloroplast genes. Male sterility. Chloroplast mutations. Maternal inheritance.
<b>7.</b>	Nature of the eukaryotic gene: split gene with a promoter and terminator. Variant forms of eukaryotic gene – nested genes, overlapping genes, assembled genes, assorted genes. Multigene families— organization and significance. Transposable elements in pro- and eukaryotes: types, mechanism of transposition, significance of transposable elements.
<b>8.</b>	Mutations: types, causes and detection. Physical and chemical mutagens. Lethal, conditional, biochemical, loss of function, gain of function. Molecular basis of mutations. Spontaneity of mutations, site-directed mutagenesis. Recombination: molecular mechanism— role of rec A, B, C, D enzymes, Holliday model, site specific recombination.

### Practical

S. No	Exhibit/Experiment/Assignment
1.	Assignment on Mendel's principles, chisquare test, proabability.
2.	Assignment on dominance relationships, multiple alleles and two gene interactions.
3.	Assignment on linkage and crossing over.

### Reference Books

1.	Benajamin Pierce 2013. <b>Genetics: A Conceptual Approach.</b> 5 <sup>th</sup> Edition.W.H. Freeman and Company.
1.	Lewin B. 2000. <b>Gene VII.</b> Oxford University Press, New York, USA.
2.	Snustad DP. and Simons MJ 2000. <b>Principles of Genetics.</b> 2 <sup>nd</sup> Edition. John Wiley and Sons Inc., USA.
3.	Atherly AG, Girton JR and McDonald JF. 1999. <b>The Science of Genetics.</b> Saunders College Publishing, Fort Worth, USA.
4.	Karp G. 1999. <b>Cells and Molecular Biology: concepts and Experiments.</b> Hohn Wiley and Sons Inc., USA.
5.	Hartl DL and Jones EW. 1998. <b>Genetics: Principles and Analysis.</b> 4 <sup>th</sup> Edition. Jones and Bartlett Publishers, Massachusetts, USA.
6.	Malacinski GM and Freifelder D. 1998. <b>Essentials of Molecular Biology.</b> 3 <sup>rd</sup> Edition. Jones and Bartlet Publishers Inc., London.
7.	Russel PJ. 1998. <b>Genetics.</b> 5 <sup>th</sup> Edition. The Benjamin/ Cummings Publishing Company Inc., USA.
8.	Lewis R. 1997. <b>Human Genetics: Concepts and Applications.</b> 2 <sup>nd</sup> Edition. WCB McGraw Hill, USA.
9.	Griffiths RCL, Anthony JF, Miller JH and Suzuki DT. 1996. <b>Genetic analysis.</b> 6 <sup>th</sup> Edition. W. H. Freeman and Co., New York.



**M.Sc. Botany - Semester II**  
**B 202 MOLECULAR BIOLOGY OF PLANTS**

**Theory**

S. No	Unit
<b>SECTION A</b>	
<b>1.</b>	Composition and structure of biomolecules: carbohydrates, lipids, proteins (Ramachandran plot) domains, motifs and folds. Nucleic acids– DNA structure, A, B and Z forms of DNA. Types of small RNAs: Si RNA, micro RNA, catalytic RNA.
<b>2.</b>	DNA replication: semi-conservative, semi-discontinuous- Okazaki fragments, uni and bi directional mode of replication. RNA priming, enzymes for DNA replication– gyrase, helicase, topoisomerases and polymerases, SSBs. Mechanism of DNA replication– in prokaryotes–rolling circle and theta mode of replication, in eukaryotes– multiple replicons. Fidelity of replication. Replication at ends of chromosomes. Extrachromosomal replicons. DNA damage and repair.
<b>3.</b>	RNA synthesis and processing: transcription process in prokaryotes and eukaryotes. Transcription factors. RNA processing– mRNA processing – spliceosome, capping and tailing, processing of tRNA and rRNA.
<b>4.</b>	Protein synthesis: structure of tRNA, aminoacylation of tRNA, aminoacyl tRNA synthetases. Ribosome as a translation factory. Genetic code– codon assignment, characteristics of genetic code. Mechanism of translation in prokaryotes and eukaryotes– initiation elongation and termination. Chemical proof reading during translation. Translation inhibitors. Post translational modifications.
<b>SECTION B</b>	
<b>5.</b>	Protein sorting and targeting of proteins into nucleus, chloroplasts, mitochondria, vacuoles and peroxisomes. Protein trafficking through GERL system– signal peptide, signal recognition particle, vesicles.
<b>6.</b>	Signal transduction: signaling molecules, ligands and receptors. G protein coupled receptors. Receptor tyrosine kinases. MAP kinases. Second messengers, signal amplification, cAMPs. Ca-calmodulin pathway.
<b>7.</b>	Regulation of gene expression in prokaryotes: bacteria – Lac, arabinose ,Tryp operons, positive and negative control. Regulation in viruses–lytic and lysogenic cycles.
<b>8.</b>	Regulation of gene expression in eukaryotes: cis and trans factors. Motifs of DNA

	binding domains of trans factors–zinc fingers, leucine zippers, helix turn helix. Temporal and spatial regulation. Role of chromatin in gene expression. DNA methylation and gene imprinting. Gene silencing.
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### Practical

S. No	Exhibit/Experiment
1.	Isolation of DNA using CTAB method.
2.	Histochemical staining of carbohydrates, proteins and fats in the plant cells.
3.	Electrophoresis of seed proteins.
4.	Assignments on problems related to DNA structure, replication, transcription and translation
5.	Photographs depicting the content of theory

### Reference Books

1.	Snustad P, Simmons MJ. 2003. <b>Principles of Genetics</b> . 3 <sup>rd</sup> Edition. John Wiley and Sons, Inc, USA.
2.	Buchaman BB, Gruissem,W and Jones R. 2000. <b>Biochemistry and Molecular Biology of plants</b> : American Societies of plant physiologists, John Wiley and Sons Ltd., Maryland, U.S.A.
3.	Lewin B. 2000. <b>Genes IX</b> , Oxford University Press, New York.
5.	Lodish BA, Zipursky SL, Matsdaira P, Baltimore D and Darnell J. 2000. <b>Molecular Cell Biology</b> . 4 <sup>th</sup> Edition. W.H. Freeman and Co., New York.
6.	Alberts B, Bray D, Lewis J, Ralf M, Roberts K and Watson JD.1999. <b>Molecular Biology of the Cell</b> . Garland publishing Inc., New York.
7.	Weaver RF. 1999. <b>Molecular Biology</b> . WCB /McGraw-Hill,.
8.	Shaw CH. 1998. <b>Plant Molecular Biology. A practical approach</b> , IRL Press, Oxford.
9.	Glick BR and Thompson JE. 1992. <b>Methods in Plant Molecular Biology and Biotechnology</b> , CRC Press, Boc Raton Florida.





**M.Sc. Botany – Semester II**

**B 203 BIOLOGY AND DIVERSITY OF PTERIDOPHYTES AND GYMNOSPERMS**

**Theory**

S. No	Unit
<b>SECTION A: Pteridophytes</b>	
1.	Classification of Pteridophyta. Origin of Pteridophytes. Pteridophytes in comparison to Bryophytes and Gymnosperms. Distinguishing features of Pteridophyta. Economic importance of Pteridophytes.
2.	Morphology, anatomy and reproduction of <i>Psilotum</i> , <i>Lycopodium</i> , <i>Selaginella</i> , <i>Isoetes</i> , <i>Equisetum</i> , <i>Ophioglossum</i> , <i>Osmunda</i> , <i>Gleichenia</i> , <i>Cyathea</i> , <i>Marselia</i> , <i>Adiantum</i> , <i>Salvinia</i> and <i>Azolla</i> .
3.	General account of fossil pteridophytes–Psilopsida, Lycopsida, Sphenopsida and Pteridopsida.
4.	Evolution of stelar types in Pteridophytes. Heterospory and origin of seed habit. Evolution of the sporophyte.
<b>SECTION B: Gymnosperms</b>	
5.	The evolutionary time scale: eras, periods and epochs. General account of fossils. Types of fossil formations.
6.	Gymnosperms in comparison to ferns and seed plants. Classification of Gymnosperms and their distribution in India. Economic importance of Gymnosperms.
7.	General account of the families of Pteridospermales–Lyginopteridaceae, Medullosaceae, Caytoniaceae; Bennettitales–Cycadeodiaceae; Pentoxylales – Pentoxylaceae; Cordaitales–Cordaitaceae.
8.	Structure and reproduction in living Gymnosperms of Cycadopsida, Coniferopsida and Gnetopsida.

**Practical**

S. No	Exhibit/Experiment
1.	Examination of the external features, anatomy and reproductive structures of <i>Psilotum</i> , <i>Lycopodium</i> , <i>Selaginella</i> , <i>Isoetes</i> and <i>Equisetum</i> .
2.	Examination of the external features, anatomy and reproductive structures of <i>Ophioglossum</i> , <i>Osmunda</i> , <i>Gleichenia</i> , <i>Cyathea</i> , <i>Marselia</i> , <i>Adiantum</i> , <i>Salvinia</i> and

	<i>Azolla</i> .
3.	Observations of the slides of the following fossil plants— <i>Rhynia</i> , <i>Lepidodendron</i> , <i>Lepidocarpon</i> , <i>Miadesmia</i> , and <i>Sphenophyllum</i> .
4.	Observations of the slides fossil Pteridophytes: <i>Calamites</i> , <i>Calamostachys</i> , <i>Zygoptera</i> and <i>Etaopteris</i> .
5.	Examination of the external features, anatomy and reproductive structures of <i>Ginkgo</i> , <i>Pinus</i> , <i>Cupressus</i> and <i>Cryptomeria</i> .
6.	Examination of the external features, anatomy and reproductive structures of <i>Araucaria</i> , <i>Ephedra</i> and <i>Gnetum</i> .
7.	Study of fossil gymnosperms from prepared slides: <i>Lyginopteris</i> , <i>Lagenostoma</i> and <i>Medullosa</i> .
8.	Study of fossil gymnosperms from prepared slides: <i>Trigonocarpus</i> , <i>Conostoma</i> , <i>Heterangium</i> , <i>Cordaites</i> .

#### Reference Books

1.	Saxena P and Pathak C. 2012. <b>A Text Book of Pteridophyta.</b> , Wisdom Press, New Delhi.
2.	Sharma OP. 2006. <b>Pteridophyta.</b> MacMillan India Ltd., New Delhi.
3.	Parihar NS. 1996. <b>Biology and Morphology of Pteridophytes.</b> Central Book Depot, Allahabad.
4.	Smith GM. 1995. <b>Cryptogamic Botany. Vol. II.</b> McGraw Hill Book Company, New York.
5.	Sporne KR. 1962. <b>The Morphology of Pteridophytes.</b> Hutchinson University Library, London.
6.	Evans AJ. 1936. <b>Morphology of Vascular Plants (Lower groups).</b> McGraw Hill Book Company, New York.
7.	Biswas C and Johri BM. 1997. <b>The Gymnosperms.</b> Narosa Publishing House, New Delhi.
8.	Bhatnagar SP and Moitra A. 1996. <b>Gymnosperms.</b> New Age International Private Limited, New Delhi.
9.	Sharma OP. 1996. <b>Gymnosperms.</b> Pragati Prakashan, Meerut.
11.	Stewart WN and Rothwell GW. 1993. <b>Paleobotany and the Evolution of Plants.</b> Cambridge University Press, USA.
12.	Singh H. 1978. <b>Embryology of Gymnosperms.</b> Gebrudev Bortraeger, Berlin.

<b>13.</b>	Arnold CA. 1974. <b>An introduction to Paleobotany.</b> McGraw Hill Book Co., Inc., New York.
<b>14.</b>	Sporne KR. 1967. <b>The Morphology of Gymnosperms.</b> Hutchinson University Library, London.
<b>15.</b>	Chamberlain CJ. 1935. <b>Gymnosperms structure and evolution.</b> University of Chicago Press, USA.



## M.Sc. Botany - Semester II

### B 204 PLANT CELL, TISSUE AND ORGAN CULTURE

#### Theory

S. No	Unit
<b>SECTION A</b>	
1.	Plant cell and tissue culture: introduction, history, scope. Basic concepts of tissue of culture: tissue culture cycle, types of cultures. Concept of cellular differentiation, totipotency.
2.	Culture media: composition and effects of media components, phytohormones – effects in tissue culture. Sterilization methods.
3.	Pathways of regeneration – biochemical and molecular aspects of tissue culture cycle.
4.	Technique and applications of cryopreservation and germplasm storage.
<b>SECTION B</b>	
5.	Organogenesis and adventitious embryogenesis. Fundamental aspects of morphogenesis, somatic embryogenesis. Methods of androgenic and gynogenic haploid production-dihaploids and application in agriculture. Embryo rescue.
6.	Cell culture: establishment, plating efficiency, induction and selection of mutants. Free cell cultures: production of secondary metabolites/natural products.
7.	Somatic hybridization: protoplast isolation, fusion and culture, hybrid selection and regeneration, possibilities, achievements, limitations, merits and demerits . Cybrids. Protoplasts in genetic transformation.
8.	Applications of plant tissue culture: clonal propagation, artificial seeds and its applications, somaclonal variation and its applications.

#### Practical

S. No	Exhibit/Experiment
1.	General out lay of plant tissue culture laboratory.
2.	Preparation of media.
3.	Callus induction – carrot.
4.	Clonal propagation through meristem cultures.
5.	Embryo culture – groundnut.
6.	Anther culture – <i>Datura</i> /tobacco.
7.	Establishment of cell cultures and determination of growth pattern.
8.	Determination of plating efficiency of cell cultures.

9.	Protoplast isolation and culture.
10.	Protoplast fusion.
11.	Observation of different developmental stages of somatic embryo in embryogenic callus.
12.	Preparation of artificial seeds.

#### Reference Books

1.	Collin HA and Edwards S. 1998. <b>Plant Cell Culture</b> . Bioscientific Publishers, Oxford, UK.
2.	Callow JA, Ford-Lloyd BV and Newbury HJ. 1997. <b>Biotechnology and Plant Genetic Resources: Conservation and Use</b> . CAB International, UK.
3.	Raghavan V. 1997. <b>Molecular Biology of Flowering plants</b> . Cambridge University press, New York, USA.
4.	Bhojwani SS and Razdan MK. 1996. <b>Plant tissue culture: Theory and Practice</b> . (A revised edition). Elsevier Science Publishers, New York, USA.
5.	Jain SM, Sopory SK and Velleux RE. 1996. <b>In Vitro Haploid production in Higher Plants. Volumes 1-5</b> . Fundamental aspects and Methods Kluwer Academic Publishers, Dordrecht, Netherlands.
6.	Vasil IK and Thorpe TA. 1994. <b>Plant Cell and Tissue Culture</b> . Kluwer Academic Publishers, Dordrecht, Netherlands.
7.	Bhojwani SS. 1990. <b>Plant Tissue Culture: Applications and Limitations</b> . Elsevier Science Publishers, New York, USA.
8.	Raghavan V. 1986. <b>Embryogenesis in Angiosperms: A Developmental and Experimental Study</b> . Cambridge University Press, New York, USA.
9.	Kartha KK. 1985. <b>Cryopreservation of Plant Cells and Organs</b> . CRC Press, Boca Raton, Florida, USA.



**M.Sc. Botany – Semester III**  
**B 301 TAXONOMY OF ANGIOSPERMS AND PLANT RESOURCES**  
**UTILIZATION AND CONSERVATION**

**Theory**

S. No	Unit
<b>SECTION A</b>	
<b>1.</b>	Origin and evolution of Angiosperms. Fossil Angiosperms. Taxonomy and Systematics. Concepts of species. Taxonomic hierarchy - species, genus, family and other categories. Principles used in assessing relationship and delimitation of taxa and attribution of rank. Plant identification. Plant nomenclature – Binomial nomenclature, ICBN. Plant collection and documentation.
<b>2.</b>	Brief analysis of the features and evolutionary tendencies noticed in the following groups: Ranales, Rosales, Centrospermae, Tubiflorae, Amentiferae, Helobiales, Liliflorae and Glumiflorae.
<b>3.</b>	Taxonomic evidences: embryology, cytology and phytochemistry. Taxonomic tools: herbaria, floras, botanical gardens, biochemical and molecular techniques, computers and GIS (Geo Information Systems). Cladistics in taxonomy. Numerical taxonomy and sero taxonomy.
<b>4.</b>	Systems of Angiosperm classification: Phenetic versus Phylogenetic system. Relative merits and demerits of major systems of classification: Takhtajan, Cronquist and Thorne. Basic concepts of Molecular Systematics: Gene sequencing, Restriction site analysis, Allozymes etc., Angiosperm Phylogeny Group (APG III) classification system, Relevance of Taxonomy to conservation, sustainable utilization of bioresources and ecosystem research.
<b>SECTION B</b>	
<b>5.</b>	World centres of primary diversity of domesticated plants. The Indo-Burmese Centre, Plant Introductions and Secondary centers. Plant explorations. Origin of agriculture.
<b>6.</b>	Origin, evolution, Botany, cultivation and uses of :



	<p>1. Food Crops : Wheat, Rice</p> <p>2. Forage Crops : <i>Sorghum</i>, Red gram</p> <p>3. Fibre Crops : Cotton, Jute</p> <p>4. Oil yielding crops : Groundnut, Coconut</p> <p>5. Medicinal and aromatic crops : <i>Catharanthus</i>, <i>Withania</i>, <i>Cymbopogon</i></p>
7.	Green Revolution: benefits and adverse consequences. Ethnobotany: Introduction, concept, objectives and scope. Plant biodiversity: Concept, status in India, utilization and concerns, conservation of wild biodiversity.
8.	Principles of conservation: Strategies for conservation, <i>In-situ</i> conservation: protected areas in India- reserves, wetlands, mangroves, <i>Ex-situ</i> conservation: principles and practices. Botanical gardens. BSI, ICAR and CSIR.

### Practical

<b>Exhibits/ Experiments/ Suggested Laboratory Exercises</b>	
<b>Taxonomy</b>	
1.	Description of a specimen from representative and locally available families.
2.	Description of a species based on various specimens to study intraspecific variation: A collective exercise.
3.	Description of various species of a genus: location of key character and preparation of keys at genetic level.
4.	Location of key characters and use of keys at family level.
5.	Field trips within and around the campus; compilation of field notes and preparation of herbarium sheets of such plants, wild or cultivated, as are abundant.
6.	Training in using floras and herbaria for identification of specimens described in the class.
7.	Demonstration of the utility of secondary metabolites in the taxonomy of some appropriate genera.
8.	Comparison of different species of a genus and different genera of a family to calculate similarity coefficients and preparations of dendrograms.

<b>Plant Resources Utilization and Conservation</b>	
<b>1.</b>	<p><b>Laboratory work:</b></p> <p>1. Food crops : Wheat, Rice</p> <p>2. Forage/fodder crops : <i>Sorghum</i>, Red gram</p> <p>3. Fiber crops : Cotton, Jute</p> <p>4. Oil yielding : Groundnut, Coconut</p> <p>5. Medicinal and Aromatic plants : <i>Catharanthus</i>, <i>Withania</i>, <i>Cymbopogon</i></p>
<b>2.</b>	<p><b>Scientific visits:</b></p> <p>The students should be taken to one of the following:</p> <p>A protected areas or Biosphere reserve or national park or sanctuary. A wetland.</p> <p>A mangrove.</p> <p>NBPGR (National Bureau of Plant Genetic Resources – New Delhi). BSI.</p> <p>CSIR</p> <p>Laboratory. FRI.</p> <p>Tropical Botanical Gardens.</p>

### Reference Books

<b>Taxonomy of Angiosperms</b>	
<b>1.</b>	Mondal AK. 2011. <b>Advanced Plant Taxonomy</b> . New Central Book Agency Pvt. Ltd., Kolkata.
<b>2.</b>	Simpson MG. 2006. <b>Plant Systematics</b> . Elsevier Academic Press, California, USA.
<b>3.</b>	Nordenstam BEI, Lazily G and Kassas M. 2000. <b>Plant systematic for 2<sup>nd</sup> Century</b> . Portland Press Ltd., London.
<b>4.</b>	Takhtajan AL. 1997. <b>Diversity and classification of Flowering Plants</b> . Columbia University Press, New York.
<b>5.</b>	Zomlefer WB. 1994. <b>A Guide to flowering plant families</b> . University of California Press, USA.
<b>6.</b>	Woodland DW. 1991. <b>Contemporary Plant Systematics</b> . Prentice Hall, New Jersey.
<b>7.</b>	Stace CA. 1989. <b>Plant Taxonomy and Biosystematics</b> .2 <sup>nd</sup> Edition. Edward Arnold Ltd., London.

8.	Jones SB Jr. and Luchsinger AE. 1986. <b>Plant Systematics</b> . 2 <sup>nd</sup> Edition. McGraw Hill Book Co., New York.
9.	Radford AE. 1986. <b>Fundamentals of Plant Systematics</b> . Harper and Row Publications, USA.
10.	Heywood VH and Moore DM. 1984. <b>Current concepts in Plant Taxonomy</b> . Academic Press, London.
11.	Davis PH and Heywood VH. 1973. <b>Principles of Angiosperms Taxonomy</b> . Robert E Kreiger Pub. Co., New York.
12.	Harrison HJ. 1971. <b>New concepts in Flowering Plant Taxonomy</b> . Hieman Educational Books Ltd., London.
13.	Jones AD and Wilbins AD. 1971. <b>Variations and Adaptations in Plant species</b> . Hieman and Co., Educational Books Ltd., London.
14.	Grant V. 1971. <b>Plant Biosystematics</b> . Academic press, London.
15.	Solbrig OT. 1970. <b>Principles and Methods of Plant Biosystematics</b> . Macmillan, London.
16.	Heslop-Harrison J. 1967. <b>Plant Taxonomy</b> . English language Books Soc. and Edward Arnold Pub. Ltd., U.K.
<b>Plant Resource Utilization And Conservation</b>	
17.	Sambamurthy AVSS and Subramanyam NS. 2000. <b>Economic Botany of Crop Plants</b> . Asiatech Publishers, Inc., New Delhi.
18.	Conway G. 1999. <b>The Doubly Green Revolution: Food for All in the 21st Century</b> . Comstock Publishing Associates, New York.
19.	Pinstrup – Anderson P. et al. 1999. <b>World Food Prospects: Critical Issues for the Early 21st Century</b> . International Food Policy Research Institute, Washington DC, USA.
20.	Kocchar SL. 1998. <b>Economic Botany of the Tropics</b> . 2nd Edition. Mac Millan India Ltd., Delhi.
21.	Plant Wealth of India 1997. Special Issue of Proceedings Indian National Science Academy B-63.
22.	Sharma OP. 1996. <b>Hills Economic Botany</b> . (Late Dr. A.F. Hill, adapted by O.P. Sharmas). Tata McGraw Hill Co., Ltd., New Delhi.
23.	Frankel OH, Brown AHD and Burdon JJ. 1995. <b>The conservation of Plant Diversity</b> . Cambridge University Press, Cambridge, UK.

24.	Paroda RS and Arora RK. 1991. <b>Plant Genetic Resources Conservation and Management.</b> IPGRI (Publication) South Asia Office, C/o. NBPGR Pusa Campus, New Delhi.
25.	Swaminathan MS and Kocchar SL (ed). 1989. <b>Plants and Society.</b> Mac Millan Publication Ltd., London.
26.	Thakur RS, Puri HS and Hussain A. 1989. <b>Major Medicinal Plants of India.</b> Central Institute of Medicinal and Aromatic Plants. CSIR, Lucknow.
27.	Council of Scientific & Industrial Research 1986. <b>The useful plants of India. Publications and Information Directorate.</b> CSIR, New Delhi.
28.	Baker HG. 1978. <b>Plants and Civilization.</b> 3 <sup>rd</sup> Edition. C.A. Wadsworth, Belmont.
29.	Chrispeels MJ and Sadava D. 1977. <b>Plants, Food and People.</b> W.H. Freeman and Co., San Francisco, USA.
30.	Schery RW. 1972. <b>Plants for Man.</b> 2 <sup>nd</sup> Edition. Englewood Cliffs, New Jersey.
31.	Raw materials I - XII Revised Vol. I-III (1985-1992) supplement (2000).



**M.Sc. Botany – Semester III**

**B 302 PLANT DEVELOPMENT AND REPRODUCTION**

**Theory**

S. No	Unit
<b>SECTION A</b>	
1.	Simple and complex tissues. Epidermis – stomata, trichomes. Secretory cells and tissues. Vascular tissue development: development and structure of the primary xylem, primary phloem, secondary xylem, secondary phloem. Root shoot transition.
2.	Shoot development: organization of the shoot apical meristem (SAM), cytological and molecular analysis of SAM. Leaf growth and differentiation: differentiation of epidermis and mesophyll. Structure of foliage leaves and modified leaves. Phyllotaxy.
3.	Root development: organization of root apical meristem (RAM), cell fates and lineages, tissue differentiation. Lateral roots, root hairs, root microbe interactions. Cambium–structure, cell types, development of vascular cambium, cork cambium–structure of its derivatives, bark. Anomalous secondary growth in dicot and monocot stems.
4.	Floral development taking the examples of homeotic mutants in <i>Arabidopsis</i> and <i>Antirrhinum</i> .
<b>SECTION B</b>	
5.	Male gametophyte: structure of anther, microsporogenesis, types and role of tapetum, pollen development, sperm dimorphism, pollen embryo sacs and compound pollen grains. Pollen allergy.
6.	Female gametophyte: types of ovule, development of ovule, megasporogenesis, types of embryo sacs, organisation of the embryo sac – ultra structure of the embryo sac cells.
7.	Pollination: mechanisms and vectors. Pollen-pistil interaction–structure of the pistil, pollen-stigma interaction. Self-incompatibility: sporophytic, gametophytic, different methods to overcome self-incompatibility. Fertilization: pollen germination, pollen

	tube growth and guidance, entry of pollen tube into the embryo sac, pollen tube discharge, syngamy and triple fusion, polyspermy and hetero fertilization.
8.	Post-fertilization events: endosperm– development, types ,functions, endosperm - embryo relationship. Embryo development–Johanson and Soueges systems; Types. polyembryony; apomixis; parthenocarpy. Storage proteins of endosperm and embryo– LEA proteins. Seed dormancy, overcoming seed dormancy.

### Practical

<b>Exhibits/ Experiments/ Suggested Laboratory Exercises</b>	
<b>Plant Development</b>	
1.	Microscopic examination of transverse sections of leaves such as <i>Nerium</i> and maize to understand the internal structure of leaf tissues and trichomes, glands etc. Study of the C <sub>3</sub> and C <sub>4</sub> anatomy of plants
2.	Study of epidermal peels of different kinds of leaves to study the development and nature stomata, computing stomatal index.
3.	Study of elements of wood from macerations and sections taken in three planes T.S., T.L.S. and R.L.S
4.	Study of the anomalous structure of the stems of Aristolochia, Achyranthes, Bignonia, Boerhaavia, Leptadenia and Dracaena.
<b>Plant Reproduction</b>	
1.	Study of microsporogenesis and gametogenesis in sections of anthers.
2.	Tests for pollen viability using stains and <i>in-vitro</i> germination.
3.	Embryo sac development through examination of permanent, stained serial sections.
4.	Study of nuclear and cellular endosperm through dissections and staining.
5.	Isolation of different stages of embryo development from suitable seeds.

### Reference Books

<b>Plant Development</b>	
1.	Pullaiah T, Naidu KC, Lakshminarayana K and Hanumantha Rao B. 2007. <b>Plant Development.</b> Regency Publications, New Delhi.
2.	Fosket DE. 2004. <b>Plant Growth and Development. A Molecular approach.</b>

	Academic Press, San Diego.
3.	Howell SH. 1998. <b>Molecular Genetics of Plant Development</b> . Cambridge University Press,
4.	Waisel Y, Eshel A and Kafkaki V (ed) 1996. <b>Plant Roots: the Hidden Hall</b> . 2 <sup>nd</sup> edition. Marcel Dekker, New York.
5.	Bailey JD and Black M. 1994. <b>Seeds: Physiology of development and Germination</b> . Plenum Press, New York.
6.	Salisbury FB and Ross CW. 1992. <b>Plant Physiology</b> . 4 <sup>th</sup> Edition. Wordsworth Publishing, Belmont, California.
7.	Lyndon RF. 1990. <b>Plant Development. The Cellular Basis</b> . Unwin Hyman, London.
8.	Steeves TA and Sussex IM. 1989. <b>Patterns in Plant Development</b> . 2 <sup>nd</sup> Edition. Cambridge University Press, Cambridge.
9.	Mauseth JD. 1988. <b>Plant Anatomy</b> . Benjamin Cummings, California
10.	Fahn A. 1982. <b>Plant Anatomy</b> . 3 <sup>rd</sup> edition. Pergamon Press, Oxford
<b>Plant Reproduction</b>	
1.	Pulliah T, Lakshminarayana K and Hanumantha Rao B. 2008. <b>Plant Reproduction</b> . Scientific Publishers, Jodhpur, India.
2.	Bhojwani SS and Bhatnagar SP. 2000. <b>The Embryology of Angiosperms</b> . 4 <sup>th</sup> revised and enlarged edition. Vikas Publishing House, New Delhi.
3.	Raghavan V. 1999. <b>Developmental Biology of Flowering Plants</b> . Springer – Verlag, New York.
4.	Raghavan V. 1997. <b>Molecular Embryology of Flowering Plants</b> . Cambridge University Press, Cambridge.
5.	Shivanna KR and Swahney VK. (ed.) 1997. <b>Pollen Biotechnology for Crop Production and Improvement</b> . Cambridge University Press, Cambridge.
6.	The Plant Cell. Special Issue on Reproductive Biology of plants, Vol.5 (10) 1993. The American Society of Plant Physiologists, Rockville, Maryland, USA.
7.	Shivanna KR and Rangaswamy NS. 1992. <b>Pollen Biology, A Laboratory Manual</b> . Springer-Verlag, Berlin.
8.	Sedgely M and Griffin AR. 1989. <b>Sexual Reproduction of Tree Crops</b> . Academic Press, London
9.	Sedgely, M. and Griffin, A.R. 1989. Sexual Reproduction of Tree Crops, Academic



	Press, London.
<b>10.</b>	Leins P, Tucker SC and Endress PK. 1988. <b>Aspects of Floral Development.</b> J. Cramer, Germany.
<b>11.</b>	Shivanna KR and Johri BM.1985. <b>The Angiosperm Pollen Structure and Function.</b> Wiley Eastern Ltd., New Delhi.
<b>12.</b>	Procter M and Yeo P. 1973. <b>The Pollination of Flowers.</b> William Collins Sons, London.



**PAPER CODE: B303**  
**PLANT ECOLOGY, BIODIVERSITY AND CONSERVATION**

**Theory**

**UNIT - I**

Ecology – A synthetic approach. Major biomes and Vegetational patterns of the World. Major Vegetational and Soil types of India.

Community ecology: Methods of study of plant communities, qualitative study of plants communities. Stratification of Life forms and physiognomy, normal biological spectrum.

**UNIT - II**

Quantitative study of plant communities, distribution pattern frequency, density, canopy, basal area and cover

Synthetic characters of Community, Similarity Index, general account of classification of communities

Population Ecology: Population structure, characteristics of population; population density, Natality, Mortality, Age distribution, Biotic potential, Population growth forms and curves. Population fluctuation and population dispersal

**UNIT - III**

Plant Biodiversity: Concept, Status in India, Utilization and concerns, World Centers of primary diversity of domesticated plants. The Indo Burmese Centre, plant introduction and secondary centers.

**UNIT - IV**

Principles of Conservation: Strategies for conservation, *in situ* conservation, protected areas in India- Biosphere reserves, wetlands, mangroves, conservation of wild biodiversity, strategies for conservation – *ex situ* conservation. Principles and practices. Botanical gardens, BSI, ICAR and CSIR.

### **Suggested Laboratory Exercises**

1. study vegetation in the botanical gardens
2. To prepare life forms of local botanical gardens and prepare a biological spectrum
3. To determine the minimal size and number of quadrates required for reliable estimate of biomass in grass land
4. Quantitative analysis of vegetation: relative frequency, density, relative density, basal area and IVI
5. To estimate rate of Carbon dioxide evolution from different soils using soda lime or alkali absorption method
6. Scientific visits:  
A protected areas or Biosphere reserve or national park or sanctuary  
A wetland, Mangrove, NBPGR (National Bureau of Plant Genetic Resources – New Delhi)  
BSI, CSIR Laboratories, FRI and Tropical Botanical Gardens

### **Suggested Readings & Text Books**

01. APHA – Standard Methods for the Examination of Water and Waste Water. American Public Health Association, Washington, DC
02. Frankel, O.H. Brown, A.H.D. & Burdon, J.J. 1995. The conservation of Plant Diversity, Cambridge University Press, Cambridge, UK
03. Krebs, C.J. 1989. Ecological Methodology. Harper and Row, New York, USA
04. Ludwig, J.A. and Reynolds, J.F. 1988. Statistical Ecology. Wiley, New York
05. Magurran, A.E. 1988. Ecological Diversity and its measurement. Chapman and Hall, London

06. Moore, P.W. and Chapman, S.B. 1986. *Methods in Plant Ecology* Blackwell Scientific Publication
07. Molles, M.C. 2005. *Ecology-concepts and applications*. Mc GrawHill. Boston
08. Muller – Dombois, DD. And Ellenberg, R. 1974. *Aims and Methods of Vegetation Ecology*, Wiley, New York
  
09. Begon Michael, Colin Townsend & John L. Harper. 2005. *Ecology, From Individuals to Ecosystems*. 4<sup>th</sup> ed. Black well Publishing, Oxford.
10. Odum.E.P. & Gary W.Barrett. 2005. *Ecology*. Tomson Brooks/Cole, Singapore.
11. Sokal, R.R. and Rohit, F.J.1995. *Biometry*. W.H. Freeman & Co., San Francisco
12. Cunningham, W.P. & M.A.Cunningham 2007. *Principles of Environmental Science-Inquiry and applications*. Tata Mc GrawHill Pub.New Delhi.
13. Heywood, V.M. and Watson, R.T. 1985. **Global Biodiversity Assessment**, Cambridge Univ. Press, Cambridge.
14. Ricklefs, R.E. & Gary L. Miller. 2000.*Ecology*. 4<sup>th</sup> ed. W.H. Freeman and Company. New York
15. Richard T. Wight 2005. *Environmental Science*. 9<sup>th</sup> ed. Pearson Prentice Hall. New Delhi.
16. Given, D.R.. 1995. *Principles and practice of plant conservation*. Timber Press, Oregon
17. Jensen, John R. 2007. *Remote Sensing of the Environment: An Earth Resource Perspective*. PHI.
18. Kshnamurthy, K.V. 2004. *Advanced Textbook On Biodiversity: Principles And Practice*. Oxford
19. Sabins, F.F.2007. *Remote Sensing-principles and interpretation*. 3<sup>rd</sup>ed. Waveland Press Inc

**M.Sc. Botany – Semester III**  
**B 304 PLANT PHYSIOLOGY**

**Theory**

S. No	Unit
<b>SECTION A</b>	
<b>1.</b>	Plant water relations: free energy and chemical potential, osmotic potential, water potential and its determination, active and passive absorption of water, stomatal physiology and mechanisms of stomatal opening and closing, Soil-plant-atmosphere-continuum concept (SPAC), mechanism of water transport.
<b>2.</b>	Mineral nutrition: passive and active uptake of ions, translocation of minerals in plants, essential elements: their functions and symptoms of mineral deficiency, importance of foliar nutrition and use of chelates in agriculture, root microbe interactions in facilitating nutrient uptake, mechanism of assimilate translocation.
<b>3.</b>	The flowering process: phytochrome: structure, photochemical and biochemical properties, role in photomorphogenesis. Photoperiodism and its significance, mechanisms of floral induction. Vernalization. Morphological, biochemical and metabolic changes accompanying seed germination.
<b>4.</b>	Plant growth regulators and elicitors: biosynthesis, physiological effects and mechanism of action of auxins, gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, polyamines, jasmonic acid and salicylic acid. Role of plant growth regulators in agriculture. Hormone receptors.
<b>SECTION B</b>	
<b>5.</b>	Fundamental of Enzymology: General aspects, allosteric mechanism, regulatory and active sites, isozymes, kinetics of enzymatic catalysis, Michaelis-Menten Equation and its significance, Mechanism of enzyme action.
<b>6.</b>	Photochemistry and Photosynthesis: General concepts and historical back ground, evolution of photosynthetic apparatus, Redox reactions, photosynthetic pigments and light harvesting complexes, photo-oxidation of water, mechanisms of electron and proton transport, structure, synthesis and function of ATP, carbon assimilation-the Calvin's cycle, photorespiration and its significance, the C <sub>4</sub> cycle and CAM pathway, biosynthesis of starch and sucrose, physiological and ecological considerations.
<b>7.</b>	Respiration and Lipid metabolism : Plant respiration, glycolysis, the TCA cycle, electron

	transport and ATP synthesis, pentose phosphate pathway, glyoxylate cycle, alternative oxidase system, structure and function of lipids, fatty acid biosynthesis of membrane lipids, structural lipids and storage lipids and their catabolism. Nitrogen fixation and nitrogen metabolism: Biological nitrogen fixation, nodule formation and nod factors, biosynthesis of amino acids and proteins, mechanism of nitrate uptake and reduction.
<b>8.</b>	Stress Physiology: Plant responses to biotic and abiotic stress, mechanisms of biotic and abiotic stress tolerance, water deficit and drought resistance, salinity stress, metal toxicity, heat stress and oxidative stress.

### **Practical**

<b>Exhibits/ Experiments/ Suggested Laboratory Exercises</b>	
<b>1.</b>	Determination of osmotic potential.
<b>2.</b>	Determination of water potential.
<b>3.</b>	Demonstration of osmosis.
<b>4.</b>	Determination of root pressure.
<b>5.</b>	Effects of high and low temperatures upon the permeability of the cytoplasmic membranes.
<b>6.</b>	Determination of suction force due to transpiration.
<b>7.</b>	Stomatal frequency and stomatal index of leaves.
<b>8.</b>	Rate of transpiration in leaves by cobalt chloride paper method.
<b>9.</b>	Determination of amylase activity
<b>10.</b>	Extraction and separation of chloroplast pigments by paper chromatographic method
<b>11.</b>	Determine chlorophyll a / chlorophyll b contents in C <sub>3</sub> and C <sub>4</sub> plants by spectrophotometric method
<b>12.</b>	Determination of Hill reaction
<b>13.</b>	Determination of rate of Aerobic respiration by continuous current method
<b>14.</b>	Determination of rate of Anaerobic respiration by continuous current method
<b>15.</b>	Determination of catalase activity
<b>16.</b>	Demonstration of Polyphenol oxidase
<b>17.</b>	Determination of reducing sugars

18.	Estimation of free acids in Bryophyllum in terms of milliequivalents of NaOH
19.	Extraction and estimation of seed proteins depending upon the solubility
20.	SDS – PAGE for soluble proteins extracted from the given plant materials
21.	Separation of isozymes esterase, peroxidase by native polyacrylamide gel electrophoresis
22.	Effect of Light quality on the rate of Photosynthesis
23.	Effect of CO <sub>2</sub> concentration on the rate of Photosynthesis
24.	Estimation of Starch by gravimetric method
25.	Demonstration of Starch hydrolysis
26.	Separation of Chloroplast pigments by chemical method
27.	Separation of amino acids and carbohydrates through two dimensional chromatographic method

#### Reference books

1.	Sinha SK 2014. <b>A text book of Plant Physiology</b> . Centum Press, New Delhi.
2.	Seema Yadav 2014. <b>Plant Physiology</b> . SBW publishers, New Delhi.
3.	Heribert H and Kazuo S (eds) 2010. <b>Plant responses to abiotic stress. Series Topics in Current Genetics, Vol 4</b> . Springer, Berlin.
4.	Philip Stewart and Schine Gobig 2011. <b>Plant Physiology</b> . CRC Press.
5.	Moore TC. 2011. <b>Biochemistry and Physiology of Plant Hormones</b> . Springer, New York.
6.	Hooykaas PJJ, Hall MA and Libbenga KR (ed) 1999. <b>Biochemistry and Molecular Biology of Plant Hormones</b> . Elsevier, Amsterdam, Netherlands.
7.	Taiz L and Zeiger E. 1998. <b>Plant Physiology</b> . 2 <sup>nd</sup> Edition. Sinauer Associates including Publishers, Massachusetts, USA.
8.	Wisthoff P. 1998. <b>Molecular Plant Development from Gene to Plant</b> . Oxford University Press, Oxford, UK.
9.	Thomas and Vince – Prue D. 1997. <b>PhotoPeriodism in Plants</b> . 2 <sup>nd</sup> Edition. Academic Press, Sandeigo, USA.
10.	Hopkins WG. 1995. <b>Introduction to Plant Physiology</b> . John Wiley & Sons Including New York, USA.
11.	Mohr H and Schopfer P. 1995. <b>Plant Physiology</b> . Springer-Verlag, New York.



12.	Salisbury FB and Ross CW. 1992. <b>Plant Physiology</b> . 4 <sup>th</sup> Edition. Wordsworth Publishing Company, California, USA.
13.	Noggle GR and Fritz GJ. 1991. <b>Introductory plant physiology</b> . 2 <sup>nd</sup> Edition. Prentice hall of India Limited, New Delhi.
14.	Davies PJ (ed) 1987. <b>Plant hormones and their role in Plant Growth and Development</b> . Mertinus Nijhoff Publishers, Netherlands.
15.	Witham FH and Devlin RM. 1986. <b>Plant Physiology</b> . CBS Publishers and Distributors, Bangalore.
16.	Wilkins MD. 1987. <b>Advanced Plant Physiology</b> . English Language Book Society, Longman Scientific and Technical, Harlow, UK.
17.	Bewley JD and Black M. 1982. <b>Physiology and Biochemistry of seed in relation to germination and dormancy. Volume 1 and 2</b> . Springer – Verlag, Berlin.
18.	Khan AA. 1982. <b>The Physiology and Biochemistry of Seed Development, Dormancy and Germination</b> . Elsevier, Amsterdam, Netherlands.
19.	Ting IP. 1982. <b>Plant Physiology</b> . Addison-Wesley, Reading, MA.
20.	Murthy HNK. 1981. <b>Plant growth substances including applications in Agriculture</b> . Tata McGraw Hill Publishing Company Ltd., New Delhi.
21.	Kramer PM and Kozlowski TT. 1980. <b>Physiology of Woody Plants</b> . Academic Press, New York.
22.	Hewitt EJ and Smith TA. 1975. <b>Plant Mineral Nutrition</b> . English University Press,
23.	Meyer AM and Poljakoff-Mayber A. 1975. <b>The germination of Seeds</b> . Pergamon Press, Canada.
24.	Hess D. 1974. <b>Plant Physiology</b> . Narosa Publishing House, New Delhi.
25.	Audus LJ. 1972. <b>Plant Growth Substances. Volume 1</b> . Chemistry and Physiology. Leonard Hill, UK.
26.	Slayter RO. 1967. <b>Plant Water Relationships</b> . Academic Press, London
27.	Hillman WS. 1963. <b>Physiology of Flowering</b> . Holt, Reinhart and Winston, New York.



## M.Sc. Botany - Semester IV

### B 401 GENETIC ENGINEERING OF PLANTS AND MICROBES

#### Theory

S.No	Unit
<b>SECTION A</b>	
1.	Basics of rDNA technology: restriction enzymes–types, nomenclature, mechanism of action. Methodology of rDNA molecule synthesis–joining overlapping ends, blunt end joining, polylinkers. Vectors–features. Cloning vectors– plasmids, viral DNA, cosmids, bacterial and yeast artificial chromosomes(BACs and YACs). Expression vectors.
2.	Bacterial transformation. <i>In-vitro</i> packaging. Recognition of transformants–antibiotic resistance, <i>Lac Z</i> gene based selection. Genomic library, cDNA library.
3.	Methods of gene transfer in plants: electroporation, gene gun, <i>Agrobacterium</i> mediated– binary and co integrative vector based. Chloroplast transformation.
4.	Classical examples of successful cases of transgenic plants– fungal, bacterial, viral and insect tolerance (BT and proteinase inhibitors), herbicide tolerance, abiotic stress tolerance, male sterility– Barnase-Barstar. Quality improvement –golden rice, late ripening tomatoes (Flavr Savr).
<b>SECTION B</b>	
5.	Techniques in genetic engineering I: Blotting techniques– Southern, Northern and Western blotting, radioactive and non-radioactive labeling, detection of hybridization. <i>In-situ</i> hybridization– technique, radioactive and non-radioactive probes, enzyme and fluorescence detection methods (FISH), applications of the technique. PCR– technique, types, applications. DNA sequencing– basic principle of Sanger’s method, automated DNA sequencing, high throughput DNA sequencing.
6.	Techniques in genetic engineering II: DNA fingerprinting–hybridization based (RFLP), PCR based (RAPD, AFLP). Restriction mapping. Microarray technique and its applications. Sequencing genomes–whole genome sequencing, shot gun sequencing. Next generation sequencing– 454 sequencing.
7.	Plant growth promoting bacteria – nitrogen fixers, siderophores, phytohormone production. Genetic improvement of industrially important microbes for production of useful products – biopesticides, biofertilizers, antibiotics. Intellectual Property Rights, farmer’s rights. Patents. Ethical and environmental issues in genetic engineering.

8.	Bioinformatics: Scope. Data bases– types, Genbank, PIR, PDB. An account of NCBI. Web based tools for sequence searches –BLAST. Genome projects, genome annotation, gene annotation, features of the genome of <i>Arabidopsis</i> , rice. Genomics– structural genomics, comparative genomics, functional genomics. Molecular phylogeny and phylogenetic trees. Metagenomics.
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#### **Practicals**

S. No	Exhibit/Experiment
1.	Isolation of plasmid DNA
2.	Bacterial transformation and identification of transformation
3.	Plant DNA isolation
4.	Restriction enzyme digestion and gel electrophoresis
5.	Assignments on the syllabus
6.	Pictorial demonstration of the various techniques

#### **Reference Books**

1.	Glick BR, Pasternak JJ and Patten CL. 2010. <b>Molecular Biotechnology Principles and Applications of rDNA</b> . ASM Press, USA.
2.	Attwood TK, Smith DJP and Phukan S. 2009. <b>Introduction to Bioinformatics</b> . Pearson Education Ltd., UK.
3.	Sateesh MK. 2008. <b>Bioethics and Biosafety</b> . I K International Pvt. Ltd., Bangalore.
4.	Channarayappa. 2007. <b>Molecular Biotechnology Principles and practices</b> . Taylor and Francis, UK.
5.	Watson JD. 2007. <b>Recombinant DNA: Genes and Genomes: A short course</b> . W. H. Freeman, USA.
6.	Primrose SB and Twyman RM. 2006. <b>Principles of Genome Analysis and Genomics</b> . Blackwell publishers, USA.
7.	Lewin B. 2004. <b>Genes VIII</b> . Pearson Prentice Hall, New Jersey.
8.	Chawla HS. 2002. <b>Introduction to Plant Biotechnology</b> . Oxford and I B H Publishers, USA.



**M.Sc. Botany – Semester IV**  
**B 402 EVOLUTION AND PLANT BREEDING**

**Theory**

S. No	Unit
<b>SECTION A</b>	
<b>1.</b>	Origin of life and unicellular evolution: Origin of basic biological molecules, abiotic synthesis of monomers and polymers , concept of Oparin and Haldane, experiment of Miller (1953). The first cell – evolution of prokaryote, RNA world. Origin of eukaryotic cells– Endosymbiont theory, evolution of unicellular eukaryotes, anaerobic and aerobic metabolism.
<b>2.</b>	Theories of organic evolution: Lamarckism, Darwinism–concepts of variation, adaptation, struggle, fitness and natural selection, Synthetic theory, phyletic gradualism, punctuated equilibrium, concepts of neutral evolution.
<b>3.</b>	Molecular evolution: molecular divergence and molecular clocks–protein and nucleotide sequence analysis, gene duplication and divergence. Hardy-Weinberg equilibrium and its applications.
<b>4.</b>	Plant breeding: history, objectives, activities, important achievements and undesirable consequences. Organizations for crop improvement in India: ICAR, Agricultural universities, Central institutes for crop improvement, All India coordinated programmes. Plant Introduction, domestication and acclimatization.
<b>SECTION B</b>	
<b>5.</b>	Methods of breeding self pollinated crops: Mass selection, Pureline selection, Pedigree method, Bulk method, Backcross method, Multiline varieties.
<b>6.</b>	Methods of breeding cross pollinated plants: Bulk Selection, Recurrent selection, Synthetic varieties, Hybridization. Inbreeding depression and Heterosis – genetic and molecular basis.
<b>7.</b>	Breeding of vegetatively propagated crops. Role of apomixis in plant breeding. Mutation breeding.
<b>8.</b>	Biostatistical methods: basic concept of parametric and non-parametric methods. Graphical representation. Measures of central tendency and dispersion. Probability distributions–Binomial, Poisson and Normal distributions. Concepts of confidence intervals, types of error, levels of significance. Regression and correlation; t-test. ANOVA. Basic introduction to multivariate statistics.

### Practical

1.	Problems based on Hardy Weinberg law
2.	Line diagrams showing the plan of different methods of breeding self pollinated crops- Mass selection, Pureline selection, Pedigree method,
3.	Line diagrams showing the plan of different methods of breeding cross pollinated crops- Bulk Selection, Recurrent selection.
4.	Methods of hybridization in rice, sorghum, bajra, cotton in standing crop in the field.
5.	Assignments with problems for computing measures of central tendency and dispersion- mean, median and mode, standard deviation and standard error.
6.	Assignment with problems for computing correlation and regression coefficients.
7.	Assignment with problems for implementing t test.
8.	Assignment with problems for computing ANOVA.

### References

1.	Singh BD. 2012. <b>Plant Breeding: Principles and Methods</b> . Kalyani Publishers, Delhi.
2.	Stickberger MW. 1985. <b>Genetics</b> . McMillan, New York.
3.	Frey KJ. 1981. <b>Plant Breeding II</b> . Iowa State University Press, Oxford.
4.	Jones DA and Wilkins DA. 1971. <b>Variation and adaptation in plant species</b> . Heinemann Educational Books Ltd., London.
5.	Stebbins GL. 1971. <b>Chromosomal evolution in Higher Plants</b> . Edward Arnold Publishers Ltd., London.
6.	Poehlman JM and Borthakur D. 1969. <b>Breeding Asian field crops: With Special Reference to Crops of India</b> . Oxford and IBH Pub. Co., Delhi.
7.	Briggs FN and Knowles PF. 1967. <b>Introduction to Plant Breeding</b> . Reinhold Pub. Corp., New York.
8.	Brewbaker JL. 1964. <b>Agricultural Genetics</b> . Prentice-Hall, New Jersey, USA.
9.	Allard RW. 1961. <b>Principles of Plant Breeding</b> , 2 <sup>nd</sup> Edition. John Wiley and Sons Inc., New York.





**PAPER CODE B403**  
**ECOLOGY AND ENVIRONMENTAL BIOLOGY**

**Theory**

**UNIT - I**

Ecosystem organization: Structure and functions of Ecosystem, Management, Stability, Complexity, Dynamics, Homeostasis (Forest, Grassland, Freshwater, Ecosystems) Ecological efficiencies, Energy Dynamics, Trophic organization, Energy flow pathways  
Litter falls and decomposition (mechanism, substrate quality and climate factors). Global biogeochemical cycles of C, N, P, S and H<sub>2</sub>O.

**UNIT - II**

The role of biodiversity in Ecosystem functions and stability, speciation and extinction, IUCN categories of threat, distribution and global patterns of terrestrial bio-diversity  
Air, Water and Soil pollution; kinds, sources, quality parameters, effects on plants and ecosystems.

**UNIT - III**

Ecosystem stability: Concept (resistance and resilience) ecological perturbations (Material and anthropogenic) and their impact on plants and ecosystems  
Environmental impact assessments. Ecosystem restoration. Primary production and estimation.

**UNIT – IV**

Climate change: Greenhouse gases (CO<sub>2</sub>, CH<sub>4</sub>, NO<sub>2</sub>, CFCS sources trends and role) Ozone layer, Ozone hole and consequences of climate change (CO<sub>2</sub>, fertilization, global warming, sea level rise, UV radiation)  
Composition of soil. Factors affecting soil formation and soil profile (Laterization podosolization, gleixation, mineralization and soil classification, soil water, soil solution). Soil organic matter or humus and soil organisms

**Suggested Laboratory Exercises**

1. Estimation of Carbon footprint in the campus
2. Estimation of biomass of crop plants
3. Estimation of Chlorophyll
4. Determination of leaf area index
5. To determine the water holding capacity of soil moisture content

### **Suggested Readings & Text Books**

1. Cunningham, W.P. & M.A.Cunningham 2007. Principles of Environmental Science- Inquiry and applications. Tata Mc GrawHill Pub.New Delhi
2. Dash, M.C.2009. Fundamentals of Ecology. Tata Mc GrawHill Pub.New Delhi
3. Horpes and Row, N.Y; Batra, N.K. & Sharma, K.K. 1990. A Treatise on Plant Ecology.
4. Pradeep Publications
5. Molles, M.C. 2005. Ecology-concepts and applications. Mc GrawHill. Boston
6. Odum.E.P. & Gary W.Barrett. 2005. *Ecology*.Tomson Brooks/Cole, Singapore
7. Misra, K. C. D.N. Rao, R.S; Ambasht and Mukherjee. Ecology study of ecosystems
8. Odum, E.P. 1971. Fundamentals of Ecology (3<sup>rd</sup> Edition), Saunders & Co., Philadelphia
9. Sharma, P.D. 2001. Ecology and Environment
10. Sharma, P.D. 2<sup>nd</sup> Edition, Environmental Ecology

**PAPER CODE B404**  
**PLANT METABOLISM**

**Theory**

**UNIT - I**

Fundamental of Enzymology: General aspects, allosteric mechanism, regulatory and active sites, isozymes, mechanism of enzyme action, kinetics of enzymatic catalysis, Michaelis-Menten

Equation and its significance

Signal transduction: Receptors and G protein, Phospholipid signaling, role of cyclic nucleotides, Calcium-calmodulin cascade, diversity in protein kinases and phosphatases, Two-component sensor- regulator system in bacteria and plants, source sensing mechanism

**UNIT - II**

Photochemistry and Photosynthesis: General concepts and historical back ground, evolution of photosynthetic apparatus, Redox reactions, photosynthetic pigments and light harvesting complexes, photooxidation of water, mechanisms of electron and proton transport, structure, synthesis and function of ATP, Carbon assimilation-the Calvin cycle, photorespiration and its significance, C4 cycle and CAM pathway, biosynthesis of starch and sucrose, physiological and ecological considerations

**UNIT - III**

Respiration and Lipid metabolism : Plant respiration, glycolysis, TCA cycle, electron transport and ATP synthesis, pentose phosphate pathway, glyoxylate cycle, alternative oxidase system, structure and function of lipids, fatty acid biosynthesis of membrane lipids, structural lipids and storage lipids and their catabolism

**UNIT - IV**

Nitrogen fixation and nitrogen metabolism: Biological nitrogen fixation, nodule formation and nod factors, biosynthesis of amino acids and proteins, mechanism of nitrate uptake and reduction, ammonium assimilation, sulphate uptake, transport and assimilation

## Suggested Laboratory Exercises

1. Determination of amylase activity
2. Extraction and separation of chloroplast pigments by paper chromatographic method
3. Determine chlorophyll a / chlorophyll b contents in C<sub>3</sub> and C<sub>4</sub> plants by spectrophotometric method
4. Determination of catalase activity
5. Demonstration of Polyphenol oxidase
6. Determination of reducing sugars
7. Estimation of free acids in *Bryophyllum* in terms of milliequivalents of NaOH
8. Extraction and estimation of seed proteins depending upon the solubility
9. SDS – PAGE for soluble proteins extracted from the given plant materials
10. Separation of amino acids and carbohydrates through two dimensional chromatographic method

## Suggested Readings & Text Books

1. Bob B. Buchanan, Wilhelm Gruissem, and Russell L. Jones. 2002. Biochemistry and molecular biology of Plants
2. Devlin, R.M. and Witham, F.H. 1986. Plant Physiology
3. Frank Boyer Salisbury, Cleon Ross. Plant Physiology, 5<sup>th</sup> Edition.
4. Hess, D. 1974. Plant Physiology
5. York, USA
6. Hopkins, W.G. 2009. Introduction to Plant Physiology. John Wiley & Sons Including New
7. York, USA, 4<sup>th</sup> Edition.
8. Irwin P. Ting, Plant Physiology, 1982, Addison-Wesley Publishing Company.
9. Lehninger, A.L. 1982. Principles of Biochemistry, Worth, New York
10. Noggle, G.R. and G.J. Fritz. 1991. Introductory plant physiology (2<sup>nd</sup> edition) Prentice hall of India Limited
11. Postgate John, R. 1975. The physiology and genetics of Nitrogen fixation, Plenum, Press,
12. London
13. Postgate John, R. 1982. the fundamentals of Nitrogen fixation, Cambridge Univ., Press,
14. Cambridge.

**M.Sc. Botany – Semester I**  
**B101: BIOLOGY AND DIVERSITY OF ALGAE AND BRYOPHYTES**  
**Theory**

S. No	Unit
<b>SECTION A</b>	
1.	Criteria employed in classification of algae. Classification given by Fritsch, Bold and Wynne, Lee. Thallus organization, reproduction and life cycles in algae.
2.	Range of thallus structure, reproduction, life histories of Chlorophyceae with special reference to the genera: <i>Chlamydomonas</i> , <i>Tetraspora</i> , <i>Volvox</i> , <i>Chlorella</i> , <i>Scenedesmus</i> , <i>Ulva</i> , <i>Enteromorpha</i> , <i>Cladophora</i> , <i>Fritschiella</i> , <i>Oedogonium</i> , <i>Spirogyra</i> , <i>Cosmarium</i> , <i>Caulerpa</i> , <i>Chara</i> .
3.	Salient features of Protochlorophyta; Xanthophyta: <i>Vaucheria</i> . Bacillariophyta: <i>Cyclotella</i> , <i>Navicula</i> ; Phaeophyta: <i>Ectocarpus</i> , <i>Dictyota</i> , <i>Padina</i> , <i>Laminaria</i> , <i>Sargassum</i> .
4.	Salient features of Rhodophyta: <i>Gelidium</i> , <i>Gracilaria</i> , <i>Polysiphonia</i> ; Cyanophyta: <i>Nostoc</i> , <i>Lyngbya</i> , <i>Spirulina</i> .
<b>SECTION B</b>	
5.	Diversity of marine and fresh water algae in India. Economic importance of algae– single cell protein, pigments, lipids, and omega fatty acids. Algal blooms. Algal bio fertilizers. Cultivation of economically important seaweeds– <i>Porphyra</i> , <i>Gracilaria</i> , <i>Gelidium</i> . Mass culture of micro algae.
6.	Classification of Bryophytes given by Smith, Campbell. Ecological and economic importance of Bryophytes. Conduction in Bryophytes.
7.	Morphology, structure, reproduction and life history of Hepatocopsida: Marchantiales: <i>Marchantia</i> ; Jungermaniales: <i>Pellia</i> , <i>Porella</i> ; Anthocertopsida: <i>Anthoceros</i> .
8.	Morphology, structure, reproduction and life history of Bryopsida: Sphagnales: <i>Sphagnum</i> ; Funariales: <i>Funaria</i> ; Polytrichales: <i>Polytrichum</i> .

**Practical**

S. No	Exhibit/Experiment
1.	Examination of vegetative and reproductive morphology of Chlorophyceae: <i>Chlamydomonas</i> , <i>Tetraspora</i> , <i>Volvox</i> , <i>Chlorella</i> , <i>Scenedesmus</i> , <i>Ulva</i> , <i>Enteromorpha</i> , <i>Cladophora</i> , <i>Fritschiella</i> , <i>Oedogonium</i> , <i>Spirogyra</i> , <i>Cosmarium</i> , <i>Caulerpa</i> , <i>Chara</i> .
2.	Examination of vegetative and reproductive morphology of Bacillariophyceae:

	<i>Cyclotella, Navicula</i> ; Phaeophyceae: <i>Ectocarpus, Dictyota, Padina, Laminaria, Sargassum</i> .
3.	Examination of vegetative and reproductive morphology of Rhodophyceae: <i>Gelidium, Gracilaria, Polysiphonia</i> .
4.	Examination vegetative and reproductive morphology of Xanthophyceae: <i>Vaucheria</i> Cyanophyceae: <i>Nostoc, Lyngbya, Spirulina</i> .
5.	Field work to get acquaintance with the algae of Visakhapatnam coast and fresh water algae in and around Visakhapatnam.
6.	An examination of the external features and internal structure and reproductive organs of: <i>Riccia, Targionia, Monoclea, Plagiochasma</i> .
7.	An examination of the external features and internal structure and reproductive organs of the genera: <i>Fimbriaria, Marchantia, Pellia, Porella</i> .
8.	An examination of the external features and internal structure and reproductive organs of: <i>Anthoceros, Notothylus, Andreaea, Funaria, Polytrichum</i> .

#### Reference Books

1.	Lee RW. 2007. <b>Classification of Algae</b> .
2.	Kumar HD. 1988. <b>Introductory Phycology</b> . Affiliated East West Press Pvt. Ltd., New Delhi.
3.	Round FE. 1986. <b>The Biology of Algae</b> . Cambridge University Press, New York.
4.	Bold HC and Wyne MJ. 1978. <b>Introduction to the Algae</b> . Prentice-Hall, New Jersey.
5.	Presscot GW. 1969. <b>The Algae- a Review</b> . Houghton Mifflin Company, Boston.
6.	Morris I. 1967. <b>An Introduction to the Algae</b> . Cambridge University Press, UK.
7.	Chapman VJ. 1962. <b>The Algae</b> . Macmillan and Co Ltd., London.
8.	Lewin RA. 1962. <b>Physiology and Biochemistry of Algae</b> . Academic Press, New York.
9.	Round FE. 1962. <b>Ecology of Algae</b> . Cambridge University Press, New York
10.	Smith GE (ed) 1950. <b>Fresh Water Algae</b> . Elsevier Science, USA.
11.	Fritsch FE. 1945. <b>The Structure and Reproduction of Algae Vols. 1&amp; II</b> . Cambridge University Press, New York.
11.	Chopra RN and Kumra PK. 1988. <b>Biology of Bryophytes</b> . New Age International (P) Ltd. Publishers, New Delhi.
12.	Parihar NS. 1991. <b>Bryophyta</b> . Central Book Depot, Allahabad.

<b>13.</b>	Puri P. 1980. <b>Bryophytes</b> . Atmaram and Sons, Delhi.
<b>14.</b>	Smith GM. 1955. <b>Cryptogamic Botany Vol.II</b> . Tata McGraw Hill Publishing Co. Ltd., New Delhi.
<b>15.</b>	Kashyap S. 1929. <b>Liverworts of the Western Himalayas and Punjab Plains Part I and Part II</b> . University of Panjab, Lahore, Pakistan.





**M.Sc. Botany - Semester I**  
**B 102: BIOLOGY AND DIVERSITY OF BACTERIA, VIRUSES AND FUNGI**  
**Theory**

S. No	Unit
<b>SECTION A</b>	
1.	General account of archaeobacteria, eubacteria and cyanobacteria. Classification of eubacteria. Ultrastructure, nutrition, reproduction and economic importance of bacteria.
2.	Morphology and chemical composition of Actinomycetes, Spirochetes, Rickettsiae and Mycoplasmas.
3.	Classification of viruses. Ultrastructure and chemistry of viruses. Replication and transmission of viruses. History, origin and evolution of plant viruses. Plant viral diseases.
4.	Microbial Ecology: quorum sensing, gentrification, phosphorous solubilization, nitrogen fixation.
<b>SECTION B</b>	
5.	Classification and phylogeny of fungi. Molecular aspects in classification. Thallus organization in fungi. Ultrastructure of fungal cell. Unicellular and multicellular organization. Cell wall composition. Fungal diseases in plants and humans.
6.	General account of Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina.
7.	Reproduction in fungi: vegetative, asexual and sexual. Heterothallism, heterokaryosis and parasexuality. Nutrition in fungi: saprobic, biotrophic, and symbiotic.
8.	Fungi in industry: medicine, food, pest and weed management (biocontrol agents). Mushroom cultivation. Fermentation methods. Mycorrhiza.

**Practical**

S. No	Exhibits/ Experiments
1.	Tools of microbiology: Care and use of the microscope, Spectrophotometer, P <sup>H</sup> meter, Micrometer, Hemocytometer, Autoclave, Centrifuge, Biological safety

	cabinets, Inoculation needle and loop, Incubator, Colony counter & Lyophilizer.
2.	Differential staining: Gram staining.
3.	Differential staining: Acid fast staining.
4.	Study of bacterial growth: To prepare the growth curve of bacteria.
5.	Study of cyanobacteria: Isolation and cultivation of cyanobacteria.
6.	Isolation of rhizobia from root nodules.
7.	Cultivation of viruses in embryonated eggs.
8.	Isolation of fungi by Petri plate exposure method.
9.	Morphological study of: <i>Stemonitis</i> , <i>Saprolegnia</i> , <i>Mucor</i> , <i>Morchella</i> , <i>Aspergillus</i> , <i>Agaricus</i> , <i>Cyathus</i> , <i>Synchytrium</i> , <i>Helminthosporium</i> .
10.	Symptomatology and anatomical study of some diseased specimens: white rust, powdery mildew, green ear of bajra, rust of wheat, rust of linseed, Tikka disease of ground nut, red rot of sugarcane, blast of rice, citrus canker, tobacco mosaic disease.
<b>References Books</b>	
1.	Kaursethi I and Surinder KW 2011. <b>Text Book of Fungi and their Allies.</b> Macmillan publishers, New Delhi, India.
2.	Ram Reddy S & Reddy SM 2007. <b>Essentials of Virology.</b> Scientific publishers, Jodhpur, India.
3.	Sharma K 2005. <b>Manual of Microbiology Tools and Techniques.</b> Ane Book, New Delhi, India.
4.	Matthew RH 2004. <b>Plant virology.</b> 4 <sup>th</sup> edition. Academic press an imprint of Elsevier, California, USA.
5.	Prescott <i>et al.</i> 2003. <b>Microbiology.</b> McGraw Hill Education, New York.
6.	Aneja KR 2003. <b>Experiments in Microbiology, Plant pathology and Biotechnology.</b> New Age International publishers, New Delhi.
7.	Verma HN 2003. <b>Basics of plant Virology.</b> IBH publishing co. Pvt. Ltd., New Delhi.

8.	Mehrotra KS and Aneja KR 2003. <b>An Introduction to Mycology</b> . New Age International Publishers, New Delhi.
9.	Sullia SB and Shantharam S 2001. <b>General Microbiology</b> . Oxford and IBH publishing Co. Pvt. Ltd, New Delhi.
10.	Reddy SM and Ram Reddy S 2000. <b>Microbiology a Laboratory Manual</b> . BSC Publishers and Distributors, Hyderabad.
11.	Flint SJ, Enquist LW, Krug RM, Racaniello VR, Skalka AM 2000. <b>Principles of Virology, Molecular Biology, Pathogenesis and Control</b> . ASM press, Washington DC.
12.	Rao AS 1999. <b>Introduction to Microbiology</b> . Prentice Hall of India Pvt. Ltd., Delhi.
13.	Alexopoulos CJ, Mims CW, Blackwell M 1996. <b>Introductory Mycology</b> . 4 <sup>th</sup> edition. Replika press, North Delhi.
14.	Paul S 1995. <b>Bacteria in Biology, Biotechnology and Medicine</b> . 5 <sup>th</sup> edition. John Wiley and son Ltd., UK.
15.	Pelczar, Chan and Krieg 1993. <b>Microbiology</b> . 5 <sup>th</sup> edition. McGraw Hill Education, New York.
16.	<i>Stainer</i> RT, Ingraham JL, Wheelis ML and Painter PR 1987. <b>General Microbiology</b> . 5 <sup>th</sup> Edition. Macmillan, London.
17.	Smith KM 1968. <b>Plant viruses</b> . Elsevier, New York.
18.	Rangaswamy G 1962. <b>Bacterial Plant disease in India</b> . Asia Publishing House, Bombay.



**M.Sc. Botany - Semester I**  
**B103 CELL BIOLOGY OF PLANTS**

**Theory**

S. No	Unit
<b>SECTION A</b>	
1.	The cell theory. Origin and development of cell biology as a separate branch. Dimensions of size and weight: micron to angstrom, microgram to pictogram. Ultra structure and organization of prokaryotic and eukaryotic cells. Specialized cell types.
2.	Chemical foundation: macromolecules–structure, shape and information. Non-covalent interactions in relation to function of nucleic acids and proteins. Biochemical energetics: types of energy– thermal, electrical and radiant energy, interconvertability of energy. Laws of thermodynamics as applicable to biological systems.
3.	Cell wall:structure and functions, cell wall architecture, biogenesis and growth. Plasmodesmata: structure and function, plasmodesmata in comparison to gap junctions of animal cells. Plasma membrane: structure, models and functions. ATPases receptors, carriers, channels, pumps. Vacuole structure and function, vacuolar ATPases, transporters.
4.	Cytoskeleton: microtubules and microfilaments, their role in cell division and motility; intermediate filaments– role in providing strength. Labeled antibody technique for visualizing cytoskeleton.
<b>SECTION B</b>	
5.	Chloroplast and Mitochondria: structure and function, genome organization, nucleo-cytoplasmic interactions, RNA editing.
6.	Other organelles: structure and function– endoplasmic reticulum, Golgi apparatus lysosomes,, ribosomes, microbodies, peroxisomes.
7.	Tools in cell biology I: microscopy–working principles of light microscopy, resolution power of microscope, different types of light microscopes, stains used. Image processing methods in microscopy. Scanning electron microscopy. Transmission electron microscopy– principle of working, preparation of specimens for electron microscopy –Fixing, sectioning, spreading molecules, negative staining, shadow casting, freeze fracture and freeze etching.
8.	Tools in cell biology II: subcellular fractionation– homogenization, principle of density gradient centrifugation. Spectroscopic techniques– principle and applications

	of UV- visible, ESR. Spectrofluorimetry. Circular dichroism (CD). Nuclear magnetic resonance (NMR). Whole cell autoradiography. Radiolabeling techniques: properties of different radioisotopes used in biology, their detection and measurement, incorporation of radioisotopes in biological tissues and cells.
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### Practical

S. No	Exhibit/Experiment
1.	Electron microscopic picture of prokaryotic and eukaryotic cells.
2.	Images of cytoskeleton.
3.	Electron microscope pictures of chloroplast and mitochondria.
4.	Electron microscope pictures of endoplasmic reticulum, Golgi apparatus.
5.	Study of mitosis using acetocarmine.
6.	Isolation of mitochondria and the activity of its marker enzyme, succinate dehydrogenase (SDM).
7.	Fluorescence staining with FDA for cell viability and cell wall staining with calcofluor.
8.	Pictures of images of shadow casting, negative staining, freeze fracturing and freeze etching.
9.	Images of cells in fluorescence, phase contrast and confocal microscopy, whole cell autoradiography.
10.	Establishing sucrose density gradients.

### Reference Books

1.	Alberts B, Breyer D, Hopkin K, Johnson AD, Lewis J, Raff M, Roberts K and Watter P 2014. <b>Essential Cell Biology</b> . 4 <sup>th</sup> Edition. Garland publishers, New York.
2.	Sharp D, Ploppe G and Sikorski E 2014. <b>Lewin's Cells</b> . 3 <sup>rd</sup> Edition. Viva Books, New Delhi.
3.	Cooper GM, Hausman RE 2013. <b>The Cell – A Molecular Approach</b> . 6 <sup>th</sup> Edition. Sinauer Associates, Incorporated, USA.
4.	Karp G 2013. <b>Cell and Molecular Biology – Concepts and Experiments</b> . 7 <sup>th</sup> Edition. Wiley Global Education, USA
5.	McLennan A, Bates A, Turner P, White M 2013. <b>Bios Instant Notes in Molecular Biology</b> . 4 <sup>th</sup> Edition. Garland publishers, New York.
6.	Cowling G, Allen T 2011. <b>The Cell. A very Short Introduction</b> . Oxford University Press, USA.

7.	Alberts B, Johnson A, Lewis J, Raff M, Roberts K, Walker P 2007. <b>Molecular Biology of the Cell</b> . 5 <sup>th</sup> Edition. Garland publishers, New York.
8.	Schaffer SW 2007. <b>Mitochondria: The Dynamic Organelle</b> . 1 <sup>st</sup> Edition. Springer Verlag.
9.	Wilson J, Hunt T 2007. <b>Molecular Biology of the Cell</b> 5 <sup>th</sup> edition. <b>The Problems Book</b> . 2 <sup>nd</sup> Edition. Garland publishers, New York.
10.	Celis JE (ed) 2006. <b>Cell Biology—A Laboratory Hand Book</b> . 3 <sup>rd</sup> Edition. Elsevier, USA.
11.	Lodish H, Berk A, Kaiser CA, Kreiger M, Scott P M, Bretcher A, Ploegh H, Matsudaira P. 2004. <b>Molecular Cell Biology</b> . 5 <sup>th</sup> edition. W. H. Freeman and Company, New York.
12.	De DN 2000. <b>Plant Cell Vacuoles. An Introduction</b> . CSIRO Publication Collingwood, Australia.
13.	Krishna Murthy KV 2000. <b>Methods in Cell Wall Cytochemistry</b> . CPC Press, Boca Raton, Florida.
14.	Lodish, Berk A, Zipursky SL, Matsudaira P, Baltimore D and Darnell J 2000 <b>Molecular Cell Biology</b> . 4 <sup>th</sup> Edition. W.H. Freeman and Co., New York.
15.	Alberts B, Bray D, Lewis J, Raff M, Roberts K and Watson JD 1999. <b>Molecular Biology of the Cell</b> , Garland Publishing, New York.
16.	Kleinsmith LJ and Kish VM 1995. <b>Principles of Cell and Molecular Biology</b> . 2 <sup>nd</sup> Edition. Harper Collins College Publishers, New York, USA.
17.	Avers CJ 1986. <b>Molecular Cell Biology</b> . Addison Wesley Publishing Company USA.





**M.Sc. Botany – Semester I**  
**B 104 CYTOLOGY AND CYTOGENETICS**

**Theory**

S. No	Unit
<b>SECTION A</b>	
<b>1.</b>	Nucleus: structure of nuclear membrane and nuclear pore complex, nucleolus, ribosome biosynthesis. Chromatin: eu and heterochromatin, arrangement of chromatin. Molecular organization of chromatin: components, nucleosomes – composition and organization, 10 nm, 30 nm, solenoid, scaffolds. Chromosome structure: molecular organization of centromeres and telomeres. Types of chromosomes: lampbrush, polytene.
<b>2.</b>	Chromosome identification: karyotype analysis. Chromosome banding techniques – Q, C, G and R banding. Flowcytometry and confocal microscopy in karyotype analysis. Computer assisted karyotype analysis – chromosome microdissection and micro cloning. FISH and GISH techniques.
<b>3.</b>	Chromosomal structural aberrations: origin, meiosis and breeding behaviour of duplications, deficiencies, inversions and interchanges. Types of inversions. Robertsonian translocations – basic concept of complex translocation heterozygotes.
<b>4.</b>	Chromosomal numerical aberrations: classification of numerical aberrations. Aneuploids – trisomics (primary, secondary, tertiary), monosomics and nullisomics – meiotic behavior. Eupolyploids – origin and production of auto -and allopolyploids, meiosis in autotetraploid. Genome of tobacco and wheat as examples of allopolyploids.
<b>SECTION B</b>	
<b>5.</b>	Nuclear DNA content: C-value paradox, hyperchromicity, cot curves and their significance. Molecular organization of eukaryotic nuclear genome: highly repeated, middle repeated and unique sequences.
<b>6.</b>	Cell cycle and its regulation: the G1, S, G2 and M phases. Synchronous and asynchronous cell divisions. The measurement of duration of different phases of cell cycle using a flow cytometer. Check points in cell cycle – role of cyclins and cyclin-dependent kinases in regulation of cell cycle.
<b>7.</b>	The different stages of mitosis and meiosis: description of the stages. Experimental control of cell division. Significance of meiosis.

8.	Apoptosis: mechanism and significance. Initiation of cancer at cellular level – proto oncogenes and oncogenes; retinoblastoma and E2F proteins.
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### Practical

S. No	Exhibit/ Experiment
1.	Photographs of interphase nucleus, 10 nm, 30nm and scaffolds. Electron microscope picture of metaphase chromosome, <i>in-situ</i> hybridization of chromosome spreads showing telomeres and centromeres. rRNA synthesis –christmas tree configuration.
2.	Pictures of lampbrush and polytene chromosomes.
3.	Photographs of chromosomes with different banding patterns. Identifying homologous chromosomes from the pictures.
4.	Preparation of karyotypes in <i>Allium/ Aloe</i> (with treated root tips).Construction of idograms from pictures of karyotypes.
5.	Photographs showing meiosis in structural and numerical aberrations.
6.	Meiosis in <i>Rheo discolor</i> showing complex translocation heterozygote.
7.	Preparation of slides from <i>Allium</i> floral buds for observation and identification of stages of meiosis.
8.	C value paradox chart and Britten and Kohne's Cot curves picture.

### Reference Books

1.	Singh RJ. 2014. <b>Plant Cytogenetics</b> . 2 <sup>nd</sup> Edition. CRC Press, India.
2.	Pierce BA. 2013. <b>Genetics: A Conceptual Approach</b> . 5 <sup>th</sup> Edition. W. H. Freeman, California.
3.	William K, Cummings S, Spencer MR and Charlotte A. 2013. <b>Essentials of Genetics</b> . Pearson Books, Delhi.
4.	Hartwell L. 2011 <b>Genetics: From Genes to Genomes, Study Guide and Solution Manual</b> . 4 <sup>th</sup> Edition. Nero, McGraw Hill Publishing company, New York.
5.	Bass H and Birchler J. 2011. <b>Plant cytogenetics: Genome structure and chromosome Function</b> . Springer, New York.
6.	Ram M. 2010. <b>Cytogenetics and Genetics</b> . PHI Learning Pvt. Ltd., Delhi.
7.	Anthony J, Griffiths F, Wessig SR, Carroll SB and Doebley J. 2010. <b>Introduction to genetic analysis</b> . 10 <sup>th</sup> Edition. W. H. Freeman, California.
8.	Russel PJ. 2009. <b>Genetics–A Molecular Approach</b> . 3 <sup>rd</sup> Edition. Pearson Benjamin Cummings, San Francisco, USA.
9.	Roy D. 2009. <b>Cytogenetics</b> . Alfa Science International Ltd., UK.

10.	Brooker R. 2008. <b>Genetics, Analysis and Principles</b> . 3 <sup>rd</sup> edition. McGraw Hill Science.
11.	Gupta P.K .1995. <b>Cytogenetics</b> . Rastogi & Company, Meerut.
12.	Sybenga J. 1992. <b>Cytogenetics in Plant Breeding</b> . Springer London Ltd.
13.	David M. Prescott. 1988. <b>Cells</b> . Jones and Bartlett Publ. Boston.
14.	Swanson M and Young. 1982. <b>Cytogenetics</b> . Prentice Hall, India.
15.	Khush GS. 1973. <b>Cytogenetics of Aneuploids</b> . Academic Press, New York and London.
16.	Sybenga J. 1973. <b>General Cytogenetics</b> . North Holland and American Elsevier Publishing Co., New York.
17.	Burnham CR. 1962. <b>Discussions in Cytogenetics</b> . Burgess Publishing Co., Minnesota.



**M.Sc. Botany - Semester II**

**B 201 GENETICS**

**Theory**

<b>S. No</b>	<b>Unit</b>
<b>SECTION A</b>	
<b>1.</b>	Concept of genetic markers and their types. Mendel's experiments and theories, application of probability laws to Mendelian principles. Chi-square testing for goodness of fit. Penetrance and expressivity. Pleiotropism. Phenocopies. Codominance and incomplete dominance.
<b>2.</b>	Multiple allelism: interaction among multiple alleles, complementation test, pseudoalleles. Gene interaction and modified F <sub>2</sub> ratios in two gene interactions.
<b>3.</b>	Linkage and crossing over: identifying linkage from F <sub>2</sub> and test cross, recombination frequency and distance between genes. Linkage maps. Tetrad analysis—ordered and unordered tetrads.
<b>4.</b>	Recombination in prokaryotes: transformation, conjugation, transduction, sexduction. Mapping of genes in bacteria using transformation and conjugation (interrupted mating). Fine structure analysis of gene – Benzer's work.
<b>SECTION B</b>	
<b>5.</b>	Sex determination: chromosomal and genetic basis. Sex-linked inheritance. Sex influenced and sex limited characters. Polygenic inheritance: heritability and its measurement. QTL mapping.
<b>6.</b>	Extra chromosomal inheritance: inheritance of mitochondrial and chloroplast genes. Male sterility. Chloroplast mutations. Maternal inheritance.
<b>7.</b>	Nature of the eukaryotic gene: split gene with a promoter and terminator. Variant forms of eukaryotic gene – nested genes, overlapping genes, assembled genes, assorted genes. Multigene families— organization and significance. Transposable elements in pro- and eukaryotes: types, mechanism of transposition, significance of transposable elements.
<b>8.</b>	Mutations: types, causes and detection. Physical and chemical mutagens. Lethal, conditional, biochemical, loss of function, gain of function. Molecular basis of mutations. Spontaneity of mutations, site-directed mutagenesis. Recombination: molecular mechanism— role of rec A, B, C, D enzymes, Holliday model, site specific recombination.

### Practical

S. No	Exhibit/Experiment/Assignment
1.	Assignment on Mendel's principles, chisquare test, proabability.
2.	Assignment on dominance relationships, multiple alleles and two gene interactions.
3.	Assignment on linkage and crossing over.

### Reference Books

1.	Benajamin Pierce 2013. <b>Genetics: A Conceptual Approach.</b> 5 <sup>th</sup> Edition.W.H. Freeman and Company.
1.	Lewin B. 2000. <b>Gene VII.</b> Oxford University Press, New York, USA.
2.	Snustad DP. and Simons MJ 2000. <b>Principles of Genetics.</b> 2 <sup>nd</sup> Edition. John Wiley and Sons Inc., USA.
3.	Atherly AG, Girton JR and McDonald JF. 1999. <b>The Science of Genetics.</b> Saunders College Publishing, Fort Worth, USA.
4.	Karp G. 1999. <b>Cells and Molecular Biology: concepts and Experiments.</b> Hohn Wiley and Sons Inc., USA.
5.	Hartl DL and Jones EW. 1998. <b>Genetics: Principles and Analysis.</b> 4 <sup>th</sup> Edition. Jones and Bartlett Publishers, Massachusetts, USA.
6.	Malacinski GM and Freifelder D. 1998. <b>Essentials of Molecular Biology.</b> 3 <sup>rd</sup> Edition. Jones and Bartlet Publishers Inc., London.
7.	Russel PJ. 1998. <b>Genetics.</b> 5 <sup>th</sup> Edition. The Benjamin/ Cummings Publishing Company Inc., USA.
8.	Lewis R. 1997. <b>Human Genetics: Concepts and Applications.</b> 2 <sup>nd</sup> Edition. WCB McGraw Hill, USA.
9.	Griffiths RCL, Anthony JF, Miller JH and Suzuki DT. 1996. <b>Genetic analysis.</b> 6 <sup>th</sup> Edition. W. H. Freeman and Co., New York.



**M.Sc. Botany - Semester II**  
**B 202 MOLECULAR BIOLOGY OF PLANTS**

**Theory**

S. No	Unit
<b>SECTION A</b>	
<b>1.</b>	Composition and structure of biomolecules: carbohydrates, lipids, proteins (Ramachandran plot) domains, motifs and folds. Nucleic acids– DNA structure, A, B and Z forms of DNA. Types of small RNAs: Si RNA, micro RNA, catalytic RNA.
<b>2.</b>	DNA replication: semi-conservative, semi-discontinuous- Okazaki fragments, uni and bi directional mode of replication. RNA priming, enzymes for DNA replication– gyrase, helicase, topoisomerases and polymerases, SSBs. Mechanism of DNA replication– in prokaryotes–rolling circle and theta mode of replication, in eukaryotes– multiple replicons. Fidelity of replication. Replication at ends of chromosomes. Extrachromosomal replicons. DNA damage and repair.
<b>3.</b>	RNA synthesis and processing: transcription process in prokaryotes and eukaryotes. Transcription factors. RNA processing– mRNA processing – spliceosome, capping and tailing, processing of tRNA and rRNA.
<b>4.</b>	Protein synthesis: structure of tRNA, aminoacylation of tRNA, aminoacyl tRNA synthetases. Ribosome as a translation factory. Genetic code– codon assignment, characteristics of genetic code. Mechanism of translation in prokaryotes and eukaryotes– initiation elongation and termination. Chemical proof reading during translation. Translation inhibitors. Post translational modifications.
<b>SECTION B</b>	
<b>5.</b>	Protein sorting and targeting of proteins into nucleus, chloroplasts, mitochondria, vacuoles and peroxisomes. Protein trafficking through GERL system– signal peptide, signal recognition particle, vesicles.
<b>6.</b>	Signal transduction: signaling molecules, ligands and receptors. G protein coupled receptors. Receptor tyrosine kinases. MAP kinases. Second messengers, signal amplification, cAMPs. Ca-calmodulin pathway.
<b>7.</b>	Regulation of gene expression in prokaryotes: bacteria – Lac, arabinose ,Tryp operons, positive and negative control. Regulation in viruses–lytic and lysogenic cycles.
<b>8.</b>	Regulation of gene expression in eukaryotes: cis and trans factors. Motifs of DNA



	binding domains of trans factors–zinc fingers, leucine zippers, helix turn helix. Temporal and spatial regulation. Role of chromatin in gene expression. DNA methylation and gene imprinting. Gene silencing.
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### Practical

S. No	Exhibit/Experiment
1.	Isolation of DNA using CTAB method.
2.	Histochemical staining of carbohydrates, proteins and fats in the plant cells.
3.	Electrophoresis of seed proteins.
4.	Assignments on problems related to DNA structure, replication, transcription and translation
5.	Photographs depicting the content of theory

### Reference Books

1.	Snustad P, Simmons MJ. 2003. <b>Principles of Genetics</b> . 3 <sup>rd</sup> Edition. John Wiley and Sons, Inc, USA.
2.	Buchaman BB, Gruissem,W and Jones R. 2000. <b>Biochemistry and Molecular Biology of plants</b> : American Societies of plant physiologists, John Wiley and Sons Ltd., Maryland, U.S.A.
3.	Lewin B. 2000. <b>Genes IX</b> , Oxford University Press, New York.
5.	Lodish BA, Zipursky SL, Matsdaira P, Baltimore D and Darnell J. 2000. <b>Molecular Cell Biology</b> . 4 <sup>th</sup> Edition. W.H. Freeman and Co., New York.
6.	Alberts B, Bray D, Lewis J, Ralf M, Roberts K and Watson JD.1999. <b>Molecular Biology of the Cell</b> . Garland publishing Inc., New York.
7.	Weaver RF. 1999. <b>Molecular Biology</b> . WCB /McGraw-Hill,.
8.	Shaw CH. 1998. <b>Plant Molecular Biology. A practical approach</b> , IRL Press, Oxford.
9.	Glick BR and Thompson JE. 1992. <b>Methods in Plant Molecular Biology and Biotechnology</b> , CRC Press, Boc Raton Florida.



**M.Sc. Botany – Semester II**

**B 203 BIOLOGY AND DIVERSITY OF PTERIDOPHYTES AND GYMNOSPERMS**

**Theory**

S. No	Unit
<b>SECTION A: Pteridophytes</b>	
1.	Classification of Pteridophyta. Origin of Pteridophytes. Pteridophytes in comparison to Bryophytes and Gymnosperms. Distinguishing features of Pteridophyta. Economic importance of Pteridophytes.
2.	Morphology, anatomy and reproduction of <i>Psilotum</i> , <i>Lycopodium</i> , <i>Selaginella</i> , <i>Isoetes</i> , <i>Equisetum</i> , <i>Ophioglossum</i> , <i>Osmunda</i> , <i>Gleichenia</i> , <i>Cyathea</i> , <i>Marselia</i> , <i>Adiantum</i> , <i>Salvinia</i> and <i>Azolla</i> .
3.	General account of fossil pteridophytes–Psilopsida, Lycopsida, Sphenopsida and Pteridopsida.
4.	Evolution of stelar types in Pteridophytes. Heterospory and origin of seed habit. Evolution of the sporophyte.
<b>SECTION B: Gymnosperms</b>	
5.	The evolutionary time scale: eras, periods and epochs. General account of fossils. Types of fossil formations.
6.	Gymnosperms in comparison to ferns and seed plants. Classification of Gymnosperms and their distribution in India. Economic importance of Gymnosperms.
7.	General account of the families of Pteridospermales–Lyginopteridaceae, Meduloisaceae, Caytoniaceae; Bennettitales–Cycadeodiaceae; Pentoxylales – Pentoxylaceae; Cordaitales–Cordaitaceae.
8.	Structure and reproduction in living Gymnosperms of Cycadopsida, Coniferopsida and Gnetopsida.

**Practical**

S. No	Exhibit/Experiment
1.	Examination of the external features, anatomy and reproductive structures of <i>Psilotum</i> , <i>Lycopodium</i> , <i>Selaginella</i> , <i>Isoetes</i> and <i>Equisetum</i> .
2.	Examination of the external features, anatomy and reproductive structures of <i>Ophioglossum</i> , <i>Osmunda</i> , <i>Gleichenla</i> , <i>Cyathea</i> , <i>Marselia</i> , <i>Adiantum</i> , <i>Salvinla</i> and

	<i>Azolla</i> .
3.	Observations of the slides of the following fossil plants— <i>Rhynia</i> , <i>Lepidodendron</i> , <i>Lepidocarpon</i> , <i>Miadesmia</i> , and <i>Sphenophyllum</i> .
4.	Observations of the slides fossil Pteridophytes: <i>Calamites</i> , <i>Calamostachys</i> , <i>Zygoptera</i> and <i>Etaopteris</i> .
5.	Examination of the external features, anatomy and reproductive structures of <i>Ginkgo</i> , <i>Pinus</i> , <i>Cupressus</i> and <i>Cryptomeria</i> .
6.	Examination of the external features, anatomy and reproductive structures of <i>Araucaria</i> , <i>Ephedra</i> and <i>Gnetum</i> .
7.	Study of fossil gymnosperms from prepared slides: <i>Lyginopteris</i> , <i>Lagenostoma</i> and <i>Medullosa</i> .
8.	Study of fossil gymnosperms from prepared slides: <i>Trigonocarpus</i> , <i>Conostoma</i> , <i>Heterangium</i> , <i>Cordaites</i> .

#### Reference Books

1.	Saxena P and Pathak C. 2012. <b>A Text Book of Pteridophyta.</b> , Wisdom Press, New Delhi.
2.	Sharma OP. 2006. <b>Pteridophyta.</b> MacMillan India Ltd., New Delhi.
3.	Parihar NS. 1996. <b>Biology and Morphology of Pteridophytes.</b> Central Book Depot, Allahabad.
4.	Smith GM. 1995. <b>Cryptogamic Botany. Vol. II.</b> McGraw Hill Book Company, New York.
5.	Sporne KR. 1962. <b>The Morphology of Pteridophytes.</b> Hutchinson University Library, London.
6.	Evans AJ. 1936. <b>Morphology of Vascular Plants (Lower groups).</b> McGraw Hill Book Company, New York.
7.	Biswas C and Johri BM. 1997. <b>The Gymnosperms.</b> Narosa Publishing House, New Delhi.
8.	Bhatnagar SP and Moitra A. 1996. <b>Gymnosperms.</b> New Age International Private Limited, New Delhi.
9.	Sharma OP. 1996. <b>Gymnosperms.</b> Pragati Prakashan, Meerut.
11.	Stewart WN and Rothwell GW. 1993. <b>Paleobotany and the Evolution of Plants.</b> Cambridge University Press, USA.
12.	Singh H. 1978. <b>Embryology of Gymnosperms.</b> Gebrudev Bortraeger, Berlin.

<b>13.</b>	Arnold CA. 1974. <b>An introduction to Paleobotany.</b> McGraw Hill Book Co., Inc., New York.
<b>14.</b>	Sporne KR. 1967. <b>The Morphology of Gymnosperms.</b> Hutchinson University Library, London.
<b>15.</b>	Chamberlain CJ. 1935. <b>Gymnosperms structure and evolution.</b> University of Chicago Press, USA.



## M.Sc. Botany - Semester II

### B 204 PLANT CELL, TISSUE AND ORGAN CULTURE

#### Theory

S. No	Unit
<b>SECTION A</b>	
1.	Plant cell and tissue culture: introduction, history, scope. Basic concepts of tissue of culture: tissue culture cycle, types of cultures. Concept of cellular differentiation, totipotency.
2.	Culture media: composition and effects of media components, phytohormones – effects in tissue culture. Sterilization methods.
3.	Pathways of regeneration – biochemical and molecular aspects of tissue culture cycle.
4.	Technique and applications of cryopreservation and germplasm storage.
<b>SECTION B</b>	
5.	Organogenesis and adventitious embryogenesis. Fundamental aspects of morphogenesis, somatic embryogenesis. Methods of androgenic and gynogenic haploid production-dihaploids and application in agriculture. Embryo rescue.
6.	Cell culture: establishment, plating efficiency, induction and selection of mutants. Free cell cultures: production of secondary metabolites/natural products.
7.	Somatic hybridization: protoplast isolation, fusion and culture, hybrid selection and regeneration, possibilities, achievements, limitations, merits and demerits . Cybrids. Protoplasts in genetic transformation.
8.	Applications of plant tissue culture: clonal propagation, artificial seeds and its applications, somaclonal variation and its applications.

#### Practical

S. No	Exhibit/Experiment
1.	General out lay of plant tissue culture laboratory.
2.	Preparation of media.
3.	Callus induction – carrot.
4.	Clonal propagation through meristem cultures.
5.	Embryo culture – groundnut.
6.	Anther culture – <i>Datura</i> /tobacco.
7.	Establishment of cell cultures and determination of growth pattern.
8.	Determination of plating efficiency of cell cultures.

9.	Protoplast isolation and culture.
10.	Protoplast fusion.
11.	Observation of different developmental stages of somatic embryo in embryogenic callus.
12.	Preparation of artificial seeds.

#### Reference Books

1.	Collin HA and Edwards S. 1998. <b>Plant Cell Culture</b> . Bioscientific Publishers, Oxford, UK.
2.	Callow JA, Ford-Lloyd BV and Newbury HJ. 1997. <b>Biotechnology and Plant Genetic Resources: Conservation and Use</b> . CAB International, UK.
3.	Raghavan V. 1997. <b>Molecular Biology of Flowering plants</b> . Cambridge University press, New York, USA.
4.	Bhojwani SS and Razdan MK. 1996. <b>Plant tissue culture: Theory and Practice</b> . (A revised edition). Elsevier Science Publishers, New York, USA.
5.	Jain SM, Sopory SK and Velleux RE. 1996. <b>In Vitro Haploid production in Higher Plants. Volumes 1-5</b> . Fundamental aspects and Methods Kluwer Academic Publishers, Dordrecht, Netherlands.
6.	Vasil IK and Thorpe TA. 1994. <b>Plant Cell and Tissue Culture</b> . Kluwer Academic Publishers, Dordrecht, Netherlands.
7.	Bhojwani SS. 1990. <b>Plant Tissue Culture: Applications and Limitations</b> . Elsevier Science Publishers, New York, USA.
8.	Raghavan V. 1986. <b>Embryogenesis in Angiosperms: A Developmental and Experimental Study</b> . Cambridge University Press, New York, USA.
9.	Kartha KK. 1985. <b>Cryopreservation of Plant Cells and Organs</b> . CRC Press, Boca Raton, Florida, USA.





**M.Sc. Botany – Semester III**  
**B 301 TAXONOMY OF ANGIOSPERMS AND PLANT RESOURCES**  
**UTILIZATION AND CONSERVATION**

**Theory**

S. No	Unit
<b>SECTION A</b>	
<b>1.</b>	Origin and evolution of Angiosperms. Fossil Angiosperms. Taxonomy and Systematics. Concepts of species. Taxonomic hierarchy - species, genus, family and other categories. Principles used in assessing relationship and delimitation of taxa and attribution of rank. Plant identification. Plant nomenclature – Binomial nomenclature, ICBN. Plant collection and documentation.
<b>2.</b>	Brief analysis of the features and evolutionary tendencies noticed in the following groups: Ranales, Rosales, Centrospermae, Tubiflorae, Amentiferae, Helobiales, Liliflorae and Glumiflorae.
<b>3.</b>	Taxonomic evidences: embryology, cytology and phytochemistry. Taxonomic tools: herbaria, floras, botanical gardens, biochemical and molecular techniques, computers and GIS (Geo Information Systems). Cladistics in taxonomy. Numerical taxonomy and sero taxonomy.
<b>4.</b>	Systems of Angiosperm classification: Phenetic versus Phylogenetic system. Relative merits and demerits of major systems of classification: Takhtajan, Cronquist and Thorne. Basic concepts of Molecular Systematics: Gene sequencing, Restriction site analysis, Allozymes etc., Angiosperm Phylogeny Group (APG III) classification system, Relevance of Taxonomy to conservation, sustainable utilization of bioresources and ecosystem research.
<b>SECTION B</b>	
<b>5.</b>	World centres of primary diversity of domesticated plants. The Indo-Burmese Centre, Plant Introductions and Secondary centers. Plant explorations. Origin of agriculture.
<b>6.</b>	Origin, evolution, Botany, cultivation and uses of :

	<p>1. Food Crops : Wheat, Rice</p> <p>2. Forage Crops : <i>Sorghum</i>, Red gram</p> <p>3. Fibre Crops : Cotton, Jute</p> <p>4. Oil yielding crops : Groundnut, Coconut</p> <p>5. Medicinal and aromatic crops : <i>Catharanthus</i>, <i>Withania</i>, <i>Cymbopogon</i></p>
7.	Green Revolution: benefits and adverse consequences. Ethnobotany: Introduction, concept, objectives and scope. Plant biodiversity: Concept, status in India, utilization and concerns, conservation of wild biodiversity.
8.	Principles of conservation: Strategies for conservation, <i>In-situ</i> conservation: protected areas in India- reserves, wetlands, mangroves, <i>Ex-situ</i> conservation: principles and practices. Botanical gardens. BSI, ICAR and CSIR.

### Practical

Exhibits/ Experiments/ Suggested Laboratory Exercises	
Taxonomy	
1.	Description of a specimen from representative and locally available families.
2.	Description of a species based on various specimens to study intraspecific variation: A collective exercise.
3.	Description of various species of a genus: location of key character and preparation of keys at genetic level.
4.	Location of key characters and use of keys at family level.
5.	Field trips within and around the campus; compilation of field notes and preparation of herbarium sheets of such plants, wild or cultivated, as are abundant.
6.	Training in using floras and herbaria for identification of specimens described in the class.
7.	Demonstration of the utility of secondary metabolites in the taxonomy of some appropriate genera.
8.	Comparison of different species of a genus and different genera of a family to calculate similarity coefficients and preparations of dendrograms.

<b>Plant Resources Utilization and Conservation</b>	
<b>1.</b>	<p><b>Laboratory work:</b></p> <p>1. Food crops : Wheat, Rice</p> <p>2. Forage/fodder crops : <i>Sorghum</i>, Red gram</p> <p>3. Fiber crops : Cotton, Jute</p> <p>4. Oil yielding : Groundnut, Coconut</p> <p>5. Medicinal and Aromatic plants : <i>Catharanthus</i>, <i>Withania</i>, <i>Cymbopogon</i></p>
<b>2.</b>	<p><b>Scientific visits:</b></p> <p>The students should be taken to one of the following:</p> <p>A protected areas or Biosphere reserve or national park or sanctuary. A wetland.</p> <p>A mangrove.</p> <p>NBPGR (National Bureau of Plant Genetic Resources – New Delhi). BSI.</p> <p>CSIR</p> <p>Laboratory. FRI.</p> <p>Tropical Botanical Gardens.</p>

#### Reference Books

<b>Taxonomy of Angiosperms</b>	
<b>1.</b>	Mondal AK. 2011. <b>Advanced Plant Taxonomy</b> . New Central Book Agency Pvt. Ltd., Kolkata.
<b>2.</b>	Simpson MG. 2006. <b>Plant Systematics</b> . Elsevier Academic Press, California, USA.
<b>3.</b>	Nordenstam BEI, Lazily G and Kassas M. 2000. <b>Plant systematic for 2<sup>nd</sup> Century</b> . Portland Press Ltd., London.
<b>4.</b>	Takhtajan AL. 1997. <b>Diversity and classification of Flowering Plants</b> . Columbia University Press, New York.
<b>5.</b>	Zomlefer WB. 1994. <b>A Guide to flowering plant families</b> . University of California Press, USA.
<b>6.</b>	Woodland DW. 1991. <b>Contemporary Plant Systematics</b> . Prentice Hall, New Jersey.
<b>7.</b>	Stace CA. 1989. <b>Plant Taxonomy and Biosystematics</b> .2 <sup>nd</sup> Edition. Edward Arnold Ltd., London.

8.	Jones SB Jr. and Luchsinger AE. 1986. <b>Plant Systematics</b> . 2 <sup>nd</sup> Edition. McGraw Hill Book Co., New York.
9.	Radford AE. 1986. <b>Fundamentals of Plant Systematics</b> . Harper and Row Publications, USA.
10.	Heywood VH and Moore DM. 1984. <b>Current concepts in Plant Taxonomy</b> . Academic Press, London.
11.	Davis PH and Heywood VH. 1973. <b>Principles of Angiosperms Taxonomy</b> . Robert E Kreiger Pub. Co., New York.
12.	Harrison HJ. 1971. <b>New concepts in Flowering Plant Taxonomy</b> . Hieman Educational Books Ltd., London.
13.	Jones AD and Wilbins AD. 1971. <b>Variations and Adaptations in Plant species</b> . Hieman and Co., Educational Books Ltd., London.
14.	Grant V. 1971. <b>Plant Biosystematics</b> . Academic press, London.
15.	Solbrig OT. 1970. <b>Principles and Methods of Plant Biosystematics</b> . Macmillan, London.
16.	Heslop-Harrison J. 1967. <b>Plant Taxonomy</b> . English language Books Soc. and Edward Arnold Pub. Ltd., U.K.
<b>Plant Resource Utilization And Conservation</b>	
17.	Sambamurthy AVSS and Subramanyam NS. 2000. <b>Economic Botany of Crop Plants</b> . Asiatech Publishers, Inc., New Delhi.
18.	Conway G. 1999. <b>The Doubly Green Revolution: Food for All in the 21st Century</b> . Comstock Publishing Associates, New York.
19.	Pinstrup – Anderson P. et al. 1999. <b>World Food Prospects: Critical Issues for the Early 21st Century</b> . International Food Policy Research Institute, Washington DC, USA.
20.	Kocchar SL. 1998. <b>Economic Botany of the Tropics</b> . 2nd Edition. Mac Millan India Ltd., Delhi.
21.	Plant Wealth of India 1997. Special Issue of Proceedings Indian National Science Academy B-63.
22.	Sharma OP. 1996. <b>Hills Economic Botany</b> . (Late Dr. A.F. Hill, adapted by O.P. Sharma). Tata McGraw Hill Co., Ltd., New Delhi.
23.	Frankel OH, Brown AHD and Burdon JJ. 1995. <b>The conservation of Plant Diversity</b> . Cambridge University Press, Cambridge, UK.

24.	Paroda RS and Arora RK. 1991. <b>Plant Genetic Resources Conservation and Management.</b> IPGRI (Publication) South Asia Office, C/o. NBPGR Pusa Campus, New Delhi.
25.	Swaminathan MS and Kocchar SL (ed). 1989. <b>Plants and Society.</b> Mac Millan Publication Ltd., London.
26.	Thakur RS, Puri HS and Hussain A. 1989. <b>Major Medicinal Plants of India.</b> Central Institute of Medicinal and Aromatic Plants. CSIR, Lucknow.
27.	Council of Scientific & Industrial Research 1986. <b>The useful plants of India. Publications and Information Directorate.</b> CSIR, New Delhi.
28.	Baker HG. 1978. <b>Plants and Civilization.</b> 3 <sup>rd</sup> Edition. C.A. Wadsworth, Belmont.
29.	Chrispeels MJ and Sadava D. 1977. <b>Plants, Food and People.</b> W.H. Freeman and Co., San Francisco, USA.
30.	Schery RW. 1972. <b>Plants for Man.</b> 2 <sup>nd</sup> Edition. Englewood Cliffs, New Jersey.
31.	Raw materials I - XII Revised Vol. I-III (1985-1992) supplement (2000).



## M.Sc. Botany – Semester III

### B302 PLANT REPRODUCTION

#### Theory:

Male Gametophyte: Structure of anthers; microsporogenesis; role of tapetum; pollen development, sperm dimorphism; pollen embryo sacs and compound pollen grains.

Female Gametophyte: Ovule development; megasporogenesis, organisation of the embryo sac; ultra structure of the embryo sac cells.

Pollination, Pollen-pistil interaction: Structure of the pistil; pollen-stigma interactions; Sporophytic and Gametophytic self-incompatibility, different methods to overcome self-incompatibility.

Fertilization: Pollen germination; pollen tube growth and guidance; Entry of pollen tube into the embryo sac; pollen tube discharge, syngamy and triple fusion; polyspermy and hetero fertilization.

Post-fertilisation events: Endosperm development; Types of Endosperm; Functions; Endosperm and embryo relationships.

Embryo development: Johanson and Soueges systems; Types.

Polyembryony; apomixis; parthenocarpy - outlines only.

Seed Dormancy: Seed dormancy; overcoming seed dormancy.

Outlines of Experimental Embryology – Anther culture, ovary culture, ovule culture; embryo culture; Invitro fertilisation.

Applications of Angiosperm Embryology (Agricultural, Horticultural and Taxonomic Considerations).



**Suggested Laboratory Exercises:**

Study of microsporogenesis and gametogenesis in sections of anthers.

Tests for pollen viability using stains and invitro germination.

Embryo sac development through examination of permanent, stained serial sections.

Study of nuclear and cellular endosperm through dissections and staining.

Isolation of different stages of embryo development from suitable seeds.

### **Suggested readings:**

1. Bhojwani, S.S and Bhatnagar, S.P. 2000. The Embryology of Angiosperms (4<sup>th</sup> revised and enlarged edition) Vikas Publishing House, New Delhi;
2. Leins, P., Tucker, S.C. and Endress. P.K. 1988. Aspects of Floral Development. J. Cramer, Germany;
3. Procter, M. and Yeo, P. 1973. The Pollination of Flowers. William Collins Sons, London;
4. Pulliah, T., Lakshminarayana, K. and Hanumantha Rao, B., 2008. Plant Reproduction, Scientific Publishers, Jodhpur, India;
5. Raghavan, V. 1997. Molecular Embryology of Flowering Plants. Cambridge University Press, Cambridge;
6. Raghavan, V. 1999. Developmental Biology of Flowering Plants. Springer – Verlag, New York;
7. Sedgely, M. and Griffin, A.R. 1989. Sexual Reproduction of Tree Crops, Academic Press, London;
8. Shivanna, K.R. and Swahney, V.K. (Eds.) 1997. Pollen Biotechnology for Crop Production and Improvement. Cambridge University Press, Cambridge;
9. Shivanna, K.R. and Rangaswamy, N.S. 1992. Pollen Biology, A Laboratory Manual. Springer-Verlag, Berlin;
10. Shivanna, K.R. and Johri, B.M.1985. The Angiosperm Pollen Structure and Function, Wiley Eastern Ltd., New Delhi;
11. The Plant Cell. Special Issue on Reproductive Biology of plants, Vol.5 (10) 1993. The American Society of Plant Physiologists, Rockville, Maryland, USA.



**M.Sc. Botany - Semester III**

**B 303 PLANT ECOLOGY**

**Theory**

<b>S. No</b>	<b>Unit</b>
<b>SECTION A</b>	
1.	The environment: physical environment, biotic environment and abiotic environment. Ecology and human welfare. Climate, soil and vegetation patterns of the world: life zones, major biomes, vegetation and soil types of the world.
2.	Habitat and niche: concept of habitat and niche, niche width and overlap, fundamental and realized niche, resource partitioning, character displacement.
3.	Population Ecology: characteristics of a population, population growth curves, population regulation, life history strategies (r and k selection), concept of meta population, demes and dispersal, interdemec extinctions, age structured population.
4.	Species interactions: types of interactions, interspecific competition, herbivory, carnivory. Ecological succession: types, mechanisms, changes involved in succession, concept of climax. Hydrosere and Xerosere
<b>SECTION B</b>	
5.	Community ecology: nature of communities, community structure and attributes, levels of species diversity and its measurement, edges and ecotones, community classification.
6.	Ecosystem: structure and function. Energy dynamics. Mineral cycling (carbon, nitrogen and phosphorus). Primary production and decomposition. Structure and function of some Indian ecosystems– Terrestrial (forest, grassland) and aquatic (fresh water, marine, estuarine).
7.	Biogeography: Major terrestrial biomes. Theories of island biogeography. Biogeographical zones of India.
8.	Applied ecology: Environmental pollution – air, water and soil, kinds, sources, quality parameters. Effects on plant ecosystems. Climate change – green house gases, ozone layer and ozone hole, consequences of climate change. Methods for mitigation of climate change: physical, chemical and biological. Biodiversity status, monitoring and documentation, major drivers of biodiversity change, biodiversity management approaches. Conservation biology: principles of conservation, major approaches to management. Indian case studies on

conservation, management strategy (Biosphere reserves, Project tiger).

### Practical

#### Exhibits/ Experiments/ Suggested Laboratory Exercises

<b>1.</b>	To study the stratification of plants in botanical gardens.
<b>2.</b>	To prepare life forms of botanical gardens of college campus. Compare the biological spectrum of college campus with normal biological spectrum.
<b>3.</b>	To estimate the frequency of plants in the college campus.
<b>4.</b>	To estimate the relative frequency of plants in the college campus.
<b>5.</b>	To estimate the density of a plant species in the college campus.
<b>6.</b>	To estimate the relative density of a plant species in college campus.
<b>7.</b>	To determine the minimal size and number of quadrats required for reliable estimate of biomass in grass land.
<b>8.</b>	To determine the basal area of a plant species in the campus.
<b>9.</b>	To determine the important value index (IVI) of plant species in the campus.
<b>10.</b>	To estimate IVI of the plant species in a woodland using point center quarter methods.
<b>11.</b>	To determine plant diversity indices (Shamon - Wiener) continuum of dominance, species richness, equitability and biodiversity of species in the campus.
<b>12.</b>	To estimate rate of carbon dioxide evolution from different soils using soda lime or alkali absorption method.
<b>13.</b>	To study environmental impact of a given developmental activity using check list as a EIA method.
<b>14.</b>	Enumeration in pond ecosystems.
<b>15.</b>	To study the composition of woodland ecosystem.
<b>16.</b>	Demonstration of chemical energy stored in leaves which was the transformed from radiation energy.
<b>17.</b>	Estimation of biomass of cropland plots.

<b>18.</b>	Estimation of chlorophyll.
<b>19.</b>	Determination of leaf area index methods with plain graph sheets.
<b>20.</b>	To determine the water holding capacity of soil collected from different locations

#### Reference Books

<b>1.</b>	American Public Health Association American Water Works Association. 2013. <b>Standard Methods for the Examination of Water and Waste Water.</b> General Books LLC, USA.
<b>2.</b>	Sharma PD. 2007. <b>Ecology and Environment.</b> Rastogi Publications, Meerut.
<b>3.</b>	Sharma PD. 2001. <b>Ecology and Environment.</b> Rastogi Publications, Meerut.
<b>4.</b>	Smith RL. 1996. <b>Ecology and field Biology.</b> Harper Collins, New York.
<b>5.</b>	Sokal RR and Rohit FJ. 1995. <b>Biometry.</b> W.H. Freeman and Co., New York.
<b>6.</b>	Batra NK. 1992. <b>Treatise on Plant Ecology.</b> Pradeep Publications, Delhi.
<b>7.</b>	CJ. 1989. <b>Ecological Methodology.</b> Harper and Row, New York, USA.
<b>8.</b>	Ludwig JA and Reynolds JF. 1988. <b>Statistical Ecology.</b> Wiley, New York.
<b>9.</b>	Magurran AE. 1988. <b>Ecological Diversity and its measurement.</b> Croom Helm, UK.
<b>10.</b>	Moore PD and Chapman SB. 1986. <b>Methods in Plant Ecology.</b> Blackwell Scientific, Oxford, UK.
<b>11.</b>	Pielow EC. 1984. <b>The interpretation of Ecological Data.</b> John and Wiley Sons, USA.
<b>12.</b>	Muller – Dombois D and Ellenberg H. 1974. <b>Aims and Methods of Vegetation Ecology.</b> Blackburn Press, New Jersey.
<b>13.</b>	Odum PE. 1971. <b>Fundamentals of Ecology.</b> 3 <sup>rd</sup> Edition. W. B. Saunders, Philadelphia.
<b>14.</b>	Dansemmire RF. 1968. <b>Plant Communities.</b> Horpes and Row, New York.
<b>15.</b>	Misra R. 1968. <b>Ecology Work Book.</b> Oxford and IBH Publishing Co., New Delhi.
<b>16.</b>	Ambasht RS and Ambasht NK. <b>A Text Book Plant Ecology.</b> CBS Publishers and distributors, New Delhi.



**M.Sc. Botany – Semester III**  
**B 304 PLANT PHYSIOLOGY**

**Theory**

S. No	Unit
<b>SECTION A</b>	
<b>1.</b>	Plant water relations: free energy and chemical potential, osmotic potential, water potential and its determination, active and passive absorption of water, stomatal physiology and mechanisms of stomatal opening and closing, Soil-plant-atmosphere-continuum concept (SPAC), mechanism of water transport.
<b>2.</b>	Mineral nutrition: passive and active uptake of ions, translocation of minerals in plants, essential elements: their functions and symptoms of mineral deficiency, importance of foliar nutrition and use of chelates in agriculture, root microbe interactions in facilitating nutrient uptake, mechanism of assimilate translocation.
<b>3.</b>	The flowering process: phytochrome: structure, photochemical and biochemical properties, role in photomorphogenesis. Photoperiodism and its significance, mechanisms of floral induction. Vernalization. Morphological, biochemical and metabolic changes accompanying seed germination.
<b>4.</b>	Plant growth regulators and elicitors: biosynthesis, physiological effects and mechanism of action of auxins, gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, polyamines, jasmonic acid and salicylic acid. Role of plant growth regulators in agriculture. Hormone receptors.
<b>SECTION B</b>	
<b>5.</b>	Fundamental of Enzymology: General aspects, allosteric mechanism, regulatory and active sites, isozymes, kinetics of enzymatic catalysis, Michaelis-Menten Equation and its significance, Mechanism of enzyme action.
<b>6.</b>	Photochemistry and Photosynthesis: General concepts and historical back ground, evolution of photosynthetic apparatus, Redox reactions, photosynthetic pigments and light harvesting complexes, photo-oxidation of water, mechanisms of electron and proton transport, structure, synthesis and function of ATP, carbon assimilation-the Calvin's cycle, photorespiration and its significance, the C <sub>4</sub> cycle and CAM pathway, biosynthesis of starch and sucrose, physiological and ecological considerations.
<b>7.</b>	Respiration and Lipid metabolism : Plant respiration, glycolysis, the TCA cycle, electron



	transport and ATP synthesis, pentose phosphate pathway, glyoxylate cycle, alternative oxidase system, structure and function of lipids, fatty acid biosynthesis of membrane lipids, structural lipids and storage lipids and their catabolism. Nitrogen fixation and nitrogen metabolism: Biological nitrogen fixation, nodule formation and nod factors, biosynthesis of amino acids and proteins, mechanism of nitrate uptake and reduction.
<b>8.</b>	Stress Physiology: Plant responses to biotic and abiotic stress, mechanisms of biotic and abiotic stress tolerance, water deficit and drought resistance, salinity stress, metal toxicity, heat stress and oxidative stress.

### **Practical**

<b>Exhibits/ Experiments/ Suggested Laboratory Exercises</b>	
<b>1.</b>	Determination of osmotic potential.
<b>2.</b>	Determination of water potential.
<b>3.</b>	Demonstration of osmosis.
<b>4.</b>	Determination of root pressure.
<b>5.</b>	Effects of high and low temperatures upon the permeability of the cytoplasmic membranes.
<b>6.</b>	Determination of suction force due to transpiration.
<b>7.</b>	Stomatal frequency and stomatal index of leaves.
<b>8.</b>	Rate of transpiration in leaves by cobalt chloride paper method.
<b>9.</b>	Determination of amylase activity
<b>10.</b>	Extraction and separation of chloroplast pigments by paper chromatographic method
<b>11.</b>	Determine chlorophyll a / chlorophyll b contents in C <sub>3</sub> and C <sub>4</sub> plants by spectrophotometric method
<b>12.</b>	Determination of Hill reaction
<b>13.</b>	Determination of rate of Aerobic respiration by continuous current method
<b>14.</b>	Determination of rate of Anaerobic respiration by continuous current method
<b>15.</b>	Determination of catalase activity
<b>16.</b>	Demonstration of Polyphenol oxidase
<b>17.</b>	Determination of reducing sugars

18.	Estimation of free acids in Bryophyllum in terms of milliequivalents of NaOH
19.	Extraction and estimation of seed proteins depending upon the solubility
20.	SDS – PAGE for soluble proteins extracted from the given plant materials
21.	Separation of isozymes esterase, peroxidase by native polyacrylamide gel electrophoresis
22.	Effect of Light quality on the rate of Photosynthesis
23.	Effect of CO <sub>2</sub> concentration on the rate of Photosynthesis
24.	Estimation of Starch by gravimetric method
25.	Demonstration of Starch hydrolysis
26.	Separation of Chloroplast pigments by chemical method
27.	Separation of amino acids and carbohydrates through two dimensional chromatographic method

#### Reference books

1.	Sinha SK 2014. <b>A text book of Plant Physiology</b> . Centrum Press, New Delhi.
2.	Seema Yadav 2014. <b>Plant Physiology</b> . SBW publishers, New Delhi.
3.	Heribert H and Kazuo S (eds) 2010. <b>Plant responses to abiotic stress. Series Topics in Current Genetics, Vol 4</b> . Springer, Berlin.
4.	Philip Stewart and Schine Gobig 2011. <b>Plant Physiology</b> . CRC Press.
5.	Moore TC. 2011. <b>Biochemistry and Physiology of Plant Hormones</b> . Springer, New York.
6.	Hooykaas PJJ, Hall MA and Libbenga KR (ed) 1999. <b>Biochemistry and Molecular Biology of Plant Hormones</b> . Elsevier, Amsterdam, Netherlands.
7.	Taiz L and Zeiger E. 1998. <b>Plant Physiology</b> . 2 <sup>nd</sup> Edition. Sinauer Associates including Publishers, Massachusetts, USA.
8.	Wisthoff P. 1998. <b>Molecular Plant Development from Gene to Plant</b> . Oxford University Press, Oxford, UK.
9.	Thomas and Vince – Prue D. 1997. <b>PhotoPeriodism in Plants</b> . 2 <sup>nd</sup> Edition. Academic Press, Sandeigo, USA.
10.	Hopkins WG. 1995. <b>Introduction to Plant Physiology</b> . John Wiley & Sons Including New York, USA.
11.	Mohr H and Schopfer P. 1995. <b>Plant Physiology</b> . Springer-Verlag, New York.

12.	Salisbury FB and Ross CW. 1992. <b>Plant Physiology</b> . 4 <sup>th</sup> Edition. Wordsworth Publishing Company, California, USA.
13.	Noggle GR and Fritz GJ. 1991. <b>Introductory plant physiology</b> . 2 <sup>nd</sup> Edition. Prentice hall of India Limited, New Delhi.
14.	Davies PJ (ed) 1987. <b>Plant hormones and their role in Plant Growth and Development</b> . Mertinus Nijhoff Publishers, Netherlands.
15.	Witham FH and Devlin RM. 1986. <b>Plant Physiology</b> . CBS Publishers and Distributors, Bangalore.
16.	Wilkins MD. 1987. <b>Advanced Plant Physiology</b> . English Language Book Society, Longman Scientific and Technical, Harlow, UK.
17.	Bewley JD and Black M. 1982. <b>Physiology and Biochemistry of seed in relation to germination and dormancy. Volume 1 and 2</b> . Springer – Verlag, Berlin.
18.	Khan AA. 1982. <b>The Physiology and Biochemistry of Seed Development, Dormancy and Germination</b> . Elsevier, Amsterdam, Netherlands.
19.	Ting IP. 1982. <b>Plant Physiology</b> . Addison-Wesley, Reading, MA.
20.	Murthy HNK. 1981. <b>Plant growth substances including applications in Agriculture</b> . Tata McGraw Hill Publishing Company Ltd., New Delhi.
21.	Kramer PM and Kozlowski TT. 1980. <b>Physiology of Woody Plants</b> . Academic Press, New York.
22.	Hewitt EJ and Smith TA. 1975. <b>Plant Mineral Nutrition</b> . English University Press,
23.	Meyer AM and Poljakoff-Mayber A. 1975. <b>The germination of Seeds</b> . Pergamon Press, Canada.
24.	Hess D. 1974. <b>Plant Physiology</b> . Narosa Publishing House, New Delhi.
25.	Audus LJ. 1972. <b>Plant Growth Substances. Volume 1</b> . Chemistry and Physiology. Leonard Hill, UK.
26.	Slayter RO. 1967. <b>Plant Water Relationships</b> . Academic Press, London
27.	Hillman WS. 1963. <b>Physiology of Flowering</b> . Holt, Reinhart and Winston, New York.



## M.Sc. Botany - Semester IV

### B 401 GENETIC ENGINEERING OF PLANTS AND MICROBES

#### Theory

S.No	Unit
<b>SECTION A</b>	
1.	Basics of rDNA technology: restriction enzymes–types, nomenclature, mechanism of action. Methodology of rDNA molecule synthesis–joining overlapping ends, blunt end joining, polylinkers. Vectors–features. Cloning vectors– plasmids, viral DNA, cosmids, bacterial and yeast artificial chromosomes(BACs and YACs). Expression vectors.
2.	Bacterial transformation. <i>In-vitro</i> packaging. Recognition of transformants–antibiotic resistance, <i>Lac Z</i> gene based selection. Genomic library, cDNA library.
3.	Methods of gene transfer in plants: electroporation, gene gun, <i>Agrobacterium</i> mediated– binary and co integrative vector based. Chloroplast transformation.
4.	Classical examples of successful cases of transgenic plants– fungal, bacterial, viral and insect tolerance (BT and proteinase inhibitors), herbicide tolerance, abiotic stress tolerance, male sterility– Barnase-Barstar. Quality improvement –golden rice, late ripening tomatoes (Flavr Savr).
<b>SECTION B</b>	
5.	Techniques in genetic engineering I: Blotting techniques– Southern, Northern and Western blotting, radioactive and non-radioactive labeling, detection of hybridization. <i>In-situ</i> hybridization– technique, radioactive and non-radioactive probes, enzyme and fluorescence detection methods (FISH), applications of the technique. PCR– technique, types, applications. DNA sequencing– basic principle of Sanger’s method, automated DNA sequencing, high throughput DNA sequencing.
6.	Techniques in genetic engineering II: DNA fingerprinting–hybridization based (RFLP), PCR based (RAPD, AFLP). Restriction mapping. Microarray technique and its applications. Sequencing genomes–whole genome sequencing, shot gun sequencing. Next generation sequencing– 454 sequencing.
7.	Plant growth promoting bacteria – nitrogen fixers, siderophores, phytohormone production. Genetic improvement of industrially important microbes for production of useful products – biopesticides, biofertilizers, antibiotics. Intellectual Property Rights, farmer’s rights. Patents. Ethical and environmental issues in genetic engineering.

8.	Bioinformatics: Scope. Data bases– types, Genbank, PIR, PDB. An account of NCBI. Web based tools for sequence searches –BLAST. Genome projects, genome annotation, gene annotation, features of the genome of <i>Arabidopsis</i> , rice. Genomics– structural genomics, comparative genomics, functional genomics. Molecular phylogeny and phylogenetic trees. Metagenomics.
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#### **Practicals**

<b>S. No</b>	<b>Exhibit/Experiment</b>
1.	Isolation of plasmid DNA
2.	Bacterial transformation and identification of transformation
3.	Plant DNA isolation
4.	Restriction enzyme digestion and gel electrophoresis
5.	Assignments on the syllabus
6.	Pictorial demonstration of the various techniques

#### **Reference Books**

1.	Glick BR, Pasternak JJ and Patten CL. 2010. <b>Molecular Biotechnology Principles and Applications of rDNA</b> . ASM Press, USA.
2.	Attwood TK, Smith DJP and Phukan S. 2009. <b>Introduction to Bioinformatics</b> . Pearson Education Ltd., UK.
3.	Sateesh MK. 2008. <b>Bioethics and Biosafety</b> . I K International Pvt. Ltd., Bangalore.
4.	Channarayappa. 2007. <b>Molecular Biotechnology Principles and practices</b> . Taylor and Francis, UK.
5.	Watson JD. 2007. <b>Recombinant DNA: Genes and Genomes: A short course</b> . W. H. Freeman, USA.
6.	Primrose SB and Twyman RM. 2006. <b>Principles of Genome Analysis and Genomics</b> . Blackwell publishers, USA.
7.	Lewin B. 2004. <b>Genes VIII</b> . Pearson Prentice Hall, New Jersey.
8.	Chawla HS. 2002. <b>Introduction to Plant Biotechnology</b> . Oxford and I B H Publishers, USA.



**M.Sc. Botany – Semester IV**  
**B 402 EVOLUTION AND PLANT BREEDING**

**Theory**

S. No	Unit
<b>SECTION A</b>	
<b>1.</b>	Origin of life and unicellular evolution: Origin of basic biological molecules, abiotic synthesis of monomers and polymers , concept of Oparin and Haldane, experiment of Miller (1953). The first cell – evolution of prokaryote, RNA world. Origin of eukaryotic cells– Endosymbiont theory, evolution of unicellular eukaryotes, anaerobic and aerobic metabolism.
<b>2.</b>	Theories of organic evolution: Lamarckism, Darwinism–concepts of variation, adaptation, struggle, fitness and natural selection, Synthetic theory, phyletic gradualism, punctuated equilibrium, concepts of neutral evolution.
<b>3.</b>	Molecular evolution: molecular divergence and molecular clocks–protein and nucleotide sequence analysis, gene duplication and divergence. Hardy-Weinberg equilibrium and its applications.
<b>4.</b>	Plant breeding: history, objectives, activities, important achievements and undesirable consequences. Organizations for crop improvement in India: ICAR, Agricultural universities, Central institutes for crop improvement, All India coordinated programmes. Plant Introduction, domestication and acclimatization.
<b>SECTION B</b>	
<b>5.</b>	Methods of breeding self pollinated crops: Mass selection, Pureline selection, Pedigree method, Bulk method, Backcross method, Multiline varieties.
<b>6.</b>	Methods of breeding cross pollinated plants: Bulk Selection, Recurrent selection, Synthetic varieties, Hybridization. Inbreeding depression and Heterosis – genetic and molecular basis.
<b>7.</b>	Breeding of vegetatively propagated crops. Role of apomixis in plant breeding. Mutation breeding.
<b>8.</b>	Biostatistical methods: basic concept of parametric and non-parametric methods. Graphical representation. Measures of central tendency and dispersion. Probability distributions–Binomial, Poisson and Normal distributions. Concepts of confidence intervals, types of error, levels of significance. Regression and correlation; t-test. ANOVA. Basic introduction to multivariate statistics.



### Practical

1.	Problems based on Hardy Weinberg law
2.	Line diagrams showing the plan of different methods of breeding self pollinated crops- Mass selection, Pureline selection, Pedigree method,
3.	Line diagrams showing the plan of different methods of breeding cross pollinated crops- Bulk Selection, Recurrent selection.
4.	Methods of hybridization in rice, sorghum, bajra, cotton in standing crop in the field.
5.	Assignments with problems for computing measures of central tendency and dispersion- mean, median and mode, standard deviation and standard error.
6.	Assignment with problems for computing correlation and regression coefficients.
7.	Assignment with problems for implementing t test.
8.	Assignment with problems for computing ANOVA.

### References

1.	Singh BD. 2012. <b>Plant Breeding: Principles and Methods</b> . Kalyani Publishers, Delhi.
2.	Stickberger MW. 1985. <b>Genetics</b> . McMillan, New York.
3.	Frey KJ. 1981. <b>Plant Breeding II</b> . Iowa State University Press, Oxford.
4.	Jones DA and Wilkins DA. 1971. <b>Variation and adaptation in plant species</b> . Heinemann Educational Books Ltd., London.
5.	Stebbins GL. 1971. <b>Chromosomal evolution in Higher Plants</b> . Edward Arnold Publishers Ltd., London.
6.	Poehlman JM and Borthakur D. 1969. <b>Breeding Asian field crops: With Special Reference to Crops of India</b> . Oxford and IBH Pub. Co., Delhi.
7.	Briggs FN and Knowles PF. 1967. <b>Introduction to Plant Breeding</b> . Reinhold Pub. Corp., New York.
8.	Brewbaker JL. 1964. <b>Agricultural Genetics</b> . Prentice-Hall, New Jersey, USA.
9.	Allard RW. 1961. <b>Principles of Plant Breeding</b> , 2 <sup>nd</sup> Edition. John Wiley and Sons Inc., New York.



**M.Sc. Botany - Semester IV**

**B 403 PLANT PATHOLOGY**

**Theory**

<b>S. No</b>	<b>Unit</b>
<b>SECTION A</b>	
<b>1.</b>	Importance of plant diseases, classification of plant diseases, causes of plant diseases, symptoms of plant diseases, post harvest diseases. Dispersal of plant pathogens- active and passive.
<b>2.</b>	Infection phenomena – pre penetration, penetration and post penetration. Factors affecting infection. Effect of environment on plant disease development – temperature, humidity and light.
<b>3.</b>	Molecular basics of host pathogen interactions (fungi, bacteria & viruses) and genetic engineering for disease resistance. Defense mechanisms in plants: pre-and post-infectious defense mechanisms, phytoalexins.
<b>4.</b>	Role of enzymes in plant diseases – pectic, macerating, cellulolytic, lignolytic, proteolytic, lypolytic enzymes and hemicellulases, inactivation of enzymes.
<b>SECTION B</b>	
<b>5.</b>	Role of toxins in plant diseases – Phytotoxins, vivo toxins, host specific patho toxins & non specific patho toxins.
<b>6.</b>	Control of plant diseases: Cultural practices: field & crop sanitation, crop rotation; Chemical control: systematic & non systematic fungicides; Biological control. microbial pesticides.  Plant diseases management through host resistance: vertical, horizontal, monogenic, polygenic, specific & general resistance. Development of resistant varieties.
<b>7.</b>	Symptoms, etiology, epidemiology & control measures with reference to the following:  Fungal diseases – Club root of crucifers, Damping off of seedlings. Leaf spot of

	turmeric, Ergot of bajra, Powdery mildew of Cucurbits, Whip smut of sugarcane, Grain smut of <i>Sorghum</i> , Bean rust, Coffee rust, Blast disease of rice, Wilt of cotton, Tikka disease of ground nut.
8.	Bacterial diseases – Citrus Canker, Angular leaf spot of cotton, Bacterial leaf Blight of rice, Brown rot of potatoes. Viral and phytoplasma diseases – Grassy shoot diseases of sugarcane, Little leaf of brinjal, Rice tungro.

### Practical

S. No	Exhibits/ Experiments
1.	Study of symptoms, microscopic examination of diseased parts and identification of the pathogens involved in different plant diseases  Fungal diseases–Club root of crucifers, Damping off of seedlings. Leaf spot of turmeric, Ergot of bajra, Powdery mildew of Cucurbits, Whip smut of sugarcane, Grain smut of <i>Sorghum</i> , Bean rust, Coffee rust, Blast disease of rice, Wilt of cotton, Tikka disease of ground nut.  Bacterial diseases–Citrus Canker, Angular leaf spot of cotton, Bacterial leaf Blight of rice, Brown rot of potatoes.  Viral and phytoplasma diseases – Grassy shoot disease of sugarcane, Little leaf of brinjal, rice tungro.
2.	Isolation of fungal pathogens from leaves.
3.	Isolation of fungal pathogens from soil.
4.	Extraction of pectolytic enzymes from a pathogen.
5.	Extraction of cellulase enzyme from a pathogen.
6.	Isolation of plant pathogen– bacteria.
7.	Isolation (purification) of plant viruses.

### Reference Books

1.	Ravichandra NG. 2013. <b>Fundamentals of Plant Pathology</b> . PHI Learning Pvt. Ltd., Delhi.
2.	Ronald PC. 2007. <b>Plant-Pathogen Interactions: Methods in Molecular Biology</b> . Humana Press, New Jersey.

3.	Mehrotra RS.2006. <b>Plant pathology</b> . Tata McGraw Hill Publishing Co. Ltd., New Delhi.
4.	Sharma PD. 2004. <b>Plant pathology</b> . Rastogi Publications, New Delhi.
	Bilgrami S and Dubey HC. 1998. <b>A text book of modern Plant pathology</b> . Sangam Books Ltd., Mumbai.
5.	Stacey G and Keen TN. (ed). 1996. <b>Plant Microbe Interactions. Vols. I-III</b> . Chapman and Hall, New York; <b>Vol. IV</b> . APS Press, St. Paul, Minnesota.
6.	Singh RS. 1990. <b>Plant diseases</b> . Oxford and IBH Publishing Co., New Delhi.
7.	Butler EJ. 1973. <b>Fungi and diseases in plants</b> . Periodical Expert Book Agency, Delhi.
8.	Roberts D and Boothroyd CW. 1973. <b>Fundamentals of Plant pathology</b> . W. H. Freeman and Co., Ltd., New York.
9.	Rangaswamy G. 1972. <b>Disease of crop plants in India</b> . Prentice Hall of India, New Delhi.
10.	Strobell GA and Mathre DE. 1970. <b>Outline of Plant pathology</b> . D. Van Nostrand-Reinhold Co., New York.
11.	Matthews REF. 1970. <b>Plant virology</b> . Academic Press, New York.
12.	Agrios GN. 1969. <b>Plant Pathology</b> . Academic Press, New York.
13.	Walker JC. 1969. <b>Plant pathology</b> . McGraw Hill Book Co., New York.
14.	Wheeler BEJ.1969. <b>An introduction of Plant diseases</b> . John Wiley and Sons Ltd., New York.
15.	Smith KM. 1968. <b>Plant viruses</b> . Methuen, London.
16.	Mundkar BB.1967. <b>Fungi and Plant diseases</b> . McMillan and Co. Ltd., Calcutta.
17.	Wood RKS.1967. <b>Physiological Plant Pathology</b> . Blackwell Scientific Publications, Oxford.
18.	Kelman A. 1967. <b>Source Book of Laboratory Exercise in Plant Pathology</b> . W. H. Freeman, New York.
19.	Rangaswamy G. 1962. <b>Bacterial Plant Diseases in India</b> . Asia Publishing House,

	Bombay.
<b>20.</b>	Horsfall JC and Diamond AE.1960. <b>Plant Pathology – An Advanced Treatise – 3 volumes.</b> Academic Press, New York.
<b>21.</b>	Goodman et al.1957. <b>Biochemistry and Physiology of Infections and Plant Diseases.</b> Princeton, Van Nostrand, Belgium.
<b>22.</b>	Plank JEV.1953. <b>Plant Diseases – Epidemics and Control.</b> Academic Press, New York.



**M.Sc. Botany - Semester IV**  
**B 404 CROP PHYSIOLOGY AND BIOTECHNOLOGY**

**Theory**

S. No	Unit
<b>SECTION A</b>	
1.	Crop Physiology: Molecular biology of light reactions. Photosynthetic pathways.
2.	Mechanism of Photorespiration. Biotechnological strategies to improve photosynthesis, yield components. Source – sink relationships.
3.	Stress Physiology: Physiology and molecular biology of stress tolerance in response to water, salt and heavy metal stress.
4.	Methods in biotechnology: Tissue culture techniques in crop improvement, Protoplasts and cell fusion.
<b>SECTION B</b>	
5.	Recombinant DNA technology: basic principles of recombinant DNA technique. Techniques of transferring genes into plants.
6.	Potentials of Biotechnology: Molecular mechanism to confer herbicide resistance in crop plants. Genetic engineering to improve plant disease resistance.
7.	Genetic manipulation of crops for insect resistance, Genetic engineering of seed proteins and oils.
8.	Bioinformatics: Fundamentals of Genomics and Proteomics. PCR and its application in crop improvement, Principles of microarray technology and its applications.

**Practical**

S. No	Exhibit/Experiment
1.	Exercise-1: Chlorophyll absorption spectrum and quantitative determinations, assay of Hill reaction in isolated chloroplast. Crop growth analysis.
2.	Exercise-2: Determination of CO <sub>2</sub> compensation points in some crop plants, Estimation of carbohydrate, protein and nucleic acid contents in plants.
3.	Exercise-3: Determination of the activities of some enzymes associated with Carbohydrates and protein metabolism.
4.	Exercise-4: Effect of nitrogen and potassium on the growth and yield of crop plants.
5.	Exercise-5: Leaf anatomy in relation to diversity in photosynthetic pathways.
6.	Exercise-6: Effect of water and salt stress on the accumulation of proteins.
7.	Exercise-7: Estimation of nitrogen, phosphorus and potassium.



8.	Exercise-8: Experiments to study the effect of water and salt stress on seed germination and seedling development.
9.	Exercise-9: Experiments to study the weed control using some common herbicides.
10.	Exercise-10: Polyacrylamide gel electrophoresis of proteins.
11.	Exercise-11: Isolation of DNA.
12.	Exercise-12: Polymerase chain reaction.
13.	Exercise-13: Isolation of explants, establishment and maintenance of callus; Sub-culture of callus. Study of Somaclonal variation.
14.	Exercise-14: Isolation and culture of single cells.
15.	Exercise-15: Experiments on herbicide resistance and disease resistance in plants.

#### Reference Books

1.	Lebowitz RJ. 1995. <b>Plant Biotechnology, a laboratory manual</b> . Wm. C. Brown Publishers, Qubuque.
2.	Murray Meo – young. 1995. <b>Comprehensive Biotechnology. Vol . 1</b> . Pergamon Press Oxford.
3.	Marshall G and Walters O (ed) 1994. <b>Molecular Biology in Crop Protection</b> . Champman and Hall.
4.	Old RW and Primrose SB. 1994. <b>Principles of gene manipulation</b> . Blackwell Science.
5.	Salunkhe DK, Bhatt NR and Desai BB. 1990. <b>Post Harvest Biotechnology of Flowers and Ornamental Plants</b> . N. Bayopokash, Calcutta
6.	Davies KE. (ed) 1988. <b>Genome Analysis</b> . IRI Press, Oxford.
7.	Pierik RIM. 1987. <b>Invitro Culture of Higher Plants</b> . Martinus Nihoff Publishers Dordrecht.
8.	Primrose SB. 1987. <b>Molecular Biotechnology</b> . Blackwell Scientific Publications,
9.	Day PR. 1986. <b>Biotechnology and Crop Improvement and Protection</b> . BCPC Publications.
10.	Mantell SH and Smith N (ed) 1983. <b>Plant Biotechnology</b> . Cambridge University Press, Cambridge.
11.	Noggle GR and Fritz GJ. 1977. <b>Introductory plant physiology</b> .
12.	Reinert J and Bajaj YPS. 1977. <b>Plant Cell, Tissue and Organ Culture</b> . Springer – verlag, Berlin.
13.	Lange OI, Kappen L and Schule DD. 1976. <b>Water and Plant Life</b> .

<b>14.</b>	Burris RH and Black CC (ed) 1975. <b>CO<sub>2</sub> Metabolism and Productivity of Plants.</b>
<b>15.</b>	Evans IT. 1975. <b>Crop Physiology.</b>
<b>16.</b>	Major AM and Mayber P. 1975. <b>The germination of seeds.</b> 2 <sup>nd</sup> Edition.
<b>17.</b>	Mayber PA and Gele J. (ed) 1975. <b>Plants in Saline Environments.</b>
<b>18.</b>	Ashston and Crafts A. 1973. <b>Mode of Action of Herbicides.</b>
<b>19.</b>	Epstein E. 1972. <b>Mineral Nutrition of Plants: Principles and Perspectives.</b>
<b>20.</b>	Fogg GK. 1972. <b>Photosynthesis.</b>
<b>21.</b>	Hillman WS. 1972. <b>The Physiology of Flowering</b>
<b>22.</b>	Kozlowski TT. (ed) 1972. <b>Seed Biology. 3 Vols.</b>
<b>23.</b>	Levitt J. 1972. <b>Response of Plants to Environmental Stresses.</b>
<b>24.</b>	Hatch MD, Osmond CB and Slatyer RO (ed) 1971. <b>Photosynthesis and Photorespiration.</b>
<b>25.</b>	Gregory RPF. 1971. <b>Biochemistry of Photosynthesis.</b>
<b>26.</b>	Zelitch I. 1971. <b>Photosynthesis, Photorespiration and Plant Productivity.</b>
<b>27.</b>	Gollek B. (ed) 1970. <b>Structure and Function of Plant Cells in Saline Habitats.</b>
<b>28.</b>	Kozlowski TT. (ed) 1968. <b>Water Deficit and Plant Growth.</b>
<b>29.</b>	<b>Annual Review of Plant Physiology.</b> 1950. Vol. – Annual Reviews Inc., Stanford.

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AC IIIsem - Paper 3 Syllabus.doc

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M.Sc\_Analytical Chemistry Practical\_Syllabus.doc

**Adikavi Nannaya University :: Rajahmundry**  
**Department of Chemistry**  
**M.Sc. (Final) Chemistry Syllabus for III-Semester**  
**Specialization: Analytical Chemistry**  
**Paper - I: Separation Methods – I**  
(Effective from 2016-17 Admitted batch)

**Unit – I Chromatography - 1**

**Chromatography:** classification of different chromatographic methods, methods of development-Elution development, Gradient elution development, displacement development, and frontal analysis.

Principles of chromatography, different migration, adsorption phenomena, partition, adsorption coefficient, retardation factor, retention time and volume, column capacity, temperature effects, partition isotherm.

Dynamics of chromatography-efficiency of chromatographic column, zone spreading, High Equivalent Theoretical Plate (HETP), Van Deemter equation, resolution, choice of column, length and flow velocity, qualitative and quantitative analysis.

**Unit - II Chromatography – 2**

**Column chromatography (adsorption chromatography):** principles, general aspects, adsorption isotherms, chromatographic media, nature of forces between adsorbent and solutes, eluents (mobile phase), column chromatography without detectors and liquid chromatography with detectors and applications.

**Gel Exclusion chromatography or Gel filtration chromatography:** principles, properties of xerogels, apparatus and detectors, resolution of gel type, applications to organic compounds.

**Capillary Electrophoresis :** Principle, Details of the Instrument, Applications to Inorganic and Organic compounds.

**Unit – III Chromatography – 3**

**Gas chromatography:** Theory, Instrument description of equipment and different parts, columns (packed and capillary columns), detector specifications-thermal conductivity detector, flame ionization detector, electron capture detector, nitrogen-phosphorus detector, photo ionization detector, programmed temperature gas chromatography; applications in the analysis of gases, petroleum products etc., other detectors used their Principles and Applications.

**Inorganic molecular sieves:** structure of zeolites, crystals, types of sieves, application in the separation of gases including hydrocarbons, ion exclusion-principles and applications,

Counter current chromatography-principles and application, Affinity chromatography- principles and applications

### ***GC-MS – Introduction***

Instrumentation – GC – MS interface – Mass spectrometer (MS) Instrument operation, processing GC – MS data – ion chromatogram Library searching – Quantitative measurement – sample preparation Selected ion monitoring – Application of GC-MS for Trace constituents. Drugs analysis, Environmental analysis and others.

## **Unit – IV Chromatography – 4**

***Liquid-liquid partition chromatography:*** principle, supports, partitioning liquids, eluents, reverse phase chromatography, apparatus, applications

***High performance liquid chromatography:*** Theory, Instrument description of the different parts of the equipment, columns, detectors-UV detector, refractometric detector, Fluorescence detector, Diode Array detector, applications in the separation of organic compounds, names of other detectors used their Principles and Applications.

***LC-MS*** – Introduction – Instrumentation – liquid chromatograph – Mass spectrometer Interface – Instrumental details – Processing LC-MS data – ion chromatograms – Library searching – Quantitative measurements. Sample preparation – selected ion monitoring. Application of LC-MS for Drug analysis, Environmental samples and others.

### **Text books:**

1. R.P.W Scott, Techniques and practice of Chromatography, Marel Dekker Inc., New York
2. M.N. Sastri ,Separation methods, Himalaya Publishing Company, Mumbai

### **Reference books:**

1. E. Helfman, Chromatography, Van Nostrand, Reinhold, New York
2. E. Lederer and M. Lederer, Chromatography, Elsevier, Amsterdam.
3. Chemical separation methods, John A Dean, Von Nostrand Reinhold, New York
4. R.P.W Scott, Techniques and practice of Chromatography, Marel Dekker Inc., New York
5. H.M Mc Nair and J. M. Miller, Basic Gas Chromatography, John Wiley, New York
6. W. Jeumings, Analytical Gas chromatography, Academic Press, New York
7. H. Eugelhardt (ed), Practice of HPLC, Springer Verrag, Berrin

**Adikavi Nannaya University :: Rajahmundry**  
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**Specialization: Analytical Chemistry**  
**Paper- II: Quality control and Traditional methods of Analysis-I**  
(Effective from 2016-17 Admitted batch)

**Unit – I: Quality control in Analytical Chemistry**

- (a) **Characteristics of an analysis:** quality of an analytical procedure, limit of detection, sensitivity, safety, cost measurability, selectivity and specificity, quality control-principles of Ruggedness test, control charts, Youden plot, and ranking test.
- (b) **Evaluation and reliability of analytical data:** limitation of analytical methods, accuracy, precision, errors in chemical analysis, classification of errors, minimization of errors, significant figures, computations and propagation of errors.
- (c) **Statistical analysis:** Mean deviation, Standard deviation, coefficient of variance, normal distribution, F test, T test, rejection of results, presentation of data.
- (d) **Quality assurance and management systems:** elements of quality assurance, quality assurance in design, development, production and services, quality and quantity management system, **ISO 9000** and **ISO 14000** series-meaning of quality, quality process model, customer requirement of quality calibration and testing, statistical process control, process control tools, control chart, statistical quality control, acceptance sampling.  
Good laboratory practices (GLP) – need for GLP, GLP implementation and organization, GLP status in India.
- (e) Brief out line of ICH guide lines on drug substances and products.

**Unit – II Decomposition techniques in analysis**

**(a) Inorganic Compounds**

Principle of decomposition and Dissolution. Difference between dissolution / decomposition of Organic and Inorganic substances.

Importance of Decomposition Techniques in Analysis.

Principle of Dissolution of an inorganic substance.

Decomposition of samples with acids – H<sub>2</sub>O, HCl, HF, HNO<sub>3</sub>, H<sub>2</sub>SO<sub>4</sub> and HClO<sub>4</sub>

Decomposition of samples by fusion, Principle and with two examples each

Alkali Fusion--- Na<sub>2</sub>CO<sub>3</sub>, NaOH,

Acidic Fusion--- Sodium Hydro Sulphate, Sodium Pyro Sulphate

Oxidation Fusion---Na<sub>2</sub>O<sub>2</sub>, Sodium Chlorate

Reductive Fusion Na<sub>2</sub>CO<sub>3</sub> + Na<sub>4</sub>BO<sub>4</sub>

What is Sintering process, How is it different from Fusion.

Fusion with alkali carbonates, alkali hydroxides, Sodium Peroxide

Decomposition of samples by sintering with sodium peroxide, sodium carbonate.

Principles of decomposition at high temperatures, high pressures .

Principles of Microwave and ultrasonic decomposition techniques.

### **(b) Organic Compounds**

Principles of solubility of organic compounds, non polar, polar solvents.  
Recrystallisation methods and application of solubility and Recrystallisation.

### **Unit – III Oxidant systems – Principles and applications in analysis**

Analytical chemistry of some selected oxidant systems – formal, standard and normal potentials in various media, species responsible for the oxidation properties, stability of the solutions, standardization, requirement for the selections of the oxidants, selection of suitable indicators for Oxidant systems.

- a) Inorganic Systems Mn (III), Mn (VII), Ce (IV), Cr (VI), V (V), periodate, iodate,
- b) Organic Systems chloramine-T.

### **Unit – IV Organic Functional group analysis**

Classification of functional groups with suitable examples.

Determination of:

- 1) Functional groups imparting acidic nature – thiol, enediol, phenolic hydroxyl.
- 2) Functional groups imparting basic nature – Aliphatic and Aromatic primary, secondary and tertiary amines – hydrazine derivatives.
- 3) Functional groups which impart neither acidic nor basic nature – Aldehydes, Ketones, Nitro, Methoxy, Olifinic.

### **Text books:**

1. Technical methods of analysis – Griffin, Mc Graw Hill Book Co.
2. Chemical Separation and measurements – D.G Peterseti, John M.Haves Sanders Co.
3. Chemical analysis – H.A Laitinan, Mc Graw Hill Book Co.
4. Newer redox titrants – Berka, Zyka and Vulterin, Pergamon Press
5. Volumetric Analysis, Vol III – I.M Kolthoff and R. Belcher, Interscience Public, New York
6. Vogel's Text Book of Inorganic Quantitative Analysis – J. Bassett et al, ELBS
7. Organic functional groups – S. Siggia

### **Reference Books:**

1. D.A Skoog, D.M West and F.J Holler, Analytical Chemistry, An Introduction, Sanders College Publishing, New York
2. K.V.S.G Murali Krishna, An Introduction ISO 9000, ISO 1400 Series, Environmental Management
3. Quality Assurance and Good Laboratory Practices, Prof. Y. Anjaneyulu, In Now Publication, New York
4. Quality Assurance in Analytical Chemistry – G.Kateman and F.W Pijpers, John Wiley and Sons, New York
5. Quantitative Chemical Analysis – I.M Kolthoff, E.B Sandel, E.J Meehan, S. Bruckenstein, Macmillan Company, London
6. Decomposition Techniques in Inorganic Analysis – J.Dolezal, P.Povondra, Z.Sulcek

**Adikavi Nannaya University :: Rajahmundry**  
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**Paper – III: Applied Analysis-I**  
(Effective from 2016-17 Admitted batch)

**Unit – I Analysis of Ores**

- (a) General techniques of analysis applied to complex materials - Scope of metallurgical analysis -  
General methods of dissolution of complex materials - Various chemical methods for the effective separation of the constituents in the complex materials.
- (b) Analysis of ores: Iron ore- Analysis of the Constituents – Moisture , loss of ignition, Total Iron, ferrous Iron ,Ferric Iron, alumina , silica, Titania, Lime, Magnesia, Sulphur, phosphorous, manganese, alkalies, combined water, Carbon in blast furnace, flue dust and sinter.
- (c) Manganese Ore - Analysis of the Constituents – Total Manganese,  $\text{MnO}_2$ ,  $\text{SiO}_2$ ,  $\text{BaO}$ ,  $\text{Fe}_2\text{O}_3$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{CaO}$ , P and S
- (d) Chromite Ore - Analysis of the Constituents – Chromium,  $\text{SiO}_2$ ,  $\text{FeO}$ ,  $\text{Al}_2\text{O}_3$   $\text{CaO}$ , &  $\text{MgO}$ .
- (e) Phosphate rock Ore - Analysis of the Constituents -  $\text{CaO}$ ,  $\text{P}_2\text{O}_5$ , F,  $\text{SiO}_2$ ,  $\text{CO}_2$ , S,  $\text{Na}_2\text{O}$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{Fe}_2\text{O}_3$ ,  $\text{MgO}$ ,  $\text{K}_2\text{O}$ ,  $\text{Cl}$ ,  $\text{MnO}$ . Organic carbon, Moisture, Loss of ignition.
- (f) Aluminium Ore (Bauxite) - Analysis of the Constituents – Silica, Alumina,  $\text{Fe}_2\text{O}_3$ , Titania,  $\text{MnO}$ ,  $\text{P}_2\text{O}_5$ ,  $\text{CaO}$ ,  $\text{MgO}$ , vanadium, zirconium, and alkalies.

**Unit – II Analysis of Finished Products – I**

- (a) Analysis of steel for C, Si ,S, P, Mn, Ni, Cr; Mg and analysis of blast furnace slag .
- (b) Analysis of refractory materials: fire clay, flour spar, and magnesite
- (c) Analysis of fluxes - limestone and dolomite.

**Unit – III Analysis of Finished Products – II**

- (a) Chemical Analysis of cement-silica,  $\text{NH}_4\text{OH}$  group, ferric oxide, alumina, lime, magnesia, Sulphide Sulphur ,  $\text{K}_2\text{O}$ ,  $\text{Na}_2\text{O}$ , free  $\text{CaO}$  in Cement and Clinker,  $\text{SO}_3$  and loss on ignition.
- (b) Analysis of oils - saponification number, iodine number, and acid number..
- (c) Analysis of soaps - moisture, volatile matter, total alkali, total fatty matter, free caustic alkali or free fatty acids, sodium silicate , chloride.
- (d) Analysis of paints-vehicle and pigment,  $\text{BaSO}_4$ , total lead and lead chromate



## Unit – IV Assessment of water Quality

Sources of water, classification of water for different uses, types of water pollutants and their effects,

Analytical methods for the determination of the following ions in water:

Anions:  $\text{CO}_3^{2-}$ ,  $\text{HCO}_3^-$ ,  $\text{F}^-$ ,  $\text{Cl}^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{PO}_4^{3-}$ ,  $\text{NO}_3^-$ ,  $\text{NO}_2^-$ ,  $\text{CN}^-$ ,  $\text{S}^{2-}$

Cations:  $\text{Fe}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{Cr}^{3+}$ ,  $\text{As}^{5+}$ ,  $\text{Pb}^{2+}$ ,  $\text{Hg}^{2+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Cd}^{2+}$ ,  $\text{Co}^{2+}$

Determination of Dissolved oxygen (D.O), Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD), standards for drinking water.

### Text books

1. Handbook of Analytical Control of Iron and Steel Production, Harrison John, Wiley 1979
2. Standard methods of Chemical Analysis, Welcher
3. Technical Methods of Analysis, Griffin, Mc Graw Hill
4. Commercial Methods of Analysis, Foster Dee Snel and Frank M. Griffin, Mc Graw Hill Book Co.
5. Water Pollution, Lalude, Mc Graw Hill
6. Environmental Chemistry, Anil Kumar De, Wiley Eastern Ltd.
7. Environmental Analysis, S.M. Khopkar (IIT Bombay)

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**Paper – IV: INSTRUMENTAL METHODS OF ANALYSIS - I**

(Effective from 2016-17 Admitted batch)

**Unit – I : Spectroscopic Methods - 1**

- (a) **UV-Visible Spectroscopy:** laws of absorption, deviation from Beer's law, single and double beam spectrophotometers-instrumentation, sources of radiation, detectors, qualitative analysis by absorption measurements, general precautions in colorimetric determinations, determination of certain metal ions by using ligands –  $\text{Fe}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Al}^{3+}$ ,  $\text{NH}_4^+$ ,  $\text{Cr}^{3+}$ ,  $\text{Cr}^{6+}$ ,  $\text{Co}^{3+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Ni}^{2+}$  and anions –  $\text{NO}_2^-$ ,  $\text{PO}_4^{3-}$  using suitable reagents, simultaneous determinations of dichromate and permanganate in a mixture, spectrophotometric titrations, principle of diode array spectrophotometers.
- (b) **Spectrofluorimetry:** Theory of fluorescence, phosphorescence, factors affecting the above, quenching, relation between intensity of fluorescence and concentration, instrumentation, application with reference to  $\text{Al}^{3+}$ , chromium salts, fluorescence, thiamin (B1) and riboflavin (B2) in drug samples.

**Unit – II : Spectroscopic Methods - 2**

- (a) **Infrared spectroscopy:** units of frequency, wavelength and wave number molecular vibrations, factors influencing vibrational frequencies, instrumentation, sampling techniques, detectors, characteristic frequencies of organic molecules, qualitative and quantitative analysis with reference to (petroleum refinery and polymer industry), selected molecules like CO, CO<sub>2</sub>, non-destructive IR method for the analysis of CO and other organic compounds, principles of Fourier transform IR.
- (b) **Raman Spectroscopy:** Raman effect and spectra, differences between Raman spectra and IR spectra, instrumentation, Raman spectra of CO, CO<sub>2</sub>, N<sub>2</sub>O, H<sub>2</sub>O.

**Unit – III : Spectroscopic Methods -3**

- (a) **NMR Spectroscopy:** resonance condition, origin of NMR spectra, instrumentation, chemical shift, factors affecting chemical shift, shielding, spin-spin splitting, mechanism for spin-spin coupling, interpretation of NMR spectra of typical organic compounds, factors influencing NMR spectra, fast chemical reactions, magnitude of I, nuclei with quadrupole moments, FT NMR, study of isotopes other than proton-<sup>13</sup>C, <sup>15</sup>N, <sup>19</sup>F, <sup>31</sup>P, <sup>11</sup>B, double resonance, spin tickling, shift reagents, applications.

(b) *ESR Spectroscopy*: principle, g value, hyper fine splitting, qualitative analysis, Krammers degeneracy, fine splitting, instrumentation, introduction to double resonance technique, difference between ESR and NMR spectra, quantitative analysis, application to study of free radicals and other analytical applications.

#### **Unit – IV : Spectroscopic Methods -4**

(a) *Mass Spectroscopy*: Principle, basic instrumentation, energetics of ion formation, types of peaks observed, resolution, qualitative analysis, molecular weight determination, quantitative analysis, advantages

(b) *X-ray Spectroscopy (XRF)*: chemical analysis by X-ray spectrometers, energy dispersive and wavelength dispersive techniques, evaluation methods, instrumentation, matrix effects, applications.

#### **Text Books:**

1. Instrumental methods of analysis – H.H Willard, Meritt Jr. and J.A Dean
2. Principles of instrumental analysis – Skoog and West
3. Vogels Textbook of Quantitative Inorganic analysis – J. Basset, R.C Denney, G.H Jefferey and J.Madhan
4. Instrumental methods of analysis – B.K Sarma, Goel Publishing House, Meerut
5. Instrumental methods of Analysis – Chatwal and Anand
6. Instrumental methods of Analysis – Ewing
7. Handbook of ICP
8. The ICP – Bogdain B.

#### **Reference Books:**

1. Applications of ICP-MS, A.R Date and A.L Glay, London (Eds), Blackie, London
2. A. Moutaser and D.W Golightly (Eds), ICP in Analytical Atomic Spectrometry, VeH Publishers, New York
3. G.I Moore, Introduction to ICP emission Spectrometry in Analytical Spectroscopy, Elsevier, Amsterdam

**Adikavi Nannaya University :: Rajahmundry**  
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**Paper-1: Separation Methods – II**  
(Effective from 2016-17 Admitted batch)

**Unit – I Chromatography - 5**

- (a) **Paper chromatography:** principle, papers as a chromatographic medium, modified papers, solvent systems, mechanism of paper chromatography, experimental technique, different development methods-ascending, descending, horizontal, circular spreading, multiple development, two dimensional development, reverse phase paper chromatographic technique-visualization and evaluation of chromatograms, applications.
- (b) **Thin layer chromatography:** principle, chromatographic media-coating materials, applications, activation of adsorbent, sample development, solvent systems, development of chromatoplate, types of development, visualization methods, documentation, applications in the separation, HPTLC-principle, technique, applications.

**Unit – II Chromatography - 6**

- (a) **Ion Exchange:** principles of ion-exchange systems, synthetic ion-exchange resins, properties of anion and cation exchange resins, ion-exchange mechanism, ion-exchange equilibria, selectivity, ion-exchange capacity, applications of ion-exchangers in different fields.
- (b) **Ion exchange chromatography:** Principle, Equipment, Application Specifically Separations of Lanthanides, Actinides, amino acids.
- (c) **Ion chromatography:** principles of separation, instrumentation, detectors, separation of cations and anions, applications in the analysis of water and air pollutants.

**Unit – III Sampling of Solids, Liquids and Gases**

**Sampling:** Basis of sampling, purpose of sampling, homogeneous and heterogeneous samples, statistical criteria for good sampling, sample size, sampling unit, gross sample, laboratory sample.

Sampling of Solids: Cone and Quartering method, Long pile and alternative shovel method, precautions in preservation of solid samples, sampling of metals and other solids rods, wires, sheets, plates, especially Gold, Silver, Iron and other metals.

Sampling of different types of liquids: different sampling techniques, sampling of drinking water, industrial effluents, precautions in sampling and preservation of collected liquid samples.

Sampling of gases: sampling and Preconcentration by adsorption or absorption method, instantaneous monitoring, sampling in samplers and subsequent monitoring, different types of gas samplers, precautions in preservation of samples, systematic sampling and random sampling.

#### **Unit – IV Importance of Analytical chemistry & Solvent Extraction**

**(a) Importance of Analytical Chemistry to Industrial Research:** Importance of Qualitative and Quantitative analysis in research and development, industries and other branches of science.

Development and validation of an analytical method, units, concentrations, calculations, standards, chemical reactions, expressions of concentrations, importance of separation methods with examples.

**(b) Solvent Extraction:** principles and processes of solvent extraction, Distribution Law and Partition coefficient, nature of partition forces, different types of solvent extraction systems – Batch extraction, Continuous extraction, Counter current extraction, solvent extraction systems, applications in metallurgy, general applications in analysis and pre-concentration, special extraction systems like crown ethers, super fluid and surfactant extractions-examples.

#### **Text books:**

1. R.P.W Scott, Techniques and practice of Chromatography, Marel Dekker Inc., New York
2. Separation methods, M.N Sastri, Himalaya Publishing Company, Mumbai

#### **Reference books:**

1. E. Helfman, Chromatography, Van Nostrand, Reinhold, New York
2. E. Lederer and M. Lederer, Chromatography, Elsevier, Amsterdam.
3. Chemical separation methods, John A Dean, Von Nostrand Reinhold, New York
4. R.P.W Scott, Techniques and practice of Chromatography, Marel Dekker Inc., New York
5. E.Stahl, Thin layer chromatography, Academic Press, New York
6. James, G.Tartor (Ion chromatography)

**Adikavi Nannaya University :: Rajahmundry**  
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**Paper – II : Traditional Methods of Analysis - II**  
(Effective from 2016-17 Admitted batch)

**Unit – I Precipitation methods - 1**

- (a) Crystal habit and super saturation, nucleation and crystal growth, homogeneous and heterogeneous nucleation, solubility and particle size, colloids, completeness of precipitation, effect of excess precipitant, pH, complex formation, temperature, purity of precipitates, aging.
- (b) **Co-precipitation and post precipitation** : theory of adsorption of salts having an ion in common with the main precipitate, co-precipitation in colloidal precipitates, adsorption of solvents, mixed crystal formation by occlusion and entrapment, re-precipitation with examples, Post-precipitation – theory of post-precipitation, examples of post-precipitation, conditions for obtaining pure and quantitative precipitates.
- (c) **Precipitation Titrations**: Principle, Indicators for precipitation titrations, determination of halides.

**Unit – II Precipitation methods - 2**

- (a) **Precipitation from Homogeneous Solution (PFHS)**: theory of PFHS, methods of PFHS – increase in pH, decrease in pH, cation release, anion release, reagent synthesis, change in oxidation state, photochemical reactions, precipitation from mixed solvents. Applications of PFHS methods.
- (b) **Gravimetric determinations**: nature of species, preparation of solutions, limitations, interferences, inorganic precipitants-chloride and sulphate, organic precipitants dimethyl glyoxime (DMG), oxine, benzidine, salicylaldehyde, benzoin oxime, sodium tetraphenyl boron, tetraphenyl arsonium chloride.
- (a) **Electro-gravimetric analysis**: principle, important terms in electrogravimetry, decomposition voltage or decomposition potential, over voltage and their importance, instrumentation, electrolysis at constant current, determination of  $\text{Cu}^{2+}$  by constant current electrolysis, electrolysis at controlled potentials, determination of Cu, Pb, Sn in brass and bronze by controlled potential electrolysis.

**Unit – III Reductant system – Principles and applications in analysis**

Analytical chemistry of some selected reductant systems – formal, standard and normal potentials in various media, stability of the solutions, species responsible for

the reduction properties, standardization, requirement for the selection of the reductants, selection of suitable indicators for various reductant systems,

- (a) Inorganic Systems – Cr (II), V (II), Ti (III), Sn (II), Fe (II) in  $H_3PO_4$  and hydrazine,
- (b) Organic Systems – hydroquinone and Ascorbic acid.

#### **Unit – IV Analysis of some selected Drugs:**

Basic considerations of drugs – Classification

Determination of the following Drugs:

- 1) Acetyl salicylic acid ( Antipyretic – Analgesic )
- 2) Testosterone, progesterone and cortisone (Steroids and corticoids)
- 3) Sulphadiazine ( sulphadruugs)
- 4) Phenobarbitone (Barbituric acid derivatives)
- 5) Chloramphenicol, Benzyl penicillin and Tetracycline (Antibiotics)
- 6) Thiamine (B1), Riboflavin (B2) and ascorbic acid (c) [Vitamins]
- 7) Isoniazid ( Antimicrobial agents)
- 8) Methyldopa (Antihypertensive agents)
- 9) Metronidazole (Antiamoebic agents).

#### **Text books:**

- 1. Technical methods of analysis – Griffin, Mc Graw Hill Book Co.
- 2. Chemical Separation and measurements – D.G Peterseti, John M.Haves Sanders Co.
- 3. Chemical analysis – H.A Laitinan, Mc Graw Hill Book Co.
- 4. Newer redox titrants – Berka, Zyka and Vulterin, Pergamon Press
- 5. Volumetric Analysis, Vol III – I.M Kolthoff and R.Belvher, Interscience Public, New York
- 6. Vogel's Text Book of norganic Quantitative Analysis – J.Bassett et al, ELBS
- 7. Pharmaceutical analysis – T. Higuchi, Brochmann hausfen

#### **Reference Books:**

- 1. D.A Skoog, D.M West and F.J Holler, Analytical Chemistry, An Introduction, Sanders College Publishing, New York
- 2. Quantitative Chemical Analysis – I.M Kolthoff, E.B Sandel, E.J Meehan, S. Bruckenstein, Macmillan Company, London

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**Unit – I Analysis of raw materials**

- (a) Analysis of non-ferrous alloys:
- (i) Brass – Analysis of the constituents – Cu, Zn, Sn, Pb and Fe.
  - (ii) Bronze - Analysis of the constituents – Cu, Sn, Zn, Pb and Fe.
  - (iii) Solder - Analysis of the constituents – Sn, Pb and Sb.
- (b) Analysis of Ferro alloys :
- (i) Ferro silicon - Analysis of the constituents – Si, C, P, S
  - (ii) Ferro vanadium - Analysis of the constituents – V, C, P, S, Si, Al.
  - (iii) Ferro manganese - Analysis of the constituents – Mn, S, C, P, Si
  - (iv) Silico manganese - Analysis of the constituents – Mn, S, C, P, Si
  - (v) Ferro chromium - Analysis of the constituents – Cr, C, Si.

**Unit – II Analysis of Soil, Fertilizer and Fuel**

- (a) Analysis of soils: sampling, determination of moisture, total N, P, Si, lime, humus nitrogen, alkali salts, soil absorption ratio.
- (b) Analysis of fertilizers: ammonical fertilizers, Phosphate fertilizers, Nitrate fertilizers.
- (c) Analysis of fuels: solid fuels-coal, proximate analysis, ultimate analysis, heating value, grading of coal based on Ultimate Heat Value(UHV).

**Unit – III Assessment of Air Quality**

Composition of pure air, classification of air pollutants, toxic elements present in dust and their sources – collection of air samples.

Sources, effects, control of pollution and chemical analysis for the following.

- (a) Primary pollutants:
- (i) Carbon compounds - Carbon monoxide(CO) and Carbon dioxide(CO<sub>2</sub>).
  - (ii) Sulphur compounds- sulphur dioxide (SO<sub>2</sub>), Sulphur trioxide (SO<sub>3</sub>) and Hydrogen Sulphide (H<sub>2</sub>S).
  - (iii) Nitrogen compounds - nitric oxide (NO), and nitrogen dioxide (NO<sub>2</sub>),
  - (iv) Hydrocarbons - Aliphatic hydrocarbons and polycyclic aromatic hydrocarbons (PAH).
  - (v) Particulate matter - Respirable and Suspended particulate matter, Inorganic and Organic particulates.



- (b) Secondary pollutants - ozone (O<sub>3</sub>), peroxy acetyl nitrate (PAN), peroxy benzyl nitrate (PBN)
- (c) Standards for ambient air quality.

#### **Unit- IV Kinetic Methods of Analysis & Non aqueous Titrimetry**

- (a) Kinetic methods of analysis: introduction, slow reactions, catalyzed reactions, methods of determination of catalyst concentration, extrapolation method for the determination of catalyst, variable time method, fixed time method, examples for the determination of toxic metals and anions using some typical kinetic reactions.
- (b) Non aqueous titrimetry : Classification of solvents and titrations for non aqueous titrimetry- Types of reactions - Indicators .
- (i) Determination of acids
  - (ii) Determination of bases
  - (iii) Karl-Fisher reagent for the determination of moisture content in drugs and other samples.

#### **Text books**

1. Chemical analysis – H.A Laitinan, Mc Graw Hill Book Co
2. Standard methods of Chemical Analysis, Welcher
2. Technical Methods of Analysis, Griffin, Mc Graw Hill
3. Commercial Methods of Analysis, Foster Dee Sneel and Frank M. Griffin, Mc Graw Hill Book Co.
4. Environmental Chemistry, Anil Kumar De, Wiley Eastern Ltd.
5. Environmental Analysis, S.M Khopkar (IIT Bombay)
6. Environmental Air Analysis, Trivedi and Kudesia, Akashdeep Pub.

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**Paper - IV: Instrumental Methods of Analysis -II**  
(Effective from 2016-17 Admitted batch)

**Unit – I: Spectro-analytical Methods of Analysis**

(a) *Flame photometry*: theory, instrumentation, combustion flames, detectors, and analysis of Na, K, Ca, Mg

(b) *Atomic Absorption Spectrometer*: theory, instrumentation, flame and non-flame techniques, resonance line sources, hollow cathode lamp, instrumentation, chemical and spectral interferences, applications with special reference to analysis of trace metals in oils, alloys and toxic metals in drinking water and effluents

(c) *Inductively coupled plasma spectrometer (ICP-AES, ICP-MS)*: principles, instrumentation, plasma, AES detectors, quadrupole mass spectrometers, difference between the two detectors, analysis methods for liquids and solids, applications in the analysis of trace and toxic metals in water, geological and industrial samples.

(d) *Arc and Spark spectrographic Direct analysis of solid for metals.*

**Unit – II Thermal methods of Analysis**

(a) Thermo gravimetry-theory, instrumentation, applications with special reference to  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ ,  $\text{CaC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ ,  $\text{CaCO}_3$ ,  $(\text{COOH})_2 \cdot 2\text{H}_2\text{O}$

(b) Differential thermal analysis-principle, instrumentation, difference between TG and DTA - applications with special reference to the clays and minerals, coals (fuels)

(c) Differential scanning calorimetry-principle, instrumentation, applications to inorganic materials like chlorates and per chlorates, ammonium nitrate, organic compounds and Drugs.

**Unit- III : Electro analytical Methods of Analysis - 1**

(a) *Voltametry and polarographic analysis* : principle of polarography, residual current, migration current, diffusion current, half-wave potential, Ilkovic equation, instrumentation, Dropping mercury electrode (DME), advantages and disadvantages of DME, qualitative and quantitative analysis of inorganic ions-Cu, Bi, Pb, Cd, Zn, AC polarography, pulse polarography

(b) *Anode stripping voltametry*: principle, instrumentation, Hanging mercury drop electrode, application in the analysis of Pb and Cd in environmental samples, principle of cathode stripping voltametry.

- (c) **Coulometric analysis:** principles of coulometric analysis with constant current, coulometric analysis with controlled potential, applications of coulometric methods for the analysis of cations-As (III), Fe (II) and I<sup>-</sup> and S<sup>2-</sup> by using I<sub>2</sub> liberations and Ce<sup>4+</sup> liberation in solutions

#### **Unit – IV Electro Analytical and Radio chemical methods of analysis - 2**

- (a) **Ion Selective Electrodes:** reference electrodes - hydrogen electrode, calomel electrode, silver chloride electrode; indicator electrodes – hydrogen and glass electrodes, theory of membrane potentials and liquid junction potentials, types of ion selective electrodes, basic properties, potentials and construction, calibration of ion selective electrodes, ion selective electrodes with fixed membrane sites, silver, lead, cadmium, sulfide, fluoride, cyanide and glass electrodes, applications in the analysis of air and water pollutants, principles of liquid membrane, gas sensing and enzyme based electrode
- (b) **Radio chemical methods of analysis:** detection and measurement of radioactivity, introduction to radioactive tracers, applications of tracer technique, isotope dilution analysis - applications, activation analysis – application, advantages and disadvantages, radio carbon dating technique

#### **Text Books:**

1. Instrumental methods of analysis – H.H Willard, Meritt Jr. and J.A Dean
2. Principles of instrumental analysis – Skoog and West
1. Vogels Textbook of Quantitative Inorganic analysis – J. Basset, R.C Denney, G.H Jefferey and J.Madhan
2. Instrumental methods of analysis – B.K Sarma, Goel Publishing House, Meerut
3. Instrumental methods of Analysis – Chatwal and Anand
4. Instrumental methods of Analysis – Ewing

#### **Reference Books:**

W.Wendtlandt, Thermal Analysis, John Wiley Sons, New York

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**ANALYTICAL CHEMISTRY PRACTICAL – I**  
(With effect from 2016-2017 admitted batch)

**Classical Methods of Analysis-1**

1. Water analysis
  - (i) Determination of total hardness ( $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$ ) of water samples
  - (ii) Determination of chloride ( $\text{Cl}^-$ ) present in water samples
  - (iii) Determination of dissolved oxygen (DO) of drinking water and sewage water
  
2. Complexometric titrations
  - (i) Determination of the concentration of calcium in milk powder by complexometric titration (EDTA)
  - (ii) Determination of Calcium and Magnesium in limestone or dolomite samples using EDTA.
  
3. Fertilizer analysis
  - (i) Determination of ammonia from ammonia containing fertilizer
  - (ii) Determination of phosphate from fertilizer
  
4. Analysis of iron ore
  - (i) Complete analysis of iron ore
  - (ii) Determination of percentages of Fe (II) and Fe (III) present in iron ore sample
  
5. Analysis of Coal
  - (i) Determination of moisture content of coal sample
  - (ii) Determination of volatile matter of coal sample
  - (iii) Determination of fixed carbon of coal sample
  - (iv) Determination of ash content of coal sample

## **Instrumental Methods of Analysis-1**

1. pH metry
  - (i) Determination of alkalinity of a coloured effluent using pH metric titration.
  - (ii) Determination of purity of commercial HCl using pH metric titration.
  - (iii) Determination of purity of commercial H<sub>2</sub>SO<sub>4</sub> using pH metric titration.
  
2. Potentiometry
  - (i) Determination of Cr(VI) with Fe(II) using potentiometric end point
  - (ii) Determination of Fe (II) using ceric sulphate by potentiometric end point
  - (iii) Determination of a mixture of Ce(IV) and V(V) with Fe(II) by potentiometric end point
  - (iv) Determination of KSCN with AgNO<sub>3</sub> by potentiometric end point.
  
3. Spectrophotometry
  - (i) Determination of Fe (III) using potassium thiocyanate
  - (ii) Determination of Iron(II) using orthophenanthroline
  - (iii) Determination of phosphate in fertilizer and cola drinks by Molybdenum blue method
  - (iv) Determination of Manganese (II) -periodate method
  
4. Flame photometry
  - (i) Determination of sodium present in bread samples
  - (ii) Determination of sodium and potassium in a given sample of fertilizer
  
5. Thin layer chromatography: Determination of R<sub>f</sub> values and identification of organic compounds in a given mixture by TLC
  - (i) Separation of mixture of benzil and 2-nitrophenol
  - (ii) Mixture of benzophenone and naphthalene
  - (iii) Mixture of 2-nitrophenol and 4-nitrophenol

### References:

1. A Text Book of Quantitative Inorganic Analysis (3<sup>rd</sup> Edition) – A. I. Vogel

**Adikavi Nannaya University :: Rajahmundry**  
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**ANALYTICAL CHEMISTRY PRACTICAL – II**

(With effect from 2016-2017 admitted batch)

**Classical Methods of Analysis-2**

1. Water analysis
  - (i) Determination of alkalinity ( $\text{CO}_3^{2-}$ ,  $\text{HCO}_3^-$ ) of water samples.
  - (ii) Determination of chemical oxygen demand (COD) of drinking water and sewage water
  - (iii) Determination of biological oxygen demand (BOD) of drinking water and sewage water
  
2. Redox titrations
  - (i) Determination of oxalate in kidney stones by permanganometric titration.
  - (ii) Determination of Fe(II) present in an Iron tablet using  $\text{KMnO}_4$
  
3. Fertilizer analysis
  - (i) Determination of nitrate from fertilizer
  - (ii) Determination of sulfur (as sulfate) from sulfur containing fertilizer.
  
4. Analysis of oils and soaps
  - (i) Determination of saponification value, acid value and iodine value of oil sample
  - (ii) Determination of moisture content and total alkali of soaps
  
5. Separation and determination of ions by ion-exchanger resins
  - (i) Determination of  $\text{Na}^+$  by cation exchanger resin
  - (ii) Determination of  $\text{Na}^+$  and  $\text{K}^+$  in a mixture by cation exchanger resin
  - (iii) Determination of  $\text{Cl}^-$  and  $\text{Br}^-$  in a mixture by anion exchanger resin

## Instrumental Methods of Analysis-2

### 1. pH metry

- (i) Determination of purity of commercial  $\text{H}_3\text{PO}_4$  by pH metric titration
- (ii) Determination of  $\text{CH}_3\text{COOH}$  by pH metric titration.
- (iii) Determination of stability constant of copper glycinate

### 2. Potentiometry

- (i) Determination of Fe(II) using Mn(VII) of by potentiometric titration
- (ii) Determination of Fe (II) using V(V) of by potentiometric titration
- (iii) Determination of a mixture of Mn(VII) and V(V) with Fe(II) using potentiometric end point
- (iv) Determination of a mixture of bromide and chloride with  $\text{AgNO}_3$  using potentiometric end point

### 3. Spectrophotometry

- (i) Determination of nitrite in drinking water samples by diazotization method
- (ii) Determination of nitrate -phenoldisulphonic acid method
- (iii) Simultaneous Determination of Cr(VI) and Mn(VII) in a mixture without separation
- (iv) Determination of Cu(II) using EDTA – Photometric titration method.

### 4. Flame photometry

- (i) Determination of Lithium by flame photometry
- (ii) Determination of calcium from milk samples using flame photometry

### 5. Thin layer chromatography

- (i) Separation and identification of the given mixture of colourless compounds (Diphenylamine, Benzophenone and Naphthalene)
- (ii) Separation and identification of the given mixture of coloured compounds (azobenzene, hydroxyazobenzene, p-aminoazobenzene).

### References:

1. A Text Book of Quantitative Inorganic Analysis (3<sup>rd</sup> Edition) – A. I. Vogel



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## General Chemistry - I

### UNIT-1

**Basic Quantum Chemistry-I-** Wave equation-interpretation of wave function-properties of wave function-normalization and orthogonalisation, Operators- linear and non-linear- commutators of operators. Postulates of quantum mechanics; setting up of operators to observables; Hermitian operator- Eigen values and Eigen functions of Hermitian operator; Expansion theorems. Eigen functions of commuting operators-significance. Simultaneous measurement of properties and the uncertainty principle.

### UNIT-II

**Basic Quantum Chemistry-II-** Wave mechanics of simple systems with constant potential energy, particle in one-dimensional box- factors influencing color transition- dipole integral, Symmetry arguments in deriving the selection rules, the concept of tunneling- particle in three -dimensional box. Calculations using wave functions of the particle in a box- Orthogonality, measurability of energy, position and momentum, average values and probabilities. Rigid rotor, Wave mechanics of systems with variable potential energy-simple harmonic oscillator- solution of wave equation- selection rules.

### UNIT-III

**Fundamentals of Molecular Spectroscopy-I:** Microwave and IR- Spectroscopy- Rotational spectra of diatomic molecules- Rigid rotor-Selection rules- Calculations of bond length- Isotopic effect, Second order stark effect and its applications. Infrared spectra of diatomic molecules- harmonic and anharmonic oscillators- Selection rules- Overtones- Combination bands- Calculation of force constant, anharmonicity constant and zero point energy. Fermi resonance, simultaneous vibrational-rotational spectra of diatomic molecules.

### UNIT- IV

**Fundamentals of Molecular Spectroscopy-II:** Raman and Electronic Spectra- Classical and quantum mechanical explanations- Rotational Raman and Vibrational Raman spectra. Electronic spectra of diatomic molecules- Vibrational Coarse structure- intensities of spectral lines- Franck-Condon principle- applications, Rotational Fine structure- band head and band shading. Charge transfer spectra

### References/ Text books

1. Fundamentals of Molecular spectroscopy: by C.N. Banwell
2. Molecular spectroscopy: by B.K.Sharma
3. Molecular spectroscopy: by Aruldas
4. Introductory quantum mechanics: by A.K. Chandra
5. Quantum chemistry: by R.K. Prasad





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Paper- II: INORGANIC CHEMISTRY-I

UNIT-1

**Structure & Bonding:** Applications of VSEPR, Valence Bond and Molecular orbital theories in explaining the structures of simple molecules- role of p and d orbitals in pi bonding. Application of MO theory to square planar ( $\text{PtCl}_4^{2-}$ ) and Octahedral complexes ( $\text{CoF}_6^{3-}$ ,  $\text{Co}(\text{NH}_3)_6^{3+}$ ). Walsh diagram for  $\text{H}_2\text{O}$  molecule.

UNIT-II

**Inorganic cage and ring compounds** – preparation, structure and reactions of boranes, carboranes, metallocarboranes, boron–nitrogen ( $\text{H}_3\text{B}_3\text{N}_3\text{H}_3$ ), phosphorus–nitrogen ( $\text{N}_3\text{P}_3\text{Cl}_6$ ) and sulphur-nitrogen ( $\text{S}_4\text{N}_4$ ,  $(\text{SN})_x$ ) cyclic compounds. Electron counting in boranes – Wades rules (Polyhedral skeletal electron pair theory). Isopoly and heteropoly acids.

UNIT-III

**Coordination compounds:** Crystal field theory - crystal field splitting patterns in octahedral, tetrahedral, tetragonal, square planar, square pyramidal and trigonal bipyramidal geometries. Calculation of crystal field stabilization energies. Factors affecting crystal field splitting energies – Spectrochemical series – Jahn – Teller effect, nephelauxetic effect – ligand field theory. Term symbols – Russell – Sanders coupling – derivation of term symbols for various configurations. Spectroscopic ground states.

UNIT- IV

**Electronic spectra of transition metal complexes:** Selection rules, break down of selection rules – Orgel and Tanabe-Sugano diagrams for  $d^1$  –  $d^9$  octahedral and tetrahedral transition metal complexes of 3d series – Calculation of  $Dq$ ,  $B$  and  $\beta$  parameters. Charge transfer spectra. Magnetic properties of transition and inner transition metal complexes – spin and orbital moments – quenching of orbital momentum by crystal fields in complexes.

**Text books:**

1. Advanced Inorganic Chemistry by F.A. Cotton and G. Wilkinson, IV Edition, John Wiley and Sons, New York, 1980.
2. Inorganic Chemistry by J.E. Huheey, III Edition, Harper International Edition, 1983.
3. Theoretical Inorganic Chemistry, II Edition by M.C. Day and J. Selbin, Affiliated East-West press pvt. Ltd., New Delhi.
4. Inorganic Chemistry by Shriver and Atkins, Oxford University Press (1999).



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Paper –III: ORGANIC CHEMISTRY -I

UNIT – I

**Nature of bonding in organic molecules and Aromaticity**

15 Hrs

(A) *Electronic Effects and Reactive intermediates*:-Inductive effect, Mesomeric effect (Resonance), Hyperconjugation, Steric effect, Tautomerism, acidity and basicity of organic molecules Generation, structure, stability and reactivity of carbocations, carbanions, free radicals, carbenes, nitrenes and arynes

(B) *Criteria of Aromaticity*:-The Energy, Structural and Electronic Criteria for Aromaticity, Relationship among the Energetic, Structural, and Electronic Criteria of Aromaticity. Huckle's rule and MO Theory, aromaticity in benzenoid non-benzenoid compounds, Aromaticity in Charged and Fused-Ring Systems, Hetero-aromatic Systems, Annulenes: Cyclobutadiene, Benzene, 1,3,5,7-Cyclooctatetraene, [10] Annulenes- [12], [14], [16] and [18] annulenes, azulenes, fulvenes, fullerenes, ferrocene, anti-aromaticity and homo-aromaticity.

UNIT – II

**Stereo Chemistry & Molecular representation of organic molecules**

20 Hrs

(A) *Molecular Symmetry and Chirality*:-Symmetry elements, Definition and classification of Stereoisomers, Enantiomer, Diastereomer, Invertomer, Homomer, Epimer, Anomer, Configuration and Conformation Configurational nomenclature: D,L and R, S nomenclature, Molecules with a single chiral center: Tetra and Tri coordinate chiral center, Molecules with two or more chiral centers; constitutionally unsymmetrical and symmetrical molecules.

(B) *Geometrical Isomerism and Conformations of Cyclic Systems*:- Cis-trans, E, Z- and Syn & anti nomenclature, Methods of determining configuration of Geometrical isomers using physical, spectral and chemical methods, Stability, Cis-trans inter conversion. Conformations of cyclobutane, cyclopentane, cyclohexane, mono and disubstituted cyclohexanes.

(C) *Prochirality and Prostereoisomerism*:- Homotopic ligands and faces; enantiotopic ligands and faces; diastereotopic ligands and faces; nomenclature of enantiotopic ligands and faces (Pro-R, Pro-S, Re, Si carbonyl compounds and Alkenes)

(D) *Stereoisomerism in molecules without chiral Center* -Axial chirality Allenes, Alkylidene cycloalkanes, spiranes, nomenclature. *Atropisomerism*: Biphenyl derivatives, nomenclature. *Planar chirality*: Ansa compounds, paracyclophanes, trans-cyclooctene and Helicity.

UNIT – III

**Heterocyclic compounds**

15 Hrs

Importance of heterocyclic compounds as drugs. Nomenclature of heterocyclic systems based on ring size, number and nature of hetero atoms. Chemistry of heterocyclic compounds, synthesis and reactivity of the following systems: Quinoline, Isoquinoline, Indole, Pyrazole, Imidazole, Oxazole, Isoxazole, Pyridazine, pyrimidine and Pyrazine.

UNIT - IV

**Chemistry of some typical natural products (Alkaloids and Terpenoids)**

10 Hrs

A study of the following compounds involving their isolation, structure elucidation, synthesis and biogenesis of *Alkaloids*; Atropine, Nicotine, and Quinine.

*Terpenoids*:  $\alpha$ - Terpineol,  $\alpha$ -Pinene and Camphor.



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**Books Suggested:**

1. Advanced Organic Chemistry-Reactions, Mechanism and structure, Jerry March, 6th Ed. (John Wiley & Sons).
2. Organic Chemistry, Paula Yurkanis Bruice, 4th Ed. (Printice Hall)
3. Organic chemistry-Clayden J. (Oxford)
4. Organic Chemsitry, Wade, L.G. Jr. 5th Ed. (Pearson)
5. Advanced Organic Chemistry: Reactions and mechanisms, Miller Bernard & Other, 2nd Ed. (Pearson)
6. Mechanism and Theory in Organic Chemistry, Thomas H. Lowry, Kathleen S. Richardson, Harper & Row, (Publishers, Inc.).
7. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, 6th Ed., (Longman).
8. Reaction Mechanism in Organic Chemistry, P.S. Kalsi, 2nd Ed. (New Age International).
9. Organic Chemistry, R. T. Morrison and R. N. Boyd (Prentice-Hall)
10. Stereochemistry to Organic Compounds, E.L. Eliel (John Wiley).
11. Stereochemistry, P.S. Kalsi, 5th Ed. (New Age International).
12. Organic Chemistry Structure and Reactivity, Ege Seyhan, 3rd Ed. (AITBS)
13. Heterocyclic Chemistry, J.A.Joule, K. Kills and G. F. Smith, Chapman and Hall
14. Heterocyclic Chemistry, T.L.Gilchrist, Longman Scientific Technical
15. Heterocyclic Chemistry, Raj.K. Bansal.
16. An Introduction to the Heterocyclic Compounds, R. M. Acheson, John Wiley.

**REFERENCE BOOKS:**

1. Chemistry of Natural Products, K.W.Bentley
2. Stereochemistry of carbon compounds by E.Eliel, John Wiley & Sons, Inc.
3. Stereochemistry to Organic Compounds, D. Nasipuri, 2nd Ed. (New Age International).
4. Chemistry of Natural products by R.S. Kalsi Kalyani Publishers. 1983.



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Paper – IV: PHYSICAL CHEMISTRY-I

UNIT-I:

**Thermodynamics-I:** Concepts of partial molar properties – partial molar volume and its significance; Determination of partial molar volume: Graphical method, intercept method and apparent molar volume method. Partial molar free energy, chemical potential, Variation of chemical potential with T and P. Gibbs-Duhem equation-derivation and significance. Phase equilibrium- Derivation of phase rule from the concept of chemical potential. *Ideal solutions* - Thermodynamic properties of ideal solutions mixing quantities; Vapour pressure-Raoult's law; Thermodynamic properties of ideally dilute solutions. Vapour pressure- Henry's law.

*Non-ideal systems* -Concept of fugacity, fugacity coefficient. Determination of fugacity; Non ideal solutions. Activities and activity coefficients; Standard-state conventions for non ideal solutions; Determination of activity coefficients from vapour pressure measurements. Activity coefficients of non-volatile solutes using Gibbs-Duhem equation. Chemical equilibrium-effect of temperature on equilibrium constant- Van'tHoff equation

UNIT-II:

**Micelles and Macro molecules:** Surface active agents, classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization- phase separation and mass action models, Solubilization, micro emulsion, reverse micelles.

Polymer- definition, types of polymers, electrically conducting, fire resistant, liquid crystal polymers, kinetics of free radical polymerization. Molecular mass- Number and mass average molecular weight, molecular weight determination-End group analysis, Osmometry, viscometry, ultracentrifugation and light scattering methods.

UNIT-III:

**Chemical Kinetics:** Theories of reaction rates- Collision theory- Limitations, Transition state theory. Effect of ionic strength - Debye Huckel theory-Primary and secondary salt effects; Effect of dielectric constant, effect of substituent, Hammett equation-limitations, Taft equation; Prediction of rate constants- Consecutive reactions, parallel reactions, opposing reactions (Uni molecular steps only, no derivation). Specific and general acid-base catalysis; Skrabal diagram; Fast reactions- different methods of studying fast reactions- flow methods, relaxation methods- temperature jump and pressure jump methods.

UNIT-IV:

**Photochemistry:** Electronic transitions in molecules, Franck-Condon principle. Electronically excited molecules- singlet and triplet states, spin-orbit interaction. Quantum yield and its determination; Actinometry - ferrioxalate and uranyl oxalate actinometers-problems. Derivation of fluorescence and phosphorescence quantum yields. Quenching effect- Stern Volmer equation. Photochemical equilibrium and delayed fluorescence - E type and P type. Photochemical primary processes, types of photochemical reactions-photodissociation, addition and isomerisation reactions with examples.



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**Books:**

1. Physical Chemistry by Peter Atkins and Julio de Paula, Oxford University Press.
2. Physical Chemistry by G.W. Castellon, Narosha Publishing House
3. Physical Chemistry by W.J.Moore, Prentice Hall
4. Thermodynamics for Chemists, Samuel Glasstone
5. Chemical Kinetics by K.J.Laidler, McGraw Hill Pub.
6. Photochemistry, R.P. Kundall and A. Gilbert, Thomson Nelson.
7. Polymer Chemistry by Billmayer
8. Introduction to Polymer Science, V.R. Gowriker, N.V.Viswanadhan and J. Sreedhar., Wiley Easter.
9. Micells, Theoretical and applied aspects, V.Morol, Plenum publishers.



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LABORATORY WORK (6 hrs/week)

**INORGANIC CHEMISTRY - I**

*I. Inorganic Synthesis: Preparation of*

- (i) Tetraamminecopper(II) sulphate
- (ii) Potassium tris-oxalato ferrate(III) trihydrate
- (iii) Tris-thiourea copper(I) sulphate

*II. Semi micro qualitative analysis of six radical mixtures*

(One interfering anion and one less familiar cation for each mixture)

*Anions:*  $\text{CO}_3^{2-}$ ,  $\text{S}^{2-}$ ,  $\text{SO}_3^{2-}$ ,  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{I}^-$ ,  $\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{CH}_3\text{COO}^-$   
 $\text{C}_2\text{O}_4^{2-}$ ,  $\text{C}_4\text{H}_4\text{O}_6^{2-}$ ,  $\text{PO}_4^{3-}$ ,  $\text{CrO}_4^{2-}$ ,  $\text{AsO}_4^{3-}$ ,  $\text{F}^-$ ,  $\text{BO}_3^{3-}$

*Cations :* Ammonium ( $\text{NH}_4^+$ )  
1<sup>st</sup> group: Hg, Ag, Pb, Tl, W  
2<sup>nd</sup> group: Hg, Pb, Bi, Cu, Cd, As, Sb, Sn, Mo  
3<sup>rd</sup> group: Fe, Al, Cr, Ce, Th, Ti, Zr, V, U, Be  
4<sup>th</sup> group: Zn, Mn, Co, Ni  
5<sup>th</sup> group: Ca, Ba, Sr  
6<sup>th</sup> group: Mg, K, Li

**ORGANIC CHEMISTRY - I**

*Preparation, recrystallization, and determination of melting point & yield of the following compounds:*

- (i) Aspirin, (ii) Nerolin, (iii) Chalcone,
- (iv) *p*-Nitro acetanilide, (v) 2,4,6- Tribromoaniline, (vi) *m*-Dinitrobenzene,
- (vii) Phthalimide, (viii) Diels-Alder adduct.

**Books Suggested**

1. Vogel's Text Book of Quantitative Chemical Analysis, J. Mendham, R. C. Denney, J. D. Barnes and M. J. Thomas, 4th & 6th Ed. (Pearson Education Asia).
2. Vogel's Text Book of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, P.W.G. Smith, A.R. Tatchell, 5 Ed. (Longman Scientific & Technical)



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**PHYSICAL CHEMISTRY-I**

1. Determination of critical solution temperature of phenol-water system.
2. Effect of added electrolyte on the CST of phenol-water system.
3. Conductometric titration of Strong acid versus Strong base
4. Dissociation constant of weak acid ( $\text{CH}_3\text{COOH}$ ) by conductometric method.
5. Conductometric titration of Weak acid vs Strong base.
6. Determination of cell constant
7. Adsorption of acetic acid on animal charcoal or silica gel.
8. Acid-catalyzed hydrolysis of methyl acetate
9. Determination of partial molar volume of solute - $\text{H}_2\text{O}$  system by apparent molar volume method.



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**Paper- I: GENERAL CHEMISTRY-II**

UNIT-1

**Basic Quantum Chemistry-III-** Hydrogen atom- solution of  $R(r)$ ,  $\Phi(\phi)$  and  $\Theta(\theta)$  equations. Probability density in orbitals- shapes of orbitals- Perturbation theory- Time independent perturbation theory(only first order perturbation is to be dealt with)- application to ground state energy of Helium atom- Variation principle- applications- calculation of zero-point energy of harmonic oscillator- many electron atom- Hartee-Fock self-consistent field method(qualitative treatment only)

UNIT-II

**Molecular symmetry and Group Theory in chemistry:** Basic concepts of symmetry and Group theory-Symmetry elements, symmetry operations and point groups- Schoenflies symbols- Classification of molecules into point groups- Axioms of Group theory- Group multiplication tables for  $C_{2v}$  and  $C_{3v}$  point groups- Similarity transformations- and classes- Representations- reducible and irreducible representations, Mullikan symbols, Orthogonality theorem and its implications, Character table and its anatomy.

UNIT-III

**Treatment of analytical data:** Accuracy and precision- Classification of errors- Determination of Indeterminate errors- Minimization of errors- Absolute and Relative errors, propagation of errors-Distribution of Indeterminate errors- Gaussian distribution- Measures of central tendency-Measures of precision- Standard deviation- Standard error of mean- student's t-test- Confidence interval of mean- Testing for significance- Comparison of two means- F-test- Criteria of rejection of an observation- Significant figures and computation rules.

UNIT- IV

**Introduction to computer programming- FORTRAN 77:** Basic structures and functioning of computer with P.C. as an illustrative example- Main memory- Secondary storage memory- input/output devices- computer languages- operating systems- principles of algorithms-and flow charts-constants and variables- Arithmetic expressions- Arithmetic statements- Replacement statement- IF statement- logical IF and BLOCK IF statements- GOTO statements-subscripted variable and DIMENSION statement. DO statement- Rules for DO statement- Functions and subroutines- Development of FORTRAN statements for simple formulae in chemistry such as Vander Waals equation- pH of a solution- First order rate equation- Cell constant-Electrode potential.

Flowcharts and computer programs for

- Program for the calculation of Cell Constant, Specific Conductance and Equivalence.
- Rate Constant of First order reaction or Beer's law by linear least square method.
- Hydrogen ion concentration of a strong acid solution/Quadratic equation.
- Solution for Vander Waals equation or Hydrogen ion concentration of a monoprotic weak acid
- Standard deviation and Variance of univariant data

**References/ Text books:**

- Introductory Quantum chemistry: by A.K. Chandra
- Group theory for Chemistry: by A.K. Bhattacharya
- Introductory Group theory for chemists : by George Davidson
- Vogel's text book of quantitative analysis: byVogel
- Fundamentals of Analytical chemistry: by Skog and West
- Principles of computer programming(FORTRAN 77 IBM PC): by V.Rajaraman
- Basics of computers for chemists: by P.C. Jurs





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**Paper- II: INORGANIC CHEMISTRY-II**

UNIT-I

**Metal cluster compounds** - definition – evidences for existence of M-M bonds - conditions favorable for formation of M-M bonds – preparation, structure and bonding of the following metal cluster compounds.

$\text{Re}_2\text{Cl}_8^{2-}$ ,  $\text{Mo}_2\text{Cl}_8^{4-}$ ,  $\text{Re}_2(\text{RCOO})_4\text{X}_2$ ,  $\text{Mo}_2(\text{RCOO})_4(\text{H}_2\text{O})_2$ ,  $\text{Cr}_2(\text{RCOO})_4(\text{H}_2\text{O})_2$ ,  $\text{Cu}_2(\text{RCOO})_4(\text{H}_2\text{O})_2$ ,  $\text{Cr}_2\text{Cl}_9^{3-}$ ,  $\text{Mo}_2\text{Cl}_9^{3-}$ ,  $\text{W}_2\text{Cl}_9^{3-}$ ,  $\text{Re}_3\text{Cl}_9$ ,  $\text{Re}_3\text{Cl}_{12}^{3-}$ ,  $\text{Mo}_6\text{Cl}_8^{4+}$ ,  $\text{Nb}_6\text{X}_{12}^{2+}$  and  $\text{Ta}_6\text{X}_{12}^{2+}$ .

Polyatomic clusters – Zintl ions, Chevrel phases.

UNIT-II

**Organometallic compounds** - 16 and 18 electron rules. Isoelectronic relationship - Synthesis, structure, bonding and reactions of carbon monoxide, dinitrogen and nitric oxide complexes. Isolobal relationship – H, Cl,  $\text{CH}_3$ ,  $\text{Mn}(\text{CO})_5$ ; S,  $\text{CH}_2$ ,  $\text{Fe}(\text{CO})_4$ ; P, CH,  $\text{Co}(\text{CO})_3$ ; Synthesis, structure, bonding and reactions of metallocenes with special reference to ferrocene.

UNIT-III

**Metal Ligand equilibria in solution:** Step wise and overall formation constants and their interaction– trends in stepwise constants – factors affecting the stability of metal complexes–Pearson's theory of hard and soft acids and bases (HSAB), chelate effect and its thermodynamic origin, determination of stability constants of complexes–spectrophotometric method and pH–metric method. Reactivity of metal complexes–inert and labile complexes. Explanation of lability on the basis of VBT & CFT.

**Bio-Inorganic Chemistry:** Metalloporphyrins with special reference to Haemoglobin & Myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to  $\text{Ca}^{2+}$ . Biological and abiological Nitrogen Fixation.

UNIT- IV

**Inorganic Reaction Mechanisms:** Substitution reactions of metal complexes – D, Id, Ia and A mechanisms – Ligand replacement reactions of metal complexes – Acid hydrolysis – factors affecting acid hydrolysis – Anation and Base hydrolysis of Cobalt(III) complexes. Ligand displacement reactions of square planar complexes of platinum (II). Factors affecting square planar substitution – trans effect (theories).

Electron transfer reactions of complexes – concept of complementary and non-complementary reactions with examples. Inner and outer sphere mechanisms.

**Text books:**

1. Advanced Inorganic Chemistry by F.A. Cotton and R.G. Wilkinson, IV Edition, John, John Wiley and Sons, New York, 1980.
2. Inorganic Chemistry by J.E. Huheey, III edition, Harper International Edition, 1983.
3. Organometallic Chemistry-A unified approach by A. Singh and R.C. Mehrotra, Wiley Eastern Ltd.
4. Inorganic Chemistry by Shriver and Atkins, Oxford University Press (1999)
5. Theoretical Inorganic Chemistry, II Edition by M.C. Day and J. Selbin, Affiliated East-West press Pvt. Ltd., New Delhi.
6. Mechanisms of Inorganic reactions in solution by D.Benson, McGraw Hill, London, 1968.
7. Inorganic chemistry by K.F. Purcell and J.C.Kotz, W.B. Saunders company, New York, 1977.
8. Elements of Bioinorganic Chemistry by G.N. Mukherjee and Arabinda Das, U.N. Dhur & sons Pvt. Ltd, Calcutta.



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**Paper-III: ORGANIC CHEMISTRY-II**

UNIT-I

**Reaction Mechanism**

**15Hrs**

(A) *Aliphatic Nucleophilic Substitution and Nucleophilic Aromatic substitution*: Stereochemistry of  $S_N^2$  and  $S_N1$  mechanisms, Neighboring Group Participation (Anchimeric assistance), NGP by O, S, N: Aromatic Nucleophilic substitution:  $S_N2$  (Ar) (Addition – Elimination),  $S_N1$ (Ar) and benzyne mechanisms (Elimination - Addition); evidence for the structure of benzyne. Von Richter Sommelet-Hauser and Smiles rearrangements.

(B) *Elimination Reactions*: Type of elimination reactions, mechanisms, Stereochemistry and Orientation, Hofmann and Saytzeff rules, Syn elimination versus anti-elimination, competition between elimination and substitution, dehydration, dehydrogenation, dehalogenation, decarboxylative eliminations and pyrolytic eliminations

UNIT-II

**Addition Reactions**

**15 Hrs**

(A) *Addition to Carbon – Carbon Multiple Bonds*: Mechanistic and stereo chemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, region and chemo selectivity, orientation and reactivity, Hydrogenation of double and triple bonds, hydrogenation of aromatic rings, Hydroboration.

(B) *Addition to Carbon-Hetero Multiple Bonds*: Steric course of addition reactions to C=O and C=N, Aldol, Cannizzaro, Perkin, Knoevenagel, Claisen-Schmidt, Claisen, Dieckman, Benzoin and Stobbe condensations, Reformatsky reaction, Tollen's reaction, Prins reaction: Wittig, Grignard, Mannich, and Michael reaction, Hydrolysis of Carbon-Nitrogen bond, Isocyanates and isothioyanates.

UNIT-III

**Molecular Rearrangements**

**15 Hrs**

Types of molecular rearrangements, migratory aptitude;

*Rearrangements to electron deficient carbon*: Pinacol-pinacolone, Wagner-Meerwein, Tiffeneau – Demjanov, Dienone – Phenol, Arndt-Eistert synthesis;

*Rearrangements to electron deficient nitrogen*: Beckmann, Hofmann, Curtius, Schmidt and Lossen rearrangements;

*Rearrangements to electron deficient oxygen*: Baeyer-villiger, Hydro peroxide rearrangement and Dakin rearrangements; Neber rearrangement, Benzil-Benzilic acid and Favorskii rearrangements

UNIT-IV

**Spectroscopy and Protecting Groups**

**15 Hrs**

- A. Basic principles and importance of UV, IR, NMR and Mass.
- B. Protection of carbonyl, Hydroxyl, carboxylic and Amine groups



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**Books Suggested:**

1. Advanced Organic Chemistry-Reactions, Mechanism and structure, Jerry March, 6th Ed. (John Wiley & Sons).
2. Modern Organic Reactions, H. O. House (Benjamin)
3. Structure and Mechanism in Organic Chemistry C. K. Ingold (Cornell University Press).
4. Organic Chemistry, Paula Yurkanis Bruice, 4th Ed. (Prentice Hall)
5. Organic chemistry-Clayden J. (Oxford)
6. Organic Chemistry, Wade, L.G. Jr. 5th Ed. (Pearson)
7. Organic Chemistry, Salmons, P.W. & Others, 8th Ed. (John Wiley & Sons)
8. Advanced Organic Chemistry: Reactions and mechanisms, Miller Bernard & Other, 2nd Ed. (Pearson)
9. Mechanism and Theory in Organic Chemistry, Thomas H. Lowry, Kathleen S. Richardson, Harper & Row, (Publishers, Inc.).
10. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, 6th Ed., (Longman).
11. Reaction Mechanism in Organic Chemistry, P.S. Kalsi, 2nd Ed. (New Age International).
12. Stereochemistry to Organic Compounds, E.L. Eliel (John Wiley).
13. Stereochemistry to Organic Compounds, Nasipuri, 2nd Ed. (New Age International).
14. Stereochemistry, P.S. Kalsi, 5th Ed. (New Age International). Organic Chemistry Structure and Reactivity, Ege Seyhan, 3rd Ed. (AITBS)
15. Spectroscopic Methods in Organic Chemistry- Forth Edition, D.H. Williams and I. Fleming Tata - McGraw Hill, New Delhi, 1990.
16. Organic Spectroscopy- Second Edition, W.Kemp, ELBS Macmillan, 1987.
17. Applications of absorption spectroscopy of Organic Compounds J.R.Dyer, Prentice Hall of India, New Delhi, 1984.
18. Spectrometric identification of Organic Compounds-Fourth Edition, R.M. Silverstein: G.C.Vassillir and T.C. Merrill, John Wiley, Singapore, 1981.
19. Introduction to spectroscopy-D.L.Pavia, G.M.Lampman, G.S.Kriz, 3rdEd (Harcourt college publishers).



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**Paper – IV: PHYSICAL CHEMISTRY-II**

UNIT-I:

**Physical methods of molecular structural elucidation:** NMR: Principle and theory, Nature of spinning particle and its interaction with magnetic field. Chemical shift and its origin. Spin-Spin interaction, Application of NMR to structural elucidation- Structure of ethanol, dimethylformamide, styrene and acetophenone.

Electron Spin Resonance: Principle and experimental technique- g-factor, line shapes and line widths- hyperfine interactions- applications of ESR studies.

UNIT -II:

**Thermodynamics-II-** Brief review on entropy; entropy changes accompanying specific process – expansion, phase transition, heating, measurement of entropy. Nernst heat theorem; Third law of thermodynamics- Determination of the absolute entropy- Apparent exceptions to Third law of thermodynamics.

**Statistical Thermodynamics:** Objectives of statistical thermodynamics, Concept of distributions, Types of ensembles. Thermodynamic probability, Most probable distribution Law – Partition Function, (Definition and significance): Molar and molecular partitions-translational, rotational, vibrational and electronic partition functions- Relation between thermodynamic functions (E, H, S, G and  $C_v$ ) and the partition functions

UNIT-III:

**Electrochemistry I:** Electrochemical cell- Galvanic and electrolytic cell. Concentration cell with and without transference, Effect of complexation on redox potential- ferricyanide/ ferrocyanide couple, Iron (III) phenanthroline / Iron (II) phenanthroline couple. Determination of standard potential, solubility product equilibrium constant and activity coefficients from EMF data.

Bjerrum theory of ion association (elementary treatment) Concept of activity and activity coefficients in electrolytic solutions. The mean ionic activity coefficient. Debye-Huckel theory of electrolytic solutions. Debye-Huckel limiting law (derivation not required), Calculation of mean ionic activity coefficient; Limitations of Debye-Huckel theory. Effect of dilution on equivalent conductance of electrolytes - Anomalous behavior of strong electrolytes. Debye Huckel-Onsagar equation – verification and limitations, Fuel Cells.

UNIT-IV:

**Electrochemistry II:** The electrode-electrolyte interface. The electric double layer. The Helmholtz-Perrin parallel-plate model, the Gouy-Chapman diffuse-charge model and the Stern model.

Electrodics: Charge transfer reactions at the electrode-electrolyte interface. Exchange current density and over-potential. Derivation of Butler-Volmer equation. High field approximation, Tafel equation, Low field equilibrium, Nernst equation. Voltametry-Concentration polarization, experimental techniques.



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**Books:**

1. Text book of Physical Chemistry by Samuel Glasstone, McMillan Pub.
2. Physical Chemistry by W.J.Moore, Prentice Hall
3. Physical Chemistry by G.W. Castellon, Narosha Publishing House
4. Physical Chemistry by Peter Atkins and Julio de Paula, Oxford University Press.
5. Modern Electrochemistry, 2A & 2B, JOM Bockris & A.K.N.Reddy, Plenum publishers
6. Introduction to Electrochemistry, S.Glasstone.
7. Fundamentals of Molecular Spectroscopy, Banwell
8. Spectroscopy by Straw & Walker.
9. Statistical thermodynamics , M.C.Gupta
10. Statistical Thermodynamics, M.Dole



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**LABORATORY WORK (6 hrs/ week)**

**INORGANIC CHEMISTRY PRACTICALS –II**

**Quantitative analysis:**

*Volumetric:*

1. Determination of Ferric iron by photochemical reduction
2. Determination of Nickel by EDTA
3. Determination of Calcium and Magnesium in a mixture by EDTA
4. Determination of Ferrocyanide by Ceric sulphate
5. Determination of Copper(II) in presence of iron(III)

*Gravimetric:*

6. Determination of Zinc as Zinc pyrophosphate
7. Determination of Nickel from a mixture of Copper and Nickel.

**ORGANIC CHEMISTRY PRACTICALS –II**

*Systematic qualitative analysis of an organic mixture containing two compounds*

Identification of method of separation and the functional group(s) present in each of them and preparation of one solid derivative for the confirmation of each of the functional group(s).

**PHYSICAL CHEMISTRY PRACTICALS –II**

1. Distribution of iodine between  $\text{CHCl}_3$  and water
2. Distribution of  $\text{I}_2$  between  $\text{CHCl}_3$  and aq. KI solution- calculation of equilibrium constant.
3. Determination of Coordination number of cuprammonium cation.
4. Titration of mixture Strong acid and weak acid versus Strong base by conductometry.
5. Titration of Strong acid Vs Strong Base – pH – metry.
6. Titration of mixture of ( $\text{NaHCO}_3 + \text{Na}_2\text{CO}_3$ ) Vs HCl – pH- metry.
7. Titration of Strong acid Vs Strong Base using Quinhydrone electrode.
8. Titration of  $\text{Fe}^{+2}$  Vs  $\text{K}_2\text{Cr}_2\text{O}_7$  – potentiometry
9. Verification of Beer-Lambert's law by Iron-thiocyanate system –colorimetry.
10. Determination of single electrode potential of  $\text{Cu}^{2+}/\text{Cu}$  and estimate the given unknown concentration.



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**THIRD SEMESTER**

**Paper – I- ORGANIC REACTION MECHANISMS-I and  
PERICYCLIC REACTIONS**

(Effective from the 2016-17 Admitted Batch)

UNIT – I

15 Hrs

**A) Aliphatic Nucleophilic Substitution:**

Neighboring group participation by Bromine, Phenyl group, Non-Classical carbocations, NGP by Pi bond, Sigma bond and Cyclopropyl group,  $S_N$  at Allylic carbon (allylic rearrangements),  $S_N$  at Aliphatic trigonal carbon,  $S_N$  at Vinylic carbon, Ambident nucleophiles, Hydrolysis of esters ( $B_{AC}^2$ ,  $A_{AC}2$ ,  $A_{AC}1$ ,  $A_{AL}1$ ,  $B_{AL}1$ ), Mechanism of estrification of carboxylic acid with an alcohol using DCC, Mayers Synthesis of aldehydes, ketones and carboxylic acids Mitsunobu reaction, Von-Braun reaction

**B) Aliphatic Electrophilic Substitution:**

Mechanisms of  $S_E^2$ ,  $S_E^1$ ,  $S_{Ei}$ , *Hydrogen as electrophile*: Hydrogen exchange; Migration of double bonds, *Halogen electrophiles*. Mechanism of Halogenation of aldehydes and ketones; HVZ reaction; Halogenation of Sulphoxides & Sulphones, *Nitrogen Electrophiles*: Aliphatic diazo coupling, Diazo transfer reaction, Insertion of nitrenes, *Metal Electrophiles*: Metallation with Organometallic Compounds (Orthometallation), *Carbon as Leaving groups*: Decarboxylation of Aliphatic Acids; Dakin – West reaction; Haller–Bauer reaction.

UNIT – II

15 Hrs

**Principles of asymmetric synthesis:**

Introduction and terminology: Topicity in molecules Homotopic, stereoheterotopic (enantiotopic and diastereotopic) groups and faces, symmetry, substitution and addition criteria. Prochirality nomenclature: Pro-R, Pro-S, Re and Si. Stereoselective reactions: Substrate stereoselectivity, product stereoselectivity, enantioselectivity and diastereoselectivity. Conditions for stereoselectivity: Symmetry and transition state criteria, kinetic and thermodynamic control. Methods for inducing enantio and diastereoselectivity. Analytical methods: % Enantiomeric excess, enantiomeric ratio, optical purity, % diastereomeric excess and diastereomeric ratio. Techniques for determination of enantiomeric excess, specific rotation, Chiral NMR; Chiral derivatizing agents, Chiral solvent, Chiral shift reagents and Chiral HPLC.

UNIT – III

15 Hrs

**Pericyclic Reactions-I**

Molecular orbital symmetry, frontier orbitals of ethylene, 1,3 Butadiene, 1,3,5- Hexatriene, allyl system, classification of pericyclic reactions FMO approach, Woodward- Hoffman correlation diagram method and perturbation of molecular (PMO) approach for the explanation of pericyclic reactions under thermal and photochemical conditions.

Electrocyclic Reactions: Conrotatory and disrotatory motions ( $4n$ ) and ( $4n+2$ ), allyl systems  
Cycloadditions: Antarafacial and suprafacial additions, notation. of cycloadditions, ( $4n$ ) and ( $4n+2$ ) systems with a greater emphasis on ( $2+2$ ) and ( $4+4$ ) - cycloadditions, ( $2+2$ ) - additions of ketenes and chelotropic reactions.



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UNIT-IV

15 Hrs

**Pericyclic Reactions-II**

FMO approach and perturbation of molecular (PMO) approach for the explanation of sigma tropic rearrangements under thermal and photochemical conditions. suprafacial and antarafacial shifts of H Sigmatropic shift involving carbon moieties, retention and inversion of configurations, (3, 3) and (5, 5) sigmatropic rearrangements detailed treatment of Claisen and Cope rearrangements, fluxional tautomerism, aza-Cope rearrangement and Barton reaction.

Text Books and Reference Books:

- 1) Advanced Organic Chemistry: Reactions Mechanisms and Structure by Jerry March, Mc.Graw Hill and Kogakush.
- 2) Molecular reactions and Photochemistry by Charles Dupey and O. Chapman, Prentice Hall.
- 3) Pericyclic reactions by S.N. Mukharji, Mcmilan.
- 4) Mechanisms and Theory in Organic Chemistry by T.H. Lowery and K.S. Rich gardson.
- 5) The modern structural theory in Organic Chemistry by L.N.Ferguson, Pretice Hall
- 6) Physical Organic Chemistry by jack Hine, Mc. Graw Hill
- 7) Advanced Organic Synthesis, Part B-Reactions and Synthesis, Francis A. Carey and Richard J. Sudenburg, Fourth edition, Kluwer academic publishers, New York
- 8) Organic Synthesis, Christine Willis and Martin Willis, Oxford Chemistry primers.
- 9) Principles of Organic Synthesis, ROC Norman and JM Coxon, third edition, CBS, Publisher, Delhi.
- 10) Organic Synthesis, M. B. Smith, Mc Graw Hill, International Edition.
- 11) Organic Chemistry, Clayden, Greeves and Stuwart Warren.
- 12) Modern Organic Synthesis-an introduction by George S.Zweifel and Michael H. Nantz, W. H. Freeman & company, New York.
- 13) Pericyclic Reactions — a problem solving approach, Lehr and Merchand.
- 14) Conservation of Orbital Symmetry by Woodward and Hoffmann.





ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY

**THIRD SEMESTER**

**Paper – II- ORGANIC SPECTROSCOPY-I**

**(Effective from the 2016-17 Admitted Batch)**

UNIT-I 15 Hrs

**UV-Visible spectroscopy:**

A) Beer-Lambert's law-Deviations from Beers law-Instrumentation-Mechanics of measurement- Energy transitions-Simple chromophores- Auxochrome, Absorption shifts (Bathochromic, Hypsochromic, Hyper chromic and Hypo chromic shifts) UV absorption of Alkenes-Polyenes unsaturated cyclic systems.

B) UV absorption of carbonyl compounds:  $\alpha,\beta$ -unsaturated carbonyl systems-UV absorption of aromatic systems-solvent effects-geometrical isomerism-acid and base effects-typical examples-calculation of  $\lambda$  max values using Woodward Fieser rules, applications.

UNIT-II 15 Hrs

**Infrared spectroscopy:**

A) Mechanics of measurement-Fundamental modes of vibrations-stretching and bending vibrations-Factors effecting Vibrational frequency-hydrogen bonding.

B) Finger print region and its importance, typical group frequencies for –CH,-OH, N-H, CC,-CO and aromatic systems-Application in structural determination-Examples-simple problems.

UNIT-III 15 Hrs

**Nuclear Magnetic Resonance Spectroscopy ( $^1\text{H}$ NMR):**

A) Introduction: Basic principle of- NMR Nuclear spin- nuclear resonance-saturation-Relaxation-Instrumentation (CW&FT).

B) Shielding and deshielding of magnetic nuclei-chemical shift and its measurements, factors influencing chemical shift – spin-spin interactions- factors influencing –coupling constant J and factors effecting J value.

C)  $^{13}\text{C}$  NMR Spectroscopy: Similarities and Differences between PMR and CMR, general considerations, chemical shift (aliphatic, olefinic, alkyne, aromatic, hetero aromatic and carbonyl carbon), coupling constants, typical examples of CMR spectroscopy-simple systems.

UNIT-IV 15 Hrs

**Mass spectrometry**

A) Introduction: Ion production-E1, C1, ES, MALDI and FAB- determination of Molecular weight and formulae-Behavior of organic compounds in mass spectrometer- factors affecting fragmentation, ion analysis, and ion abundance.

B) Mass spectral fragmentation of organic compounds, Common functional groups, molecular ion peak, meta stable peak, Mc Lafferty rearrangement, Nitrogen rule, High resolution mass spectrometry, Examples of mass spectral fragmentation of organic compounds with respect of their structure determination.



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Suggested Books:

- 1) Spectroscopic Methods in Organic Chemistry- Forth Edition, D.H. Williams and I.Fleming  
Tata McGraw Hill, New Delhi, 1990.
- 2) Organic Spectroscopy- Second Edition, W.Kemp, ELBS Macmillan, 1987.
- 3) Applications of absorption spectroscopy of Organic Compounds J.R.Dyer,  
Prentice Hall of India, New Delhi, 1984.
- 4) Spectrometric identification of Organic Compounds-Fourth Edition, R.M.  
Silverstein: G.C.Vassiellr and T.C. Merrill, Johne Willey, Singapore, 1981.
- 5) Introduction to spectroscopy-D.L.Pavia, G.M.Lampman, G.S.Kriz, 3rdEd  
(Harcourt college publishers).
- 6) Absorption spectroscopy of organic molecules-V.M.Parkih.
- 7) Nuclear Magnetic Resonance-Basic principles-Atta-Ur-Rehman, Springer-Verlag, 1986.



ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY

**THIRD SEMESTER**

**Paper – III- MODERN ORGANIC SYNTHESIS-I**

**(Effective from the 2016-17 Admitted Batch)**

UNIT-I

**Formation of C-C single bonds** 15 Hrs

Alkylations via enolate, Thermodynamic and kinetic enolate, Asymmetric Aldol reaction: a) Chiral enolate and achiral aldehyde b) Achiral enolate and chiral aldehyde – explanation by Zimmerman Traxler model; Stork enamine reaction and its synthetic applications; Organo sulphur chemistry: Umpolung and its synthetic applications (Corey Seebach Reaction), sulphur ylides: dimethyl sulphonium methylide, dimethyloxosulphonium methylide preparations and their synthetic applications; Organo Palladium Chemistry: Heck Reaction, Stille coupling, Suzuki coupling, Sonogashira coupling, Negishi coupling, Wacker Oxidation; Organo copper chemistry: Gilman's reagent and synthetic applications; Synthetic applications of carbenes and carbenoids; Baylis Hilman reaction.

UNIT-II

**Formation of Carbon-Carbon double bonds** 15 Hrs

Stereochemistry of E1 and E2 reactions (Different examples of acyclic and cyclic molecules, Saytzeff rule, Hofmann rules and Bredt's rule); Pyrolytic Syn eliminations (focus should be given on stereochemistry of syn eliminations of amine oxides, xanthates and esters of acyclic and cyclic molecules); Sulphoxide-Sulphenate rearrangement (Mislow-Evans rearrangement); Wittig reaction, Wadsworth Emmons reaction, Corey-Fuchs reaction, Aza Wittig reaction, Wittig-Horner reaction and stereo chemistry of Wittig reaction; Shapiro reaction, Eschen-Moser Tanabe fragmentation, Claisen rearrangement of allyl vinyl ethers, Julia Lythgoe olefination, Mc Murray coupling, Peterson Olefination, Tebbs reagent and its application, Metathesis: Grubbs 1st and 2nd generation catalyst, Olefin cross coupling (OCM), ring closing (RCM) and ring opening (ROM) metathesis, applications, olefination by Nysted reagent.

UNIT-III

**Reactions of unactivated C-H bonds and organoboranes** 15 Hrs

The Hoffmann Loeffler- Freytag reaction, the Barton reaction and Photolysis of organic hypothalites;

Organoboranes: Preparation of Organoboranes



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viz hydroboration with  $\text{BH}_3\text{-THF}$ , dicyclohexyl borane, disiamyl borane, theryl borane, 9-BBN mono isopinacamplyl borane ( $\text{IPC}_2\text{BH}_2$ ) and diisopinacamplyl borane ( $\text{IPC}_2\text{BH}$ ) functional group transformations of Organo boranes-Oxidation, protonolysis and isomerisation. Formation of carbon-carbon-bonds viz organo boranes carbonylation and cyanidation, reactions of alkenyl boranes and trialkyl alkynyl borates.

UNIT-IV

**Protecting groups and simple applications of microwave and ultrasound assisted reactions** 15 Hrs

(A) Protecting Groups

- 1) Protection of **alcohols** as **ethers** [methyl ether ( $\text{RO-Me}$ ), Tertiary butyl ether ( $\text{ROCM}_3$ ), Benzyl ethers ( $\text{RO-Bn}$ ), *p*-methoxybenzylethers ( $\text{RO-PMB}$ )], as **Silyl ethers** [Trimethyl silylether ( $\text{R-OTMS}$ ), tri ethyl silyl ethers ( $\text{RO-TEs}$ ), *t*-butyldimethylsilyl ether ( $\text{R-OTBDMS}$  in the presence of imidazole), tri isopropylsilyl ether ( $\text{RO-TIPS}$ ), *t*-butyl diphenylsilyl ether ( $\text{RO-TBDPS}$ )], as **acetals** [tetrahydropyranyl ethers ( $\text{RO-THP}$ ), methoxymethyl ethers ( $\text{RO-CH}_2\text{-OCH}_3 = \text{RO-MOM}$ ) and **ester formation** (carboxylic acid ester and *p*-toluene sulphonate esters).
- 2) Protection of 1,2-diols by acetal, ketal and carbonate formation.
- 3) Protection of amines by acetylation, benzoylation, benzoyloxy carbonyl, Fmoc and triphenyl methyl groups.
- 4) Protection of carbonyl by acetal, ketal and thio acetal (Umpolung) groups.
- 5) Protection of carboxylic acids by esters and ortho ester formation.

(B)

Synthetic applications of PTC and crown ethers

1. Microwave Technology: Microwave equipment, activation-benefits, limitations, microwave effects. Microwave assisted reactions in organic solvents-Esterification reactions, Fries rearrangement, Orthoester Claisen rearrangement, Diels- Alder reaction, decarboxylation.
2. Ultrasound assisted reactions: introduction, substitution reactions, addition, oxidation, reduction reactions.
3. Click chemistry: criterion for click reaction, Sharpless azides cycloadditions



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Textbooks and Books for Reference:

- 1) Some Modern Methods of Organic Synthesis W. Carruthers, Third & Fourth Edition, Cambridge University Press, Cambridge, 1988.
- 2) Modern Organic Synthesis-an introduction by George S.Zweifel and Michael H. Nantz, W. H. Freeman & company, New York.
- 3) Advanced Organic Synthesis, Part B-Reactions and Synthesis, Francis A. Carey and Richard J. Sudenburg, Fourth edition, Kluwer academic publishers, New York
- 4) Organic Synthesis, Christine Willis and Martin Willis, Oxford Chemistry primers.
- 5) Principles of Organic Synthesis, ROC Norman and JM Coxon, third edition, CBS, Publisher, Delhi.
- 6) Organic Synthesis, M. B. Smith, McGraw Hill, International Edition.
- 7) Organic Chemistry, Clayden, Greeves and Stuart Warren.
- 8) Guide Book to Organic Synthesis (3<sup>rd</sup> edition), R. Mackie, D. M. Smith and Aitken.
- 9) Organo Boranes and Silanes, Thomson, Oxford Chemistry primers.
- 10) Strategic applications of named reactions in organic synthesis, Laszlo Kurti and Barbara Czako.
- 11) Modern Synthetic Reactions, Herbert O. House, Second Edition, W.A. Benzamine Inc. Menio Park, California, 1972.
- 12) Organic Synthesis viz Boranes, Herbert C. Brown Gray, W. Kramer Alan B. Levy and M. Mark Midland John Wiely & Sons, New York, 1975.
- 13) Organic Synthesis: Special Techniques, V. K. Ahluwalia and Renu Agarwal.
- 14) Organic Synthesis, Jagadamba Singh and Dr. A. Yadav, Pragati Edition.



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**THIRD SEMESTER**

**Paper – IV- : CHEMISTRY OF NATURAL PRODUCTS**

**(Effective from the 2016-17 Admitted Batch)**

**UNIT–I: Alkaloids** 15 Hrs

Introduction, isolation, general methods of structure elucidation and physiological action, degradation, classification based on nitrogen heterocyclic ring, structure, stereochemistry, synthesis and biosynthesis of morphine, strychnine, vincristine, colchicine, camptothecin and reserpine.

**UNIT–II: Terpenoids** 15 Hrs

Occurrence, isolation, general methods of structure determination, isoprene rule. Structure determination, stereochemistry, biosynthesis and synthesis of Farnesol, Zingiberene, Forskolin, Taxol, Azadirachtin and  $\beta$ -amyrin.

**UNIT–III: Steroids** 15 Hrs

Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and its stereochemistry. Isolation, structure determination and synthesis of cholesterol (total synthesis not expected), androsterone, testosterone, estrone and progesterone, Biosynthesis of steroids.

**UNIT–IV: Flavonoids and Isoflavonoids** 15 Hrs

Occurrence, nomenclature and general methods of structure determination, Isolation, structure elucidation and synthesis of Kaempferol, Quercetin, Cyanidin, Genestein, Butein and Daidzein. Biosynthesis of flavonoids and Isoflavonoids: Acetate Pathway and Shikimic acid Pathway.

Books Suggested:

1. Natural Products: Chemistry and Biological Significance, J. Mann, R.S.Davidson, J. B. Hobbs, D. V. Banthrope and J. B. Hatrbnome, Longman, Essex.
2. Organic Chemistry, Vol. 2, I. L. Finar, ELBS.
3. Chemistry of Organic Natural Products, O. P. Agrawal, Vols. 1 &2, Goel Pubs.
4. Natural Products Chemistry K. B. G. torsell, John Wiley, 1983
5. New Trends in Natural Products Chemistry, Atta-ur-Rahman and M.I.Choudhary, Harwood Academic Publisher.
6. Chemistry of Natural products P. S. Kalsi, Kalyani Publishers
7. Biosynthesis of steroids, terpenes and acetogenins, J. H. Richards & J. R. Hendrieson
8. The biosynthesis of secondary metabolites, R. D. Herbert, Chapman & Hall
9. The Biosynthesis of Secondary Metabolite, R. D. Herbert, Second edn, Chapman and Hall 1984
10. Chemical aspects of Biosynthesis, John Mann, Oxford University Press, Oxford, 1996.



ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY

FOURTH SEMESTER

Paper – I- ORGANIC REACTION MECHANISMS-II and  
ORGANIC PHOTO CHEMISTRY

(Effective from the 2016-17 Admitted Batch)

UNIT – I 15 Hrs

A) **Free Radical Reactions:**

Free radical substitution mechanisms; Mechanism at an aromatic substrate; Neighboring group assistance in free radical reactions; Reactivity for aliphatic substrates; Reactivity in aromatic substrates; Reactivity at bridge head; Reactivity in the attacking radical; Effect of solvent on reactivity, Allylic halogenations using NBS (Wohl – Ziegler bromination); Hydroxylation at aromatic carbon by Fentons reagent; Oxidation of aldehydes to carboxylic acids; Formation of cyclic ethers using Leadtetraacetate; Formation of hydroperoxides (autooxidation); Coupling of alkynes (Eglinton reaction and Glacer reaction); Arylation of Aromatic compounds by diazonium salts(Gomberg – Bachman reaction); Mechanisms of Sandmeyer reaction, Kolbes reaction, Hunsdiecker reaction, Reed reaction; free radical rearrangements.

B) **Quantitative relationships between Molecular structure and Chemical reactivity:**

Hammett and Taft Equations

C) **Rearrangements:** Wagner – Meerwein Rearrangement, Demjanov Rearrangement, Wittig Rearrangement and Stevens Rearrangement

Unit – II: 15 Hrs

**Methodologies in asymmetric synthesis**

Strategies in Asymmetric Synthesis: 1. Chiral substrate controlled, 2. Chiral auxiliary controlled, 3. Chiral reagent controlled and 4. Chiral catalyst controlled.

1. **Chiral Substrate controlled asymmetric synthesis:** Nucleophilic additions to chiral carbonyl compounds. 1, 2- asymmetric induction, Cram's rule and Felkin-Anh model.

2. **Chiral auxiliary controlled asymmetric synthesis:**  $\alpha$ -Alkylation of chiral enolates, azaenolates, imines and hydrazones. 1, 4-Asymmetric induction and Prelog's rule. Use of chiral auxiliaries in Diels-Alder reaction.

3. **Chiral reagent controlled asymmetric synthesis:** Asymmetric reductions using BINAL-H. Asymmetric hydroboration using IPC2 BH and IPCBH2.

4. **Chiral catalyst controlled asymmetric synthesis:** Sharpless and Jacobsen asymmetric epoxidations. Sharpless asymmetric dihydroxylation. Asymmetric hydrogenations using chiral Wilkinson biphosphine and Noyori catalysis. Enzyme mediated enantioselective synthesis

5. **Asymmetric aldol reaction:** Diastereoselectivity aldol reaction (chiral enolate & achiral aldehydes and achiral enolate & chiral aldehydes) its explanation by Zimmerman-Traxel model.

UNIT – III 15 Hrs

**Photo Chemistry-I**

Photochemical energy, Frank Condon Principle, Types of Electronic Excitation and Molecular orbital view of excitation, Jablonski Diagram, singlet and triplet states, dissipation of photochemical energy, photosensitization, quenching, quantum efficiency and quantum yield, Determination of Quantum yield

Photo Chemistry of Carbonyl Compounds: Norrish Type I reaction (alpha cleavage reaction), Norrish Type – II reaction, Paterno- Buchi reaction, Photo reduction & photo enolisation; photochemical Oxidations [Backstrom mechanism], Photo oxidation of alkenes with singlet oxygen.



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Unit – IV

**Photochemistry-II**

Di – Pi methane Rearrangement, Aza di – Pi methane rearrangement; Photochemistry of Benzene and substituted benzene, 1, 2 , 1,3 ,& 1, 4-additions; Photo Fries rearrangement of Phenolic acetates and Anilides; Photochemistry of unsaturated systems, Cis- Trans Isomerisation of alkenes (Direct and sensitized) (Photoisomerisation of Stilbene), Photochemistry of Butadiene; Dimerisations of alkenes, Intramolecular dimerisation.

Photochemical rearrangement of Cyclohexadienenones; Photochemistry of alpha, beta Unsaturated ketones (dimerisations and addition across the double bond); Photochemical rearrangement reactions of Cyclohexenone, Photorearrangements of Beta, gamma unsaturated systems (Mechanism of 1,2 & 1,3 – acyl shifts); Photochemistry of Nitrite esters (Barton reaction); Photochemistry of alpha diazoketones; Photo Aromatic Substitutions; Photochemistry of Pyridinium ylides.

Text Books and Reference Books:

- 1) Advanced Organic Chemistry: Reactions Mechanisms and Structure by Jerry March, Mc.Graw Hill and Kogakush.
- 2) Molecular reactions and Photochemistry by Charles Dupey and O. Chapman, Prentice Hall.
- 3) Mechanisms and Theory in Organic Chemistry by T.H. Lowery and K.S. Richardson.
- 4) The modern structural theory in Organic Chemistry by L.N.Ferguson, Prentice Hall
- 5) Physical Organic Chemistry by Jack Hine, Mc. Graw Hill
- 6) Advanced Organic Synthesis, Part B-Reactions and Synthesis, Francis A. Carey and Richard J. Sudenburg, Fourth edition, Kluwer academic publishers, New York
- 7) Organic Synthesis, Christine Willis and Martin Willis, Oxford Chemistry primers.
- 8) Principles of Organic Synthesis, R.C. Norman and J.M. Coxon, third edition, CBS, Publisher, Delhi.
- 9) Organic Synthesis, M. B. Smith, Mc Graw Hill, International Edition.
- 10) Organic Chemistry, Clayden, Greeves and Stuart Warren.
- 11) Modern Organic Synthesis-an introduction by George S.Zweifel and Michael H. Nantz, W. H. Freeman & company, New York.
- 12) Organic Photochemistry by D Coyle
- 13) Molecular Photochemistry by Gilbert & Baggo
- 14) Organic Photochemistry by Turro
- 15) Photochemistry by C W J Wells





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**FOURTH SEMESTER**

**Paper – II- ORGANIC SPECTROSCOPY-II**

**(Effective from the 2016-17 Admitted Batch)**

UNIT-I:

A) Optical Rotatory Dispersion: Theory of Optical Rotatory Dispersion-Cotton effect –CD curves-types of ORD and CD curves–similarities and difference between ORD and CD curves

B) The octant rule-application in structural studies- $\alpha$ - halo keto rule.

UNIT-II

A) Improving the PMR spectrum: Chemical and Magnetic Equivalence. Chemical exchange, First and Non-First Order Spectra and analysis of AB, AMX and ABX systems.

B) Simplification of complex spectra-: Nuclear Magnetic double resonance, Lanthanide shift reagents, solvent effects, Fourier transforms technique, Nuclear Overhauser Effect (NOE), Deuterium Exchange, spectra at higherfields. Hindered Rotations and Rate processes. Resonance of other nuclei- $^{19}\text{F}$  and  $^{31}\text{P}$

C) 2D NMR spectroscopy: Definitions and importance of COSY, DEPT, HOMCOR, HETCOR, INADEQUATE, INDOR INEPT, NOESY, HOM2DJ, HET2DJ and DQFCOSY.

UNIT-III

Solution of structural problems by joint application of UV, IR, NMR ( $^1\text{H}$ & $^{13}\text{C}$ ) and mass spectrometry.

UNIT-IV

A) Separation Techniques: Solvent extraction chromatography-paper-thin layer partition-column chromatography, Electrophoresis.

B) Instrumentation – Gas Chromatography, High performance Liquid Chromatography, X – Ray diffraction (XRD)

**Suggested Books:**

- 1) Spectroscopic Methods in Organic Chemistry- Forth Edition, D.H. Williams and I. Fleming  
Tata - McGraw Hill, New Delhi, 1990.
- 2) Organic Spectroscopy- Second Edition, W.Kemp, ELBS Macmillan, 1987.
- 3) Spectrometric identification of Organic Compounds-Fourth Edition, R.M. Silverstein: G.C.Vassillr and T.C. Merill, John Willey, Singapore, 1981.
- 4) Introduction to spectroscopy-D.L.Pavia, G.M.Lampman, G.S.Kriz, 3rdEd  
(Harcourt college publishers).
- 5) "Applications of Optical rotation and Circular Dichroism", G.C. Barret, in  
"Elucidation of Organic structures by Physical and Chemical Methods"  
Part I (Eds) K.W. Bentley and G.W.Rirty John Wiley, 1972, Chapter VIII  
(only those aspects mentioned in the syllabus).
- 6) Instrumental methods of chemical analysis by H.Kaur, Pragati Prakasan,meerut.
- 7) Separation Techniques by M.N.Sastri, Himalaya publishing House (HPH), Mumbai.



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**FOURTH SEMESTER**

**Paper – III- MODERN ORGANIC SYNTHESIS-II**

**(Effective from the 2016-17 Admitted Batch)**

UNIT-I

**Organo Silanes**

15 Hrs

Synthetic applications of trimethylsilyl chloride dimethyl-*t*-butylsilyl chloride, trimethylsilyl cyanide, trimethylsilyl iodide and trimethylsilyl triflate, synthetic applications of  $\alpha$ -silyl carbanion and  $\beta$ -silyl carbonium ions. Synthetic applications of silyl enol ethers, Preparation and synthetic applications of alkynyl silanes, aryl silanes, allyl silanes and vinyl silanes, Nazarov cyclization, Synthetic conversion of  $\alpha$ ,  $\beta$ -epoxy silanes, Peterson Olefination, Brook rearrangement and Rubottom oxidation.

UNIT-II

15 Hrs

**Oxidation**

Synthetic applications of the following reagents in the oxidation of functional groups like alkenes, alkynes, alcohols, aldehydes and ketones: 1)  $\text{Pb}(\text{OAc})_4$  2)  $\text{HIO}_4$  3)  $\text{SeO}_2$  4)  $\text{CrO}_3$  (Sodium or potassium dichromate in  $\text{H}_2\text{SO}_4$ , Collins reagent, Jones reagent, Etard reagent,  $\text{CrO}_3$  in acetic anhydride, PCC (Coreys reagent), PDC, Babler oxidation), 4)  $\text{MnO}_2$  5)  $\text{KMnO}_4$  6)  $\text{OsO}_4$  7) Oxidations by using DMSO involving alkoxy sulphonium salts (Kornblum oxidation), DCC- DMSO (Pfitzner-Muffat reagent), Swern oxidation, Corey-Kim oxidation, Albright-Goldman oxidation 8) Oxidations by using IBX, DMP, TPAP, TEMPO, CAN 9) Bayer villager oxidation and Prilezhev epoxidation 10) Oxidation of alkenes using Woodward and Prevost reagents 11) Oxidation by using DDQ 12) Sharpless asymmetric epoxidation and Sharpless asymmetric dihydroxylation 13) Thallium nitrate 14) Oxidative coupling of phenols and alkynes.

UNIT-III

**Reduction**

15 Hrs

- (1) Catalytic reductions: Homogeneous (Wilkinson's Catalytic reduction) and heterogeneous catalytic reductions and their synthetic applications.
- (2) Reductions by using electrophilic nucleophilic metal hydrides:  $\text{LiAlH}_4$  (Various examples of reductions and Cram's rule), related reagents of LAH,  $\text{NaBH}_4$ ,  $\text{NaBH}_3\text{CN}$ , Trialkyl Borohydrides (Super Hydride and Selectride).
- (3) Reductions by using electrophilic metal hydrides:  $\text{BH}_3$ , DIBAL



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- (4) Reductions by dissolving metals: Clemenson reduction, Acyloin condensation, Bouveault-Blanc reduction, Birch reduction (Various examples should be discussed).
- (5) Reductions by using Diimide and Wolf-Kishner Reduction (6) Hydrogenolysis
- (7) Reductions by using tri n-butyl tin hydride.

UNIT-IV

**Retro Synthetic Analysis**

15 Hrs

1. Basic definitions of the following:
  - a) Retro synthetic analysis
  - b) Disconnection
  - c) Target molecule
  - d) Synthone
  - e) Synthetic equivalent
  - f) Functional Group Inter Conversion (FGI)
  - g) Functional Group Addition (FGA)
2. Guidelines for the order of events: One group C-X disconnections One Group C-X disconnections (Carbonyl derivatives, ethers, sulphides and alcohols); Two group C-X disconnections (1,1-difunctionalised, 1,2-difunctionalised and 1,3-difunctionalised compounds), One group C-C disconnections (Alcohols and carbonyl compounds, 1,1-C-C, 1,2-C-C and 1,3-C-C); Synthesis of alkenes (Wittig disconnections and diene synthesis), Two group disconnections (Diels Alder reaction and 1,3-difunctionalised compounds); Linear and convergent synthesis.

Textbooks and Books for Reference:

- 1) Some Modern Methods of Organic Synthesis W. Carothers, Third Edition, Cambridge University Press, Cambridge, 1988.
- 2) Modern Organic Synthesis-an introduction by George S.Zweifel and Michael H. Nantz, W. H. Freeman & company, New York.
- 3) Advanced Organic Synthesis, Part B-Reactions and Synthesis, Francis A. Carey and Richard J. Sudenburg, Fourt edition, Kluwer academic publishers, New York.
- 4) Organic Synthesis, Christine Willis and Martin Willis, Oxford Chemistry primers.
- 5) Principles of Organic Synthesis, ROC Norman and JM Coxon, third edition, CBS, Publisher, Delhi.
- 6) Organic Synthesis, M. B. Smith, McGraw Hill, International Edition.
- 7) Organic Chemistry, Clayden, Greeves and Stewart Warren.
- 8) Guide Book to Organic Synthesis (3<sup>rd</sup> edition), R. Mackie, D. M. Smith and Aitken.
- 9) Organo Boranes and Silanes, Thomson, Oxford Chemistry primers.
- 10) Strategic applications of named reactions in organic synthesis, Laszlo Kurti and Barbara Czako.
- 11) Organic Synthesis: The disconnection approach, S. Warrant John Wiley & sons, New York, 1984.
- 12) Modern Synthetic Reactions, Herbet O. Horase, Second Edition, W.A. Benzamine Inc. Menio Park, California, 1972.



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**FOURTH SEMESTER**

**Paper – IV- BIO-ORGANIC CHEMISTRY**  
**(Effective from the 2016-17 Admitted Batch)**

UNIT-I 15 Hours

**Biopolymers and Enzymes**

Peptides:  $\alpha$ -Amino acids, their general properties and synthesis, Synthesis of peptides by Merrified solid phase synthesis. Chemistry of oxytocin and dolastain-10  
Enzymes-Oxidoreductases, hydrolases, transferases, synthesis of ATP, Baker's Yeast.  
Enzyme models-NADH models, Bio transformations, Remotefunctionalization

UNIT-II 15 Hours

**Antimalarials & Antibiotics**

**i. Antimalarials**

Chemotherapy, synthesis and activity of antimalarial drugs- quinoline group-quinine, acridine group-quinacrine and guanidine group-paludrine.

**ii. Antibiotics**

General characteristics, structure- activity relationships, synthesis and activity of antibiotics: Pencillin G, Cephalosporin-C and streptomycin.

UNIT-III 15 Hours

**Vitamins and Prostaglandins**

Definition, occurrence, structural formulae, physiological functions and synthesis of Vitamins.

Vitamins: Structure determination and synthesis of Retinol (A), Thiamine (B<sub>1</sub>), Riboflavin (B<sub>2</sub>), Pyridoxine (B<sub>6</sub>) and Biotins (H), Nicotininc acid.

**Prostaglandins**

Occurrence, nomenclature, classification, biogenesis and physiological effects. Synthesis of PGE<sub>2</sub> and PGF<sub>2</sub>

UNIT-IV 15 Hours

**Nucleic Acids:**

Nucleic acids: Basic concepts of the structures of RNA and DNA and their hydrolysis products, nucleotides, nucleosides and heterocyclic bases, Genetic Code, Finger Print test.

Application of recombinant DNA technology in production of pharmaceuticals, diagnosis of diseases, insect control, improved biological detergents, gene therapy-examples.



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Reference Books and Material:

1. Chemical Aspects of Biosynthesis, John Man, Oxford University Press, Oxford, 1996.
2. Chemistry of Natural Products: A Unified Approach, N. R. Krishnaswamy, University Press (India) Ltd., Orient Longman Limited, Hyderabad, 1999.
3. Introduction to Organic Chemistry, A Streitwieser, CH Heathcock and E.M./Kosover IV Edition, McMillan, 1992. (For Merrifield synthesis of peptides and also for other aspects of Unit IV)
4. Bio-organic Chemistry, H.Dugas and C. Penney, springer, New York, 1981.
5. Details of Primary literature: Nomenclature: Structure: Dolastatin-10: JACS, 1987, 109, 6883 (structure), ibdi, 1989, 111, 5463, JCS, Parkin I, 1996, 859 (synthesis).



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**III SEMESTER**  
**Laboratory Course-1**

**100 M**

**Multistep Synthesis of Organic Compounds:**

The experiments should illustrate the use of organic reagents and may involve purification of the products by chromatographic techniques.

1. Beckmann rearrangement: Benzanilide from Benzophenone  
Benzophenone → Benzophenone oxime → Benzanilide
2. Benzilic acid rearrangement: Benzilic acid from benzoin  
Benzoin → Benzil → Benzilic acid
3. P-Bromo Aniline from Aniline :  
Aniline → Acetanilide → P-Bromo Acetanilide → P-Bromo Aniline
4. Symmetrical Tribromo Benzene from aniline:  
Aniline → Tribromoaniline → Tribromobenzene
5. 2,4,6-trimethylquinoline from p-toluidine  
p-toluidine → 4-(p-tolylamino) pent-3-ene-2-one → 2,4,6-trimethylquinoline
6. Flavone from o-hydroxy acetophenone  
o-hydroxy acetophenone → o-benzoyl acetophenone → o-hydroxy- dibenzoylmethane → Flavone
7. 2-phenylindole from phenylhydrazine  
phenylhydrazine → acetophenone phenylhydrazone → 2-phenylindole

**Laboratory Course-2**

**100 M**

**Spectral Identification of Organic Compounds (UV, IR,  $1^{\text{H}}$ - and  $^{13}\text{C}$ - NMR, MASS).**

A minimum of 40 representative examples should be studied

**Books Suggested**

1. Modern Organic Synthesis in the Laboratory *A Collection of Standard Experimental Procedures*, Jie Jack Li, Chris Limberakis, Derek A. Pflum
2. Practical organic chemistry by Mann & Saunders
3. Text book of practical organic chemistry by Vogel
4. Spectrometric Identification of organic compounds, R.M. Silverstein, F.X. Webster and D.J. Kiemle, 7th Ed., (Wiley)



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DEPARTMENT OF CHEMISTRY

**IV – SEMESTER**  
**Laboratory Course-1**

**100 M**

**Chromatographic Separation and Isolation & identification of Natural Products**

1. Thin layer chromatography: Determination of purity of a given sample, monitoring the progress of chemical reactions, identification of unknown organic compounds by comparing the R<sub>f</sub> values of known standards.
2. Isolation and identification of Natural Products
  - (a) Isolation of caffeine from tea leaves
  - (b) Isolation of eugenol from cloves
  - (c) Isolation of casein and lactose from milk
  - (d) Isolation of limonene from lemon peel
  - (e) Isolation of piperines from black pepper
  - (f) Isolation of lycopene from tomatoes
  - (g) Isolation of β-carotene from carrots

**Laboratory Course-2**  
**Estimations and Chromatography**

**100 M**

1. Estimation of (a) Glucose (b) Phenol (c) Aniline (d) Acetone (e) Aspirin (f) Ibuprofen (g) Paracetamol
2. Separation by column chromatography: Separation of a mixture of *ortho* and *para* nitroanilines using silicagel as adsorbent and chloroform as the eluent. The column chromatography should be monitored by TLC.

**Books Suggested:**

1. Ikan, R. *Natural Products, A Laboratory Guide*, 2nd ed.; Academic Press: New York, 1991.
2. Adapted from *Introduction to Organic Laboratory Techniques: A Microscale Approach*. Pavia, Lampman, Kriz and Engel. (1999) Saunders College Publishing.
3. Pharmaceutical drug analysis by Ashutoshkar
4. Quantitative analysis of drugs in pharmaceutical formulations by P D Sethi
5. Practical pharmaceutical chemistry part-1 and part-2 by A H Beckett and J B Stenlake
6. Practical organic chemistry by Mann & Saunders
7. Text book of practical organic chemistry including qualitative organic analysis by A.I. Vogel (Longman)



ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY  
**THIRD SEMESTER**  
PAPER-I: ADVANCED CHEMICAL KINETICS AND PHYSICAL  
CHEMISTRY OF POLYMERS  
(Effective from the 2016-17 admitted Batch)

UNIT-I

Theories of reaction rates – Potential energy surfaces – Reaction coordinate – theories of unimolecular gas phase reactions – Lindemann hypothesis – Hinshelwood treatment – Reactions in solutions – Kinetic Isotope effect – Linear free energy relationships – Hammett equation – Okamoto–Brown Equation – Taft Equation; Chain Reactions  $H_2-Cl_2, H_2-Br_2$  and  $H_2-O_2$  reaction – Explosion limits.

UNIT-II

Complex reactions – Consecutive – Parallel and Opposing reactions – Equilibrium and Steady state technique – Michaelis – Menten Models. Flow and relaxation Technique for fast reactions – NMR methods determining exchange rates.

UNIT-III

Characteristics of macro molecules (addition & condensation of polymerization), degree of polymerization. Shapes of macro – molecules, bulk, solution and emulsion polymerization – Co-Polymerization, block and graft copolymers, Ziegler natta catalysis. The structure and properties of polymers – Crystallinity. Glass-transition temperature, Rheology and solubility of polymers, processing of polymers – Additives.

UNIT-IV

Interaction of polymers and liquids – Flory – Huggins treatment and its limitation, Fractionation, Viscosities of polymer solutions, Synthesis and properties of polyesters, polyamides, polyurethanes, polystyrene and bakelite. Determination of molecular Weights of polymers by osmometry, light scattering, Ultra centrifuge and Viscometry.

Suggested books :

1. Chemical Kinetics by Laidler.
2. Physical Organic Chemistry by Wiberg.
3. Kinetics and Mechanism by Frost and Pearson.
4. Molecular connectivity in Chemistry and Drug Research L.B.Kier and L.H.Hall Academic press, 1976.
5. Chemical Kinetics – The study of Reaction Rates in solution – Kenneth A. CANNORSV – VCH Publishers.
6. An introducer to polymer Chemistry – W.R. Moore.
7. Introduction to polymer Chemistry – R.B. Seymour.
8. Fundamentals of Polymer Science and Engineering – Anil Kumar and S.K. Gupta.





ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY  
**THIRD SEMESTER**  
PAPER II: QUANTUM CHEMISTRY –II AND CHEMICAL  
APPLICATIONS OF SYMMETRY AND GROUP THEORY  
(Effective from the 2016-17 admitted Batch)

UNIT –I:

Wave mechanics of simple systems –Systems with discontinuity in the Potential field  
–Quantum Mechanical tunneling effect –potential barrier with finite thickness.

Wave mechanics of systems with variable potential energy – Harmonic Oscillator –  
Hermite polynomials –recursion formula –Energy levels of three dimensional harmonic  
oscillator – degeneracy of the energy levels.

UNIT –II:

Hydrogen like atoms –Solutions of the wave equation –solution of  $R(r)$ ,  $\phi(\phi)$  and  $\theta(\theta)$   
equations – Shapes of atomic orbitals – Space quantization of electronic orbitals.

Angular momentum – Commutation relations – Commutation with Hamiltonian-Spin-  
Orbit interaction – Vector model of the atom.

UNIT–III:

Representation – reducible and irreducible representations – Orthogonality theorem and  
its consequences – Constructions of Character table for  $C_{2v}$  and  $C_{3v}$  point groups – Wave  
functions as bases for irreducible representations – Direct Product

Hybridization scheme for  $AB_n$  type of molecules –  $AB_3$ ,  $AB_4$ ,  $AB_5$  and  $AB_6$  under point  
groups  $D_{3h}$ ,  $D_{4h}$ ,  $T_d$ ,  $C_{4v}$  and  $O_h$

Ligand field theory: Splitting of d-orbitals under  $D_{4h}$ ,  $T_d$ ,  $C_{4v}$  and  $O_h$  environments.

Construction of molecular orbital correlation diagram (1) for  $\sigma$  bonds in octahedral  
environment and (2) for  $H_2O$  molecule.

UNIT-IV:

Symmetry selection rules for I.R. and Raman activity – transition moment integral –  
application of direct product.

Determination of symmetries of total degrees of freedom: Calculation of Character per  
un-shifted atom for different symmetry operations and evaluation of  $SF_6$ .

Determination of symmetries of I.R. and Raman active vibrational modes for different  
molecules  $SO_2$ ,  $NO_2$ ,  $CCl_4$ ,  $POCl_3$ ,  $PCl_5$  and  $SF_6$ .

Accidental degeneracy and Fermi Resonance.

Recommended Text Books:

1. Chemical Applications of Group Theory, F.A.Cotton Wiley Eastern Limited, New Delhi.
2. Group Theory and its Applications to Chemistry, K.V.Ramana, Tata McGraw-Hill Publishing Company Limited New Delhi.
3. Introductory Quantum Chemistry, A.K.Chandra, TATA MCGRAW-HILL Publishing Company Ltd., New Delhi.
4. Quantum Chemistry, Iran Levine, Pearson Education.
5. Theoretical Chemistry, S.Glastone.



ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY  
**THIRD SEMESTER**  
PAPER-III: STATISTICAL THERMODYNAMICS AND SOLUTION  
EQUILIBRIA OF PROTON LIGAND COMPELXES  
(Effective from the 2016-17 admitted Batch)

UNIT-I:

Statistical mechanics : Ensembles (Canonical and micro canonical ) –Basic definition distribution and microstates ,thermodynamic probability . The classical distribution law . The Maxwell – Boltzmann distribution law ,method of lagrangian multiplies ,indistinguishable particles, quantum statistics – Bose –Einstein and Fermi Dirac Statistics, Conditions for the applicability of Maxwell – Boltzmann statistics, Bose – Einstein statistics and radiation, extreme gas degeneration, degenerate electron gas.

UNIT-II :

Statistical thermodynamics: Partition function. Thermodynamics functions from partition functions for multiple degree of freedom, theories of heat capacities of solids, stastical evaluation of entropy, comparison of statistical values with third law entropies (thermal entropies).

UNIT-III :

Gran analysis of acid base titrations –Determination of Carbonate content and correction factors for  $P^H$  meter dial readings ; Secondary formation function  $nbarh$ ; Calculation of stability constants of proton ligand complexes –successive approximation method –half  $nbarh$  method; Simulation of  $p^H$  metric titration data for proton –ligand systems.

UNIT –IV :

Prediction of proton –ligand formation constants using Molecular mechanics/ Quantum Chemical methods; Effect of solvent on stability – Abraham multi layer model –LD model; Components of expert systems – knowledge base, inference engine and user interface.

Suggested Books:

1. M.T.Beck,Complex Equilibria,1991
2. Alcock,solution Equilibria,1992
3. Richard E. Dickerson,Molecular Thermodynamics
4. S.Glasstone, Theoretical Chemistry
5. S.Glasstone,Thermodynamics for Chemists
6. C.Andrews ,Equilibrium Statistical Mechanics
7. Davies, Thermodynamics
8. Yeremin, Thermodynamics
9. J. Rajaram, and T.C. Kuriacose, Thermodynamics for student of chemistry.



ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY  
**THIRD SEMESTER**

PAPER –IV : INSTRUMENTATION

**(Effective from the 2016-17 admitted Batch)**

UNIT –I :

Spectrophotometry – deviations from Beer - lamberts law Instrumentation –Errors in Spectrophotometry – photometric titrations composition and stability constants of mononuclear complexes by linear extrapolation methods.Fundamental principles of Fluorescence spectroscopy and basic instrumentation of spectrofluorimeter.

UNIT –II :

Chromatographic methods - Ion exchange chromatography separation of transition metal ion – solvent extraction - partition coefficient – distribution ratio - classification of solvent extraction systems and evaluation of formation constants and applications Gas liquid Chromatography principal - Instrumentation - retention time - retention volume – Elementary principles of HPLC and hyphenated instruments.

UNIT –III :

Techniques and instrumentation of IR , Microwave and Raman. Theory and instrumentation Atomic absorption spectroscopy - Atomic emission spectroscopy with ICP source - Elementary principles of laser mass spectrometry.

UNIT – IV :

Polarography - Introduction - types of currents - qualitative and quantitative aspects of polarography – analytical applications to organic and inorganic compounds - Evaluation of stability constants by deford and hume method – amperometric titrations. Principles of thermo gravimetry - Apparatus and working, Differential methods of analysis - principle factors affecting DTA curve. Application of DTA .

Suggested Books:

1. Quantitative Analysis – R.A.Day and A.L.Underwood
2. Quantitative Inorganic Analysis – A . I . Vogel
3. Spectroscopy S.Walker and Straw Volumes I, II and III
4. Instrumental Methods of Chemical Analysis - Kudesla Snwheny (Pragati Prallesan Meerut) 1988.
5. Instrumental Techniques for Analytical Chemistry-Frank settle (Pearson Eddition )2004.

2015-16

DEPARTMENT OF PHYSICAL AND NUCLEAR CHEMISTRY AND CHEMICAL  
OCEANOGRAPHY  
ANDHRA UNIVERSITY

S.K. Anju Begum

M.Sc. (Final) PHYSICAL CHEMISTRY  
IV SEMESTER

**Paper I: ADVANCED CHEMICAL KINETICS AND PHOTO CHEMISTRY**

**UNIT - I:**

Correlation analysis - Marcus Theory of electron transfer adiabatic and non adiabatic electron transfer - outer and inner sphere mechanism - effect of solvent on rates - effect of dielectric constants on ion - ion, ion - molecule, molecule - molecule reactions - BET isotherm determination of surface area - semiconductor catalysis - Homogeneous catalysis - acid base and redox catalysis.

**UNIT - II:**

Correlation of rate with  $H_0$ ,  $H_R$ , acidity functions and their use in the illustration of mechanism in acid base catalysis - catalysis by transition metal ions and their complexes - Industrially important processes - substitution reactions in Octahedral complexes.

**UNIT - III:**

Photochemistry : Absorption Excitation - photochemical laws - quantum yield of electronically excited states - measurements of life times - Flash photolysis - Stopped flow Techniques: energy dissipation by radiative and non - radiative processes, absorption spectra - Franck - Condon principles. Photochemical stages - Primary processes and secondary processes - Rate constants and life times of reactive excited states.

**UNIT - IV:**

Properties of excited states : structure, dipole moment acid base strengths - reactivity, kinetics of bimolecular processes - quenching, Stern - Volmer equation. Photo-reduction and oxidation. Cyclo addition reactions, Woodward - Hoffmann's rules.

**Suggested Books**

1. Chemical kinetics by Laidler
2. Physical Organic Chemistry by Wiberg
3. Kinetics and mechanism by Frost and Pearson
4. Techniques in Organic Reaction Mechanism by Zuman and Patel.
5. Chemical kinetics - The study of Reaction Rates in solution - Kenneth A. CONNORS - VCH Publishers.
6. Fundamentals of photochemistry - k.k.Rohatgi - Mukherjee
7. Photochemistry - Cox and Kemp
8. Photochemistry - Calvert by Pitts,

ANDHRA UNIVERSITY  
M.Sc. (Final) PHYSICAL CHEMISTRY  
IV SEMESTER

PAPER II: QUANTUM CHEMISTRY-III, NUMERICAL METHODS FOR CHEMISTS AND  
ADVANCED COMPUTER PROGRAMMING

QUANTUM CHEMISTRY:

**UNIT I:**

Approximation methods. Variation method and its application- Ground state of helium atom- ground state energy of one dimensional harmonic oscillator- Perturbation theory- time dependent perturbation- First and second order approximations- Stark effect- Calculation of first and second order perturbation effects on simple systems. Time dependent perturbations- Interaction of matter with radiation; Zeeman effect- Derivation of Fermi's Golden rule.

**UNIT II:**

Born-Oppenheimer approximation- The LCAO approximation- application to  $H_2^+$  ion- MO theory and its application- Correlation diagrams- Hartee-Fock self consistent field method. Chemical bonding in poly atomic molecules- Hybrid orbitals- Huckel theory of linear conjugated systems and cyclic conjugated molecules- Aromaticity- Calculations of delocalization energy of simple conjugated systems.

**UNIT III:**

**NUMERICAL METHODS:**

Precision and Accuracy, Determinate and indeterminate errors, computational errors truncation and rounding off errors, algorithm errors-absolute and relative errors-Error propagation. Measures of Dispersion – range, arithmetic mean, mean deviation variance and standard deviation – moments – skewness and kurtosis.

Interpolation: interpolation for linear fit, linear interpolation in non-linear fit, polynomial interpolation – Lagrange interpolation formula – Application to complex equilibria.

Numerical techniques of solving ordinary first order differential equations:- Euler's method, Predictor-corrector method, Rungae-Kutta method- application to chemical kinetics.

**UNIT IV:**

Fortan programming: Concepts of algorithms and flow-charts, logical variables and logical expressions, order of evaluation of logical expressions, logical assignment statements, logical if and block if statements, computed GO TO statement, writing a decision, chain of decisions, arrays-one dimensional and two dimensional arrays. DO loop and its application in Input and Output statements. Statement Function, Function and Subroutine sub-programs.

Application to Chemical Problems: : Flowcharts and Programs for

1. Calculation of skewness and kurtosis of replicate measurements.
2. Polynomial interpolation using Lagrange interpolation formula
3. Euler's step by step iteration method for solving ordinary first order differential equation.
4. Calculation of first order rate constant of acid catalyzed hydrolysis of an ester, using a subprogram for the calculation of slope by linear least-squares method.

**RECOMMENDED TEXT BOOKS:**

1. Introductory Quantum Chemistry, A.K.Chandra, TATA McGRAW-HILL Publishing company Ltd., New Delhi.
2. Quantum Chemistry, Iran Levine, Pearson Education.
3. Theoretical Chemistry, S.Glastone
4. Computer programming in Fortan-IV by V.Rajaraman, Prentice-Hall of India Pvt. Ltd., New Delhi.

**DEPARTMENT OF PHYSICAL AND NUCLEAR CHEMISTRY AND CHEMICAL  
OCEANOGRAPHY  
ANDHRA UNIVERSITY  
M.Sc. (Final) PHYSICAL CHEMISTRY  
IV SEMESTER**

**Paper- III: ADVANCED THERMODYNAMICS AND SOLUTION EQUILIBRIA OF  
METAL-LIGAND COMPLEXES**

**UNIT - I:**

Thermodynamics and phase changes – Free energy and meaning of phase changes, calculation of phase equilibrium curves, Pressure as a measure of escaping tendency, single components phase diagrams, free energy diagrams and the critical point, first and second order transitions, partial molar quantities and their determination, chemical potential and phase rule. Thermodynamics of chemical reactions, Real gases and fugacity and its determination from PVT data.

**UNIT - II:**

Thermodynamics of living systems: Simultaneous coupled reactions, coupled reactions and metabolism free energy utilization, free energy utilization in metabolism, citric acid cycle, Terminal oxidation, Chain aerobic metabolism. Elementary aspects of non-equilibrium thermodynamics conservation of mass and energy – entropy production and flow in open system – Onsager theory – principles of microscopic reversibility.

**UNIT - III:**

Calvin Wilson Titration Techniques for metal ligand complexes – Determination of Stability constants using formation function, hydroxylated complexes stability constant by Martell method – Leden's procedure. Solution of a non – linear function of two variables – A Algorithm of MINQUAD programme – criteria of best fit model.

**UNIT - IV:**

Prediction of metal ligand stability constants – Irving and William order. Neural networks – Processing element, Transfer function, Training algorithm – BFGS, MAFQUARDT and back propagation. Multi layer perception and radial basis function NN's. Features of Trajan software – Input Output – Intelligent problem solver.

**Suggested Books**

1. M.T.Beck, complex Equilibria, 1991
2. Alcock, Solution Equilibria, 1992
3. Neural Networks systems Techniques and Applications – Ciornelices T. leondes; Vol.1:Algorithms and Architectures.
4. J.Zupan, Neural Network for Chemists, VCH,1992
5. Richard E.Dickerson , molecular Thermodynamics
6. S.Glasstone, Theroretical Chemistry
7. S.Glasstone, Thermodynamics for chemists
8. C.Andrews, Equilibrium Statistical Mechanics
9. Davies, Thermodynamics
10. Yereimin, thermodynamics
11. J.Rajaram, and T.C.Kuriacose, Thermodynamics for students of chemistry.

ANDHRA UNIVERSITY  
DEPARTMENT OF PHYSICAL AND NUCLEAR CHEMISTRY AND CHEMICAL  
OCEANOGRAPHY  
M.Sc. (Final) PHYSICAL CHEMISTRY  
IV SEMESTER

Paper IV: SPECTROSCOPY  
(Common for Physical Chemistry and Marine Chemistry)  
Effective from 2010-11 admitted batch

**UNIT - I:**

Rotational (Microwave) Spectroscopy - The rotational energies of polyatomic molecules - Rotational selection rules for linear molecules - symmetric top - Asymmetric top molecules - degeneracy of rotational energy levels - The Stark effect in molecular rotational spectra - Molecular Rotation - Nuclear spin coupling - Application of Rotation Spectra - Determination of Inter Nuclear distance - Moment of Inertia and Dipole moment.

**UNIT - II:**

Rotation vibration spectra - selection rules and transitions for the rigid rotator - harmonic oscillator model - parallel and perpendicular bands of linear and symmetric top molecules - Raman active fundamental - Criterion for their appearance - Rotational and vibrational Raman; Raman and Infrared studies of  $AB_2$ ,  $AB_3$  type molecules - correlation of infrared and Raman spectra.

**UNIT - III:**

ESR spectroscopy - the resonance condition - anisotropy in g-factor - Theory and applications of ESR method - Crystalline solids - free radicals in solutions - interpretation of ESR spectra of typical radicals and ion like  $Mn^{2+}$ ,  $Cr^{3+}$ ,  $Cu^{2+}$  - Hyperfine interactions in the following systems. P-Benzoquinone - (semi) naphthalene radical anion and anthracene radical anion.

NMR spectroscopy - chemical shifts and shielding - some application of NMR spectra - effect of chemical exchange on spectra - Effect of quadrupole interactions on NMR spectra - an elementary study of isotopes other than proton - Fluorine -19, phosphorous-31, Carbon-13, Boron-11 - NQR spectroscopy - Electric field gradient and quadrupole coupling constant - Splitting in NQR spectra - Applications of NQR spectroscopy

**UNIT - IV:**

Electron Spectroscopy - basic principles of Photo Electron Spectroscopy (PES) - Koopman's theorem and chemical shift. PES of simple molecules. Electron Spectroscopy for Chemical Analysis (ESCA) - Chemical information from ESCA. Principles and applications of Auger Electron Spectroscopy (AES) - comparison between PES, ESCA and AES - X-ray methods - X-ray fluorescence (XRF) - techniques of X-ray absorption and X-ray emission methods and their applications.

**Suggested Books**

1. Spectroscopy S. Walker and straw, volumes I, II and III
2. Molecular Spectroscopy, - Gordon M. barrow
3. Fundamentals of Molecular Spectroscopy - Banwell
4. Spectroscopy - B.K.Sharma - Goe! Publishing House Meerut. 1990.



AC IIIsem - Paper 1 Syllabus.doc

AC IIIsem - Paper 2 Syllabus.doc

AC IIIsem - Paper 3 Syllabus.doc

AC IIIsem - Paper 4 Syllabus.doc

AC IVsem - Paper 1 Syllabus.doc

AC IVsem - Paper 2 Syllabus.doc

AC IVsem - Paper 3 Syllabus.doc

AC IVsem - Paper 4 Syllabus.doc

M.Sc\_Analytical Chemistry Practical\_Syllabus.doc

**Adikavi Nannaya University :: Rajahmundry**  
**Department of Chemistry**  
**M.Sc. (Final) Chemistry Syllabus for III-Semester**  
**Specialization: Analytical Chemistry**  
**Paper - I: Separation Methods – I**  
(Effective from 2016-17 Admitted batch)

**Unit – I Chromatography - 1**

**Chromatography:** classification of different chromatographic methods, methods of development-Elution development, Gradient elution development, displacement development, and frontal analysis.

Principles of chromatography, different migration, adsorption phenomena, partition, adsorption coefficient, retardation factor, retention time and volume, column capacity, temperature effects, partition isotherm.

Dynamics of chromatography-efficiency of chromatographic column, zone spreading, High Equivalent Theoretical Plate (HETP), Van Deemter equation, resolution, choice of column, length and flow velocity, qualitative and quantitative analysis.

**Unit - II Chromatography – 2**

**Column chromatography (adsorption chromatography):** principles, general aspects, adsorption isotherms, chromatographic media, nature of forces between adsorbent and solutes, eluents (mobile phase), column chromatography without detectors and liquid chromatography with detectors and applications.

**Gel Exclusion chromatography or Gel filtration chromatography:** principles, properties of xerogels, apparatus and detectors, resolution of gel type, applications to organic compounds.

**Capillary Electrophoresis :** Principle, Details of the Instrument, Applications to Inorganic and Organic compounds.

**Unit – III Chromatography – 3**

**Gas chromatography:** Theory, Instrument description of equipment and different parts, columns (packed and capillary columns), detector specifications-thermal conductivity detector, flame ionization detector, electron capture detector, nitrogen-phosphorus detector, photo ionization detector, programmed temperature gas chromatography; applications in the analysis of gases, petroleum products etc., other detectors used their Principles and Applications.

**Inorganic molecular sieves:** structure of zeolites, crystals, types of sieves, application in the separation of gases including hydrocarbons, ion exclusion-principles and applications,

Counter current chromatography-principles and application, Affinity chromatography- principles and applications

### ***GC-MS – Introduction***

Instrumentation – GC – MS interface – Mass spectrometer (MS) Instrument operation, processing GC – MS data – ion chromatogram Library searching – Quantitative measurement – sample preparation Selected ion monitoring – Application of GC-MS for Trace constituents. Drugs analysis, Environmental analysis and others.

## **Unit – IV Chromatography – 4**

***Liquid-liquid partition chromatography:*** principle, supports, partitioning liquids, eluents, reverse phase chromatography, apparatus, applications

***High performance liquid chromatography:*** Theory, Instrument description of the different parts of the equipment, columns, detectors-UV detector, refractometric detector, Fluorescence detector, Diode Array detector, applications in the separation of organic compounds, names of other detectors used their Principles and Applications.

***LC-MS*** – Introduction – Instrumentation – liquid chromatograph – Mass spectrometer Interface – Instrumental details – Processing LC-MS data – ion chromatograms – Library searching – Quantitative measurements. Sample preparation – selected ion monitoring. Application of LC-MS for Drug analysis, Environmental samples and others.

### **Text books:**

1. R.P.W Scott, Techniques and practice of Chromatography, Marel Dekker Inc., New York
2. M.N. Sastri ,Separation methods, Himalaya Publishing Company, Mumbai

### **Reference books:**

1. E. Helfman, Chromatography, Van Nostrand, Reinhold, New York
2. E. Lederer and M. Lederer, Chromatography, Elsevier, Amsterdam.
3. Chemical separation methods, John A Dean, Von Nostrand Reinhold, New York
4. R.P.W Scott, Techniques and practice of Chromatography, Marel Dekker Inc., New York
5. H.M Mc Nair and J. M. Miller, Basic Gas Chromatography, John Wiley, New York
6. W. Jeumings, Analytical Gas chromatography, Academic Press, New York
7. H. Eugelhardt (ed), Practice of HPLC, Springer Verrag, Berrin

**Adikavi Nannaya University :: Rajahmundry**  
**Department of Chemistry**  
**M.Sc. (Final) Chemistry Syllabus for III-Semester**  
**Specialization: Analytical Chemistry**  
**Paper- II: Quality control and Traditional methods of Analysis-I**  
(Effective from 2016-17 Admitted batch)

**Unit – I: Quality control in Analytical Chemistry**

- (a) **Characteristics of an analysis:** quality of an analytical procedure, limit of detection, sensitivity, safety, cost measurability, selectivity and specificity, quality control-principles of Ruggedness test, control charts, Youden plot, and ranking test.
- (b) **Evaluation and reliability of analytical data:** limitation of analytical methods, accuracy, precision, errors in chemical analysis, classification of errors, minimization of errors, significant figures, computations and propagation of errors.
- (c) **Statistical analysis:** Mean deviation, Standard deviation, coefficient of variance, normal distribution, F test, T test, rejection of results, presentation of data.
- (d) **Quality assurance and management systems:** elements of quality assurance, quality assurance in design, development, production and services, quality and quantity management system, **ISO 9000** and **ISO 14000** series-meaning of quality, quality process model, customer requirement of quality calibration and testing, statistical process control, process control tools, control chart, statistical quality control, acceptance sampling.  
Good laboratory practices (GLP) – need for GLP, GLP implementation and organization, GLP status in India.
- (e) Brief out line of ICH guide lines on drug substances and products.

**Unit – II Decomposition techniques in analysis**

**(a) Inorganic Compounds**

Principle of decomposition and Dissolution. Difference between dissolution / decomposition of Organic and Inorganic substances.

Importance of Decomposition Techniques in Analysis.

Principle of Dissolution of an inorganic substance.

Decomposition of samples with acids – H<sub>2</sub>O, HCl, HF, HNO<sub>3</sub>, H<sub>2</sub>SO<sub>4</sub> and HClO<sub>4</sub>

Decomposition of samples by fusion, Principle and with two examples each

Alkali Fusion--- Na<sub>2</sub>CO<sub>3</sub>, NaOH,

Acidic Fusion--- Sodium Hydro Sulphate, Sodium Pyro Sulphate

Oxidation Fusion---Na<sub>2</sub>O<sub>2</sub>, Sodium Chlorate

Reductive Fusion Na<sub>2</sub>CO<sub>3</sub> + Na<sub>4</sub>BO<sub>4</sub>

What is Sintering process, How is it different from Fusion.

Fusion with alkali carbonates, alkali hydroxides, Sodium Peroxide

Decomposition of samples by sintering with sodium peroxide, sodium carbonate.

Principles of decomposition at high temperatures, high pressures .

Principles of Microwave and ultrasonic decomposition techniques.

### **(b) Organic Compounds**

Principles of solubility of organic compounds, non polar, polar solvents.  
Recrystallisation methods and application of solubility and Recrystallisation.

### **Unit – III Oxidant systems – Principles and applications in analysis**

Analytical chemistry of some selected oxidant systems – formal, standard and normal potentials in various media, species responsible for the oxidation properties, stability of the solutions, standardization, requirement for the selections of the oxidants, selection of suitable indicators for Oxidant systems.

- a) Inorganic Systems Mn (III), Mn (VII), Ce (IV), Cr (VI), V (V), periodate, iodate,
- b) Organic Systems chloramine-T.

### **Unit – IV Organic Functional group analysis**

Classification of functional groups with suitable examples.

Determination of:

- 1) Functional groups imparting acidic nature – thiol, enediol, phenolic hydroxyl.
- 2) Functional groups imparting basic nature – Aliphatic and Aromatic primary, secondary and tertiary amines – hydrazine derivatives.
- 3) Functional groups which impart neither acidic nor basic nature – Aldehydes, Ketones, Nitro, Methoxy, Olifinic.

### **Text books:**

1. Technical methods of analysis – Griffin, Mc Graw Hill Book Co.
2. Chemical Separation and measurements – D.G Peterseti, John M.Haves Sanders Co.
3. Chemical analysis – H.A Laitinan, Mc Graw Hill Book Co.
4. Newer redox titrants – Berka, Zyka and Vulterin, Pergamon Press
5. Volumetric Analysis, Vol III – I.M Kolthoff and R. Belcher, Interscience Public, New York
6. Vogel's Text Book of Inorganic Quantitative Analysis – J. Bassett et al, ELBS
7. Organic functional groups – S. Siggia

### **Reference Books:**

1. D.A Skoog, D.M West and F.J Holler, Analytical Chemistry, An Introduction, Sanders College Publishing, New York
2. K.V.S.G Murali Krishna, An Introduction ISO 9000, ISO 1400 Series, Environmental Management
3. Quality Assurance and Good Laboratory Practices, Prof. Y. Anjaneyulu, In Now Publication, New York
4. Quality Assurance in Analytical Chemistry – G.Kateman and F.W Pijpers, John Wiley and Sons, New York
5. Quantitative Chemical Analysis – I.M Kolthoff, E.B Sandel, E.J Meehan, S. Bruckenstein, Macmillan Company, London
6. Decomposition Techniques in Inorganic Analysis – J.Dolezal, P.Povondra, Z.Sulcek

**Adikavi Nannaya University :: Rajahmundry**  
**Department of Chemistry**  
**M.Sc. (Final) Chemistry Syllabus for III-Semester**  
**Specialization: Analytical Chemistry**  
**Paper – III: Applied Analysis-I**  
(Effective from 2016-17 Admitted batch)

**Unit – I Analysis of Ores**

- (a) General techniques of analysis applied to complex materials - Scope of metallurgical analysis -  
General methods of dissolution of complex materials - Various chemical methods for the effective separation of the constituents in the complex materials.
- (b) Analysis of ores: Iron ore- Analysis of the Constituents – Moisture , loss of ignition, Total Iron, ferrous Iron ,Ferric Iron, alumina , silica, Titania, Lime, Magnesia, Sulphur, phosphorous, manganese, alkalies, combined water, Carbon in blast furnace, flue dust and sinter.
- (c) Manganese Ore - Analysis of the Constituents – Total Manganese,  $MnO_2$ ,  $SiO_2$ ,  $BaO$ ,  $Fe_2O_3$ ,  $Al_2O_3$ ,  $CaO$ , P and S
- (d) Chromite Ore - Analysis of the Constituents – Chromium,  $SiO_2$ ,  $FeO$ ,  $Al_2O_3$   $CaO$ , &  $MgO$ .
- (e) Phosphate rock Ore - Analysis of the Constituents -  $CaO$ ,  $P_2O_5$ , F,  $SiO_2$ ,  $CO_2$ , S,  $Na_2O$ ,  $Al_2O_3$ ,  $Fe_2O_3$ ,  $MgO$ ,  $K_2O$ ,  $Cl$ ,  $MnO$ . Organic carbon, Moisture, Loss of ignition.
- (f) Aluminium Ore (Bauxite) - Analysis of the Constituents – Silica, Alumina,  $Fe_2O_3$ , Titania,  $MnO$ ,  $P_2O_5$ ,  $CaO$ ,  $MgO$ , vanadium, zirconium, and alkalies.

**Unit – II Analysis of Finished Products – I**

- (a) Analysis of steel for C, Si, S, P, Mn, Ni, Cr; Mg and analysis of blast furnace slag .
- (b) Analysis of refractory materials: fire clay, flour spar, and magnesite
- (c) Analysis of fluxes - limestone and dolomite.

**Unit – III Analysis of Finished Products – II**

- (a) Chemical Analysis of cement-silica,  $NH_4OH$  group, ferric oxide, alumina, lime, magnesia, Sulphide Sulphur ,  $K_2O$ ,  $Na_2O$ , free  $CaO$  in Cement and Clinker,  $SO_3$  and loss on ignition.
- (b) Analysis of oils - saponification number, iodine number, and acid number..
- (c) Analysis of soaps - moisture, volatile matter, total alkali, total fatty matter, free caustic alkali or free fatty acids, sodium silicate , chloride.
- (d) Analysis of paints-vehicle and pigment,  $BaSO_4$ , total lead and lead chromate

## Unit – IV Assessment of water Quality

Sources of water, classification of water for different uses, types of water pollutants and their effects,

Analytical methods for the determination of the following ions in water:

Anions:  $\text{CO}_3^{2-}$ ,  $\text{HCO}_3^-$ ,  $\text{F}^-$ ,  $\text{Cl}^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{PO}_4^{3-}$ ,  $\text{NO}_3^-$ ,  $\text{NO}_2^-$ ,  $\text{CN}^-$ ,  $\text{S}^{2-}$

Cations:  $\text{Fe}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{Cr}^{3+}$ ,  $\text{As}^{5+}$ ,  $\text{Pb}^{2+}$ ,  $\text{Hg}^{2+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Cd}^{2+}$ ,  $\text{Co}^{2+}$

Determination of Dissolved oxygen (D.O), Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD), standards for drinking water.

### Text books

1. Handbook of Analytical Control of Iron and Steel Production, Harrison John, Wiley 1979
2. Standard methods of Chemical Analysis, Welcher
3. Technical Methods of Analysis, Griffin, Mc Graw Hill
4. Commercial Methods of Analysis, Foster Dee Sneel and Frank M. Griffin, Mc Graw Hill Book Co.
5. Water Pollution, Lalude, Mc Graw Hill
6. Environmental Chemistry, Anil Kumar De, Wiley Eastern Ltd.
7. Environmental Analysis, S.M. Khopkar (IIT Bombay)

**Adikavi Nannaya University :: Rajahmundry**  
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**Paper – IV: INSTRUMENTAL METHODS OF ANALYSIS - I**

(Effective from 2016-17 Admitted batch)

**Unit – I : Spectroscopic Methods - 1**

- (a) **UV-Visible Spectroscopy:** laws of absorption, deviation from Beer's law, single and double beam spectrophotometers-instrumentation, sources of radiation, detectors, qualitative analysis by absorption measurements, general precautions in colorimetric determinations, determination of certain metal ions by using ligands –  $\text{Fe}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Al}^{3+}$ ,  $\text{NH}_4^+$ ,  $\text{Cr}^{3+}$ ,  $\text{Cr}^{6+}$ ,  $\text{Co}^{3+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Ni}^{2+}$  and anions –  $\text{NO}_2^-$ ,  $\text{PO}_4^{3-}$  using suitable reagents, simultaneous determinations of dichromate and permanganate in a mixture, spectrophotometric titrations, principle of diode array spectrophotometers.
- (b) **Spectrofluorimetry:** Theory of fluorescence, phosphorescence, factors affecting the above, quenching, relation between intensity of fluorescence and concentration, instrumentation, application with reference to  $\text{Al}^{3+}$ , chromium salts, fluorescence, thiamin (B1) and riboflavin (B2) in drug samples.

**Unit – II : Spectroscopic Methods - 2**

- (a) **Infrared spectroscopy:** units of frequency, wavelength and wave number molecular vibrations, factors influencing vibrational frequencies, instrumentation, sampling techniques, detectors, characteristic frequencies of organic molecules, qualitative and quantitative analysis with reference to (petroleum refinery and polymer industry), selected molecules like CO, CO<sub>2</sub>, non-destructive IR method for the analysis of CO and other organic compounds, principles of Fourier transform IR.
- (b) **Raman Spectroscopy:** Raman effect and spectra, differences between Raman spectra and IR spectra, instrumentation, Raman spectra of CO, CO<sub>2</sub>, N<sub>2</sub>O, H<sub>2</sub>O.

**Unit – III : Spectroscopic Methods -3**

- (a) **NMR Spectroscopy:** resonance condition, origin of NMR spectra, instrumentation, chemical shift, factors affecting chemical shift, shielding, spin-spin splitting, mechanism for spin-spin coupling, interpretation of NMR spectra of typical organic compounds, factors influencing NMR spectra, fast chemical reactions, magnitude of I, nuclei with quadrupole moments, FT NMR, study of isotopes other than proton-<sup>13</sup>C, <sup>15</sup>N, <sup>19</sup>F, <sup>31</sup>P, <sup>11</sup>B, double resonance, spin tickling, shift reagents, applications.



(b) *ESR Spectroscopy*: principle, g value, hyper fine splitting, qualitative analysis, Krammers degeneracy, fine splitting, instrumentation, introduction to double resonance technique, difference between ESR and NMR spectra, quantitative analysis, application to study of free radicals and other analytical applications.

#### **Unit – IV : Spectroscopic Methods -4**

(a) *Mass Spectroscopy*: Principle, basic instrumentation, energetics of ion formation, types of peaks observed, resolution, qualitative analysis, molecular weight determination, quantitative analysis, advantages

(b) *X-ray Spectroscopy (XRF)*: chemical analysis by X-ray spectrometers, energy dispersive and wavelength dispersive techniques, evaluation methods, instrumentation, matrix effects, applications.

#### **Text Books:**

1. Instrumental methods of analysis – H.H Willard, Meritt Jr. and J.A Dean
2. Principles of instrumental analysis – Skoog and West
3. Vogels Textbook of Quantitative Inorganic analysis – J. Basset, R.C Denney, G.H Jefferey and J.Madhan
4. Instrumental methods of analysis – B.K Sarma, Goel Publishing House, Meerut
5. Instrumental methods of Analysis – Chatwal and Anand
6. Instrumental methods of Analysis – Ewing
7. Handbook of ICP
8. The ICP – Bogdain B.

#### **Reference Books:**

1. Applications of ICP-MS, A.R Date and A.L Glay, London (Eds), Blackie, London
2. A. Moutaser and D.W Golightly (Eds), ICP in Analytical Atomic Spectrometry, VeH Publishers, New York
3. G.I Moore, Introduction to ICP emission Spectrometry in Analytical Spectroscopy, Elsevier, Amsterdam

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**Paper-1: Separation Methods – II**  
(Effective from 2016-17 Admitted batch)

**Unit – I Chromatography - 5**

- (a) **Paper chromatography:** principle, papers as a chromatographic medium, modified papers, solvent systems, mechanism of paper chromatography, experimental technique, different development methods-ascending, descending, horizontal, circular spreading, multiple development, two dimensional development, reverse phase paper chromatographic technique-visualization and evaluation of chromatograms, applications.
- (b) **Thin layer chromatography:** principle, chromatographic media-coating materials, applications, activation of adsorbent, sample development, solvent systems, development of chromatoplate, types of development, visualization methods, documentation, applications in the separation, HPTLC-principle, technique, applications.

**Unit – II Chromatography - 6**

- (a) **Ion Exchange:** principles of ion-exchange systems, synthetic ion-exchange resins, properties of anion and cation exchange resins, ion-exchange mechanism, ion-exchange equilibria, selectivity, ion-exchange capacity, applications of ion-exchangers in different fields.
- (b) **Ion exchange chromatography:** Principle, Equipment, Application Specifically Separations of Lanthanides, Actinides, amino acids.
- (c) **Ion chromatography:** principles of separation, instrumentation, detectors, separation of cations and anions, applications in the analysis of water and air pollutants.

**Unit – III Sampling of Solids, Liquids and Gases**

**Sampling:** Basis of sampling, purpose of sampling, homogeneous and heterogeneous samples, statistical criteria for good sampling, sample size, sampling unit, gross sample, laboratory sample.

Sampling of Solids: Cone and Quartering method, Long pile and alternative shovel method, precautions in preservation of solid samples, sampling of metals and other solids rods, wires, sheets, plates, especially Gold, Silver, Iron and other metals.

Sampling of different types of liquids: different sampling techniques, sampling of drinking water, industrial effluents, precautions in sampling and preservation of collected liquid samples.

Sampling of gases: sampling and Preconcentration by adsorption or absorption method, instantaneous monitoring, sampling in samplers and subsequent monitoring, different types of gas samplers, precautions in preservation of samples, systematic sampling and random sampling.

#### **Unit – IV Importance of Analytical chemistry & Solvent Extraction**

**(a) Importance of Analytical Chemistry to Industrial Research:** Importance of Qualitative and Quantitative analysis in research and development, industries and other branches of science.

Development and validation of an analytical method, units, concentrations, calculations, standards, chemical reactions, expressions of concentrations, importance of separation methods with examples.

**(b) Solvent Extraction:** principles and processes of solvent extraction, Distribution Law and Partition coefficient, nature of partition forces, different types of solvent extraction systems – Batch extraction, Continuous extraction, Counter current extraction, solvent extraction systems, applications in metallurgy, general applications in analysis and pre-concentration, special extraction systems like crown ethers, super fluid and surfactant extractions-examples.

#### **Text books:**

1. R.P.W Scott, Techniques and practice of Chromatography, Marel Dekker Inc., New York
2. Separation methods, M.N Sastri, Himalaya Publishing Company, Mumbai

#### **Reference books:**

1. E. Helfman, Chromatography, Van Nostrand, Reinhold, New York
2. E. Lederer and M. Lederer, Chromatography, Elsevier, Amsterdam.
3. Chemical separation methods, John A Dean, Von Nostrand Reinhold, New York
4. R.P.W Scott, Techniques and practice of Chromatography, Marel Dekker Inc., New York
5. E.Stahl, Thin layer chromatography, Academic Press, New York
6. James, G.Tartor (Ion chromatography)

**Adikavi Nannaya University :: Rajahmundry**  
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**Paper – II : Traditional Methods of Analysis - II**  
(Effective from 2016-17 Admitted batch)

**Unit – I Precipitation methods - 1**

- (a) Crystal habit and super saturation, nucleation and crystal growth, homogeneous and heterogeneous nucleation, solubility and particle size, colloids, completeness of precipitation, effect of excess precipitant, pH, complex formation, temperature, purity of precipitates, aging.
- (b) **Co-precipitation and post precipitation** : theory of adsorption of salts having an ion in common with the main precipitate, co-precipitation in colloidal precipitates, adsorption of solvents, mixed crystal formation by occlusion and entrapment, re-precipitation with examples, Post-precipitation – theory of post-precipitation, examples of post-precipitation, conditions for obtaining pure and quantitative precipitates.
- (c) **Precipitation Titrations**: Principle, Indicators for precipitation titrations, determination of halides.

**Unit – II Precipitation methods - 2**

- (a) **Precipitation from Homogeneous Solution (PFHS)**: theory of PFHS, methods of PFHS – increase in pH, decrease in pH, cation release, anion release, reagent synthesis, change in oxidation state, photochemical reactions, precipitation from mixed solvents. Applications of PFHS methods.
- (b) **Gravimetric determinations**: nature of species, preparation of solutions, limitations, interferences, inorganic precipitants-chloride and sulphate, organic precipitants dimethyl glyoxime (DMG), oxine, benzidine, salicylaldehyde, benzoin oxime, sodium tetraphenyl boron, tetraphenyl arsonium chloride.
- (a) **Electro-gravimetric analysis**: principle, important terms in electrogravimetry, decomposition voltage or decomposition potential, over voltage and their importance, instrumentation, electrolysis at constant current, determination of  $\text{Cu}^{2+}$  by constant current electrolysis, electrolysis at controlled potentials, determination of Cu, Pb, Sn in brass and bronze by controlled potential electrolysis.

**Unit – III Reductant system – Principles and applications in analysis**

Analytical chemistry of some selected reductant systems – formal, standard and normal potentials in various media, stability of the solutions, species responsible for

the reduction properties, standardization, requirement for the selection of the reductants, selection of suitable indicators for various reductant systems,

- (a) Inorganic Systems – Cr (II), V (II), Ti (III), Sn (II), Fe (II) in  $\text{H}_3\text{PO}_4$  and hydrazine,
- (b) Organic Systems – hydroquinone and Ascorbic acid.

#### **Unit – IV Analysis of some selected Drugs:**

Basic considerations of drugs – Classification

Determination of the following Drugs:

- 1) Acetyl salicylic acid ( Antipyretic – Analgesic )
- 2) Testosterone, progesterone and cortisone (Steroids and corticoids)
- 3) Sulphadiazine ( sulphadugs)
- 4) Phenobarbitone (Barbituric acid derivatives)
- 5) Chloramphenicol, Benzyl penicillin and Tetracycline (Antibiotics)
- 6) Thiamine (B1), Riboflavin (B2) and ascorbic acid (c) [Vitamins]
- 7) Isoniazid ( Antimicrobial agents)
- 8) Methyldopa (Antihypertensive agents)
- 9) Metronidazole (Antiamoebic agents).

#### **Text books:**

- 1. Technical methods of analysis – Griffin, Mc Graw Hill Book Co.
- 2. Chemical Separation and measurements – D.G Peterseti, John M.Haves Sanders Co.
- 3. Chemical analysis – H.A Laitinan, Mc Graw Hill Book Co.
- 4. Newer redox titrants – Berka, Zyka and Vulterin, Pergamon Press
- 5. Volumetric Analysis, Vol III – I.M Kolthoff and R.Belvher, Interscience Public, New York
- 6. Vogel's Text Book of norganic Quantitative Analysis – J.Bassett et al, ELBS
- 7. Pharmaceutical analysis – T. Higuchi, Brochmann hausfen

#### **Reference Books:**

- 1. D.A Skoog, D.M West and F.J Holler, Analytical Chemistry, An Introduction, Sanders College Publishing, New York
- 2. Quantitative Chemical Analysis – I.M Kolthoff, E.B Sandel, E.J Meehan, S. Bruckenstein, Macmillan Company, London

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**Paper – III: Applied Analysis – II**  
(Effective from 2016-17 Admitted batch)

**Unit – I Analysis of raw materials**

- (a) Analysis of non-ferrous alloys:
- (i) Brass – Analysis of the constituents – Cu, Zn, Sn, Pb and Fe.
  - (ii) Bronze - Analysis of the constituents – Cu, Sn, Zn, Pb and Fe.
  - (iii) Solder - Analysis of the constituents – Sn, Pb and Sb.
- (b) Analysis of Ferro alloys :
- (i) Ferro silicon - Analysis of the constituents – Si, C, P, S
  - (ii) Ferro vanadium - Analysis of the constituents – V, C, P, S, Si, Al.
  - (iii) Ferro manganese - Analysis of the constituents – Mn, S, C, P, Si
  - (iv) Silico manganese - Analysis of the constituents – Mn, S, C, P, Si
  - (v) Ferro chromium - Analysis of the constituents – Cr, C, Si.

**Unit – II Analysis of Soil, Fertilizer and Fuel**

- (a) Analysis of soils: sampling, determination of moisture, total N, P, Si, lime, humus nitrogen, alkali salts, soil absorption ratio.
- (b) Analysis of fertilizers: ammonical fertilizers, Phosphate fertilizers, Nitrate fertilizers.
- (c) Analysis of fuels: solid fuels-coal, proximate analysis, ultimate analysis, heating value, grading of coal based on Ultimate Heat Value(UHV).

**Unit – III Assessment of Air Quality**

Composition of pure air, classification of air pollutants, toxic elements present in dust and their sources – collection of air samples.

Sources, effects, control of pollution and chemical analysis for the following.

- (a) Primary pollutants:
- (i) Carbon compounds - Carbon monoxide(CO) and Carbon dioxide(CO<sub>2</sub>).
  - (ii) Sulphur compounds- sulphur dioxide (SO<sub>2</sub>), Sulphur trioxide (SO<sub>3</sub>) and Hydrogen Sulphide (H<sub>2</sub>S).
  - (iii) Nitrogen compounds - nitric oxide (NO), and nitrogen dioxide (NO<sub>2</sub>),
  - (iv) Hydrocarbons - Aliphatic hydrocarbons and polycyclic aromatic hydrocarbons (PAH).
  - (v) Particulate matter - Respirable and Suspended particulate matter, Inorganic and Organic particulates.

- (b) Secondary pollutants - ozone (O<sub>3</sub>), peroxy acetyl nitrate (PAN), peroxy benzyl nitrate (PBN)
- (c) Standards for ambient air quality.

#### **Unit- IV Kinetic Methods of Analysis & Non aqueous Titrimetry**

- (a) Kinetic methods of analysis: introduction, slow reactions, catalyzed reactions, methods of determination of catalyst concentration, extrapolation method for the determination of catalyst, variable time method, fixed time method, examples for the determination of toxic metals and anions using some typical kinetic reactions.
- (b) Non aqueous titrimetry : Classification of solvents and titrations for non aqueous titrimetry- Types of reactions - Indicators .
- (i) Determination of acids
  - (ii) Determination of bases
  - (iii) Karl-Fisher reagent for the determination of moisture content in drugs and other samples.

#### **Text books**

1. Chemical analysis – H.A Laitinan, Mc Graw Hill Book Co
2. Standard methods of Chemical Analysis, Welcher
2. Technical Methods of Analysis, Griffin, Mc Graw Hill
3. Commercial Methods of Analysis, Foster Dee Sneel and Frank M. Griffin, Mc Graw Hill Book Co.
4. Environmental Chemistry, Anil Kumar De, Wiley Eastern Ltd.
5. Environmental Analysis, S.M Khopkar (IIT Bombay)
6. Environmental Air Analysis, Trivedi and Kudesia, Akashdeep Pub.

**Adikavi Nannaya University :: Rajahmundry**  
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**Paper - IV: Instrumental Methods of Analysis -II**  
(Effective from 2016-17 Admitted batch)

**Unit – I: Spectro-analytical Methods of Analysis**

(a) *Flame photometry*: theory, instrumentation, combustion flames, detectors, and analysis of Na, K, Ca, Mg

(b) *Atomic Absorption Spectrometer*: theory, instrumentation, flame and non-flame techniques, resonance line sources, hollow cathode lamp, instrumentation, chemical and spectral interferences, applications with special reference to analysis of trace metals in oils, alloys and toxic metals in drinking water and effluents

(c) *Inductively coupled plasma spectrometer (ICP-AES, ICP-MS)*: principles, instrumentation, plasma, AES detectors, quadrupole mass spectrometers, difference between the two detectors, analysis methods for liquids and solids, applications in the analysis of trace and toxic metals in water, geological and industrial samples.

(d) *Arc and Spark spectrographic Direct analysis of solid for metals.*

**Unit – II Thermal methods of Analysis**

(a) Thermo gravimetry-theory, instrumentation, applications with special reference to  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ ,  $\text{CaC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ ,  $\text{CaCO}_3$ ,  $(\text{COOH})_2 \cdot 2\text{H}_2\text{O}$

(b) Differential thermal analysis-principle, instrumentation, difference between TG and DTA - applications with special reference to the clays and minerals, coals (fuels)

(c) Differential scanning calorimetry-principle, instrumentation, applications to inorganic materials like chlorates and per chlorates, ammonium nitrate, organic compounds and Drugs.

**Unit- III : Electro analytical Methods of Analysis - 1**

(a) *Voltametry and polarographic analysis* : principle of polarography, residual current, migration current, diffusion current, half-wave potential, Ilkovic equation, instrumentation, Dropping mercury electrode (DME), advantages and disadvantages of DME, qualitative and quantitative analysis of inorganic ions-Cu, Bi, Pb, Cd, Zn, AC polarography, pulse polarography

(b) *Anode stripping voltametry*: principle, instrumentation, Hanging mercury drop electrode, application in the analysis of Pb and Cd in environmental samples, principle of cathode stripping voltametry.



- (c) **Coulometric analysis:** principles of coulometric analysis with constant current, coulometric analysis with controlled potential, applications of coulometric methods for the analysis of cations-As (III), Fe (II) and I<sup>-</sup> and S<sup>2-</sup> by using I<sub>2</sub> liberations and Ce<sup>4+</sup> liberation in solutions

#### **Unit – IV Electro Analytical and Radio chemical methods of analysis - 2**

- (a) **Ion Selective Electrodes:** reference electrodes - hydrogen electrode, calomel electrode, silver chloride electrode; indicator electrodes – hydrogen and glass electrodes, theory of membrane potentials and liquid junction potentials, types of ion selective electrodes, basic properties, potentials and construction, calibration of ion selective electrodes, ion selective electrodes with fixed membrane sites, silver, lead, cadmium, sulfide, fluoride, cyanide and glass electrodes, applications in the analysis of air and water pollutants, principles of liquid membrane, gas sensing and enzyme based electrode
- (b) **Radio chemical methods of analysis:** detection and measurement of radioactivity, introduction to radioactive tracers, applications of tracer technique, isotope dilution analysis - applications, activation analysis – application, advantages and disadvantages, radio carbon dating technique

#### **Text Books:**

1. Instrumental methods of analysis – H.H Willard, Meritt Jr. and J.A Dean
2. Principles of instrumental analysis – Skoog and West
1. Vogels Textbook of Quantitative Inorganic analysis – J. Basset, R.C Denney, G.H Jefferey and J.Madhan
2. Instrumental methods of analysis – B.K Sarma, Goel Publishing House, Meerut
3. Instrumental methods of Analysis – Chatwal and Anand
4. Instrumental methods of Analysis – Ewing

#### **Reference Books:**

W.Wendtlandt, Thermal Analysis, John Wiley Sons, New York

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**ANALYTICAL CHEMISTRY PRACTICAL – I**  
(With effect from 2016-2017 admitted batch)

**Classical Methods of Analysis-1**

1. Water analysis
  - (i) Determination of total hardness ( $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$ ) of water samples
  - (ii) Determination of chloride ( $\text{Cl}^-$ ) present in water samples
  - (iii) Determination of dissolved oxygen (DO) of drinking water and sewage water
  
2. Complexometric titrations
  - (i) Determination of the concentration of calcium in milk powder by complexometric titration (EDTA)
  - (ii) Determination of Calcium and Magnesium in limestone or dolomite samples using EDTA.
  
3. Fertilizer analysis
  - (i) Determination of ammonia from ammonia containing fertilizer
  - (ii) Determination of phosphate from fertilizer
  
4. Analysis of iron ore
  - (i) Complete analysis of iron ore
  - (ii) Determination of percentages of Fe (II) and Fe (III) present in iron ore sample
  
5. Analysis of Coal
  - (i) Determination of moisture content of coal sample
  - (ii) Determination of volatile matter of coal sample
  - (iii) Determination of fixed carbon of coal sample
  - (iv) Determination of ash content of coal sample

## **Instrumental Methods of Analysis-1**

1. pH metry
  - (i) Determination of alkalinity of a coloured effluent using pH metric titration.
  - (ii) Determination of purity of commercial HCl using pH metric titration.
  - (iii) Determination of purity of commercial H<sub>2</sub>SO<sub>4</sub> using pH metric titration.
  
2. Potentiometry
  - (i) Determination of Cr(VI) with Fe(II) using potentiometric end point
  - (ii) Determination of Fe (II) using ceric sulphate by potentiometric end point
  - (iii) Determination of a mixture of Ce(IV) and V(V) with Fe(II) by potentiometric end point
  - (iv) Determination of KSCN with AgNO<sub>3</sub> by potentiometric end point.
  
3. Spectrophotometry
  - (i) Determination of Fe (III) using potassium thiocyanate
  - (ii) Determination of Iron(II) using orthophenanthroline
  - (iii) Determination of phosphate in fertilizer and cola drinks by Molybdenum blue method
  - (iv) Determination of Manganese (II) -periodate method
  
4. Flame photometry
  - (i) Determination of sodium present in bread samples
  - (ii) Determination of sodium and potassium in a given sample of fertilizer
  
5. Thin layer chromatography: Determination of R<sub>f</sub> values and identification of organic compounds in a given mixture by TLC
  - (i) Separation of mixture of benzil and 2-nitrophenol
  - (ii) Mixture of benzophenone and naphthalene
  - (iii) Mixture of 2-nitrophenol and 4-nitrophenol

### References:

1. A Text Book of Quantitative Inorganic Analysis (3<sup>rd</sup> Edition) – A. I. Vogel

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**ANALYTICAL CHEMISTRY PRACTICAL – II**

(With effect from 2016-2017 admitted batch)

**Classical Methods of Analysis-2**

1. Water analysis
  - (i) Determination of alkalinity ( $\text{CO}_3^{2-}$ ,  $\text{HCO}_3^-$ ) of water samples.
  - (ii) Determination of chemical oxygen demand (COD) of drinking water and sewage water
  - (iii) Determination of biological oxygen demand (BOD) of drinking water and sewage water
  
2. Redox titrations
  - (i) Determination of oxalate in kidney stones by permanganometric titration.
  - (ii) Determination of Fe(II) present in an Iron tablet using  $\text{KMnO}_4$
  
3. Fertilizer analysis
  - (i) Determination of nitrate from fertilizer
  - (ii) Determination of sulfur (as sulfate) from sulfur containing fertilizer.
  
4. Analysis of oils and soaps
  - (i) Determination of saponification value, acid value and iodine value of oil sample
  - (ii) Determination of moisture content and total alkali of soaps
  
5. Separation and determination of ions by ion-exchanger resins
  - (i) Determination of  $\text{Na}^+$  by cation exchanger resin
  - (ii) Determination of  $\text{Na}^+$  and  $\text{K}^+$  in a mixture by cation exchanger resin
  - (iii) Determination of  $\text{Cl}^-$  and  $\text{Br}^-$  in a mixture by anion exchanger resin

## Instrumental Methods of Analysis-2

### 1. pH metry

- (i) Determination of purity of commercial  $\text{H}_3\text{PO}_4$  by pH metric titration
- (ii) Determination of  $\text{CH}_3\text{COOH}$  by pH metric titration.
- (iii) Determination of stability constant of copper glycinate

### 2. Potentiometry

- (i) Determination of Fe(II) using Mn(VII) of by potentiometric titration
- (ii) Determination of Fe (II) using V(V) of by potentiometric titration
- (iii) Determination of a mixture of Mn(VII) and V(V) with Fe(II) using potentiometric end point
- (iv) Determination of a mixture of bromide and chloride with  $\text{AgNO}_3$  using potentiometric end point

### 3. Spectrophotometry

- (i) Determination of nitrite in drinking water samples by diazotization method
- (ii) Determination of nitrate -phenoldisulphonic acid method
- (iii) Simultaneous Determination of Cr(VI) and Mn(VII) in a mixture without separation
- (iv) Determination of Cu(II) using EDTA – Photometric titration method.

### 4. Flame photometry

- (i) Determination of Lithium by flame photometry
- (ii) Determination of calcium from milk samples using flame photometry

### 5. Thin layer chromatography

- (i) Separation and identification of the given mixture of colourless compounds (Diphenylamine, Benzophenone and Naphthalene)
- (ii) Separation and identification of the given mixture of coloured compounds (azobenzene, hydroxyazobenzene, p-aminoazobenzene).

### References:

1. A Text Book of Quantitative Inorganic Analysis (3<sup>rd</sup> Edition) – A. I. Vogel



ADIKAVI NANNAYA UNIVERSITY  
FIRST SEMESTER CHEMISTRY SYLLABUS  
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## General Chemistry - I

### UNIT-1

**Basic Quantum Chemistry-I-** Wave equation-interpretation of wave function-properties of wave function-normalization and orthogonalisation, Operators- linear and non-linear- commutators of operators. Postulates of quantum mechanics; setting up of operators to observables; Hermitian operator- Eigen values and Eigen functions of Hermitian operator; Expansion theorems. Eigen functions of commuting operators-significance. Simultaneous measurement of properties and the uncertainty principle.

### UNIT-II

**Basic Quantum Chemistry-II-** Wave mechanics of simple systems with constant potential energy, particle in one-dimensional box- factors influencing color transition- dipole integral, Symmetry arguments in deriving the selection rules, the concept of tunneling- particle in three -dimensional box. Calculations using wave functions of the particle in a box- Orthogonality, measurability of energy, position and momentum, average values and probabilities. Rigid rotor, Wave mechanics of systems with variable potential energy-simple harmonic oscillator- solution of wave equation- selection rules.

### UNIT-III

**Fundamentals of Molecular Spectroscopy-I:** Microwave and IR- Spectroscopy- Rotational spectra of diatomic molecules- Rigid rotor-Selection rules- Calculations of bond length- Isotopic effect, Second order stark effect and its applications. Infrared spectra of diatomic molecules- harmonic and anharmonic oscillators- Selection rules- Overtones- Combination bands- Calculation of force constant, anharmonicity constant and zero point energy. Fermi resonance, simultaneous vibrational-rotational spectra of diatomic molecules.

### UNIT- IV

**Fundamentals of Molecular Spectroscopy-II:** Raman and Electronic Spectra- Classical and quantum mechanical explanations- Rotational Raman and Vibrational Raman spectra. Electronic spectra of diatomic molecules- Vibrational Coarse structure- intensities of spectral lines- Franck-Condon principle- applications, Rotational Fine structure- band head and band shading. Charge transfer spectra

### References/ Text books

1. Fundamentals of Molecular spectroscopy: by C.N. Banwell
2. Molecular spectroscopy: by B.K.Sharma
3. Molecular spectroscopy: by Aruldas
4. Introductory quantum mechanics: by A.K. Chandra
5. Quantum chemistry: by R.K. Prasad



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Paper- II: INORGANIC CHEMISTRY-I

UNIT-1

**Structure & Bonding:** Applications of VSEPR, Valence Bond and Molecular orbital theories in explaining the structures of simple molecules- role of p and d orbitals in pi bonding. Application of MO theory to square planar ( $\text{PtCl}_4^{2-}$ ) and Octahedral complexes ( $\text{CoF}_6^{3-}$ ,  $\text{Co}(\text{NH}_3)_6^{3+}$ ). Walsh diagram for  $\text{H}_2\text{O}$  molecule.

UNIT-II

**Inorganic cage and ring compounds** – preparation, structure and reactions of boranes, carboranes, metallocarboranes, boron–nitrogen ( $\text{H}_3\text{B}_3\text{N}_3\text{H}_3$ ), phosphorus–nitrogen ( $\text{N}_3\text{P}_3\text{Cl}_6$ ) and sulphur-nitrogen ( $\text{S}_4\text{N}_4$ ,  $(\text{SN})_x$ ) cyclic compounds. Electron counting in boranes – Wades rules (Polyhedral skeletal electron pair theory). Isopoly and heteropoly acids.

UNIT-III

**Coordination compounds:** Crystal field theory - crystal field splitting patterns in octahedral, tetrahedral, tetragonal, square planar, square pyramidal and trigonal bipyramidal geometries. Calculation of crystal field stabilization energies. Factors affecting crystal field splitting energies – Spectrochemical series – Jahn – Teller effect, nephelauxetic effect – ligand field theory. Term symbols – Russell – Sanders coupling – derivation of term symbols for various configurations. Spectroscopic ground states.

UNIT- IV

**Electronic spectra of transition metal complexes:** Selection rules, break down of selection rules – Orgel and Tanabe-Sugano diagrams for  $d^1$  –  $d^9$  octahedral and tetrahedral transition metal complexes of 3d series – Calculation of  $Dq$ ,  $B$  and  $\beta$  parameters. Charge transfer spectra. Magnetic properties of transition and inner transition metal complexes – spin and orbital moments – quenching of orbital momentum by crystal fields in complexes.

**Text books:**

1. Advanced Inorganic Chemistry by F.A. Cotton and G. Wilkinson, IV Edition, John Wiley and Sons, New York, 1980.
2. Inorganic Chemistry by J.E. Huheey, III Edition, Harper International Edition, 1983.
3. Theoretical Inorganic Chemistry, II Edition by M.C. Day and J. Selbin, Affiliated East-West press pvt. Ltd., New Delhi.
4. Inorganic Chemistry by Shriver and Atkins, Oxford University Press (1999).



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Paper –III: ORGANIC CHEMISTRY -I

UNIT – I

**Nature of bonding in organic molecules and Aromaticity**

15 Hrs

(A) *Electronic Effects and Reactive intermediates*:-Inductive effect, Mesomeric effect (Resonance), Hyperconjugation, Steric effect, Tautomerism, acidity and basicity of organic molecules Generation, structure, stability and reactivity of carbocations, carbanions, free radicals, carbenes, nitrenes and arynes

(B) *Criteria of Aromaticity*:-The Energy, Structural and Electronic Criteria for Aromaticity, Relationship among the Energetic, Structural, and Electronic Criteria of Aromaticity. Huckle's rule and MO Theory, aromaticity in benzenoid non-benzenoid compounds, Aromaticity in Charged and Fused-Ring Systems, Hetero-aromatic Systems, Annulenes: Cyclobutadiene, Benzene, 1,3,5,7-Cyclooctatetraene, [10] Annulenes- [12], [14], [16] and [18] annulenes, azulenes, fulvenes, fullerenes, ferrocene, anti-aromaticity and homo-aromaticity.

UNIT – II

**Stereo Chemistry & Molecular representation of organic molecules**

20 Hrs

(A) *Molecular Symmetry and Chirality*:-Symmetry elements, Definition and classification of Stereoisomers, Enantiomer, Diastereomer, Invertomer, Homomer, Epimer, Anomer, Configuration and Conformation Configurational nomenclature: D,L and R, S nomenclature, Molecules with a single chiral center: Tetra and Tri coordinate chiral center, Molecules with two or more chiral centers; constitutionally unsymmetrical and symmetrical molecules.

(B) *Geometrical Isomerism and Conformations of Cyclic Systems*:- Cis-trans, E, Z- and Syn & anti nomenclature, Methods of determining configuration of Geometrical isomers using physical, spectral and chemical methods, Stability, Cis-trans inter conversion. Conformations of cyclobutane, cyclopentane, cyclohexane, mono and disubstituted cyclohexanes.

(C) *Prochirality and Prostereoisomerism*:- Homotopic ligands and faces; enantiotopic ligands and faces; diastereotopic ligands and faces; nomenclature of enantiotopic ligands and faces (Pro-R, Pro-S, Re, Si carbonyl compounds and Alkenes)

(D) *Stereoisomerism in molecules without chiral Center* -Axial chirality Allenes, Alkylidene cycloalkanes, spiranes, nomenclature. *Atropisomerism*: Biphenyl derivatives, nomenclature. *Planar chirality*: Ansa compounds, paracyclophanes, trans-cyclooctene and Helicity.

UNIT – III

**Heterocyclic compounds**

15 Hrs

Importance of heterocyclic compounds as drugs. Nomenclature of heterocyclic systems based on ring size, number and nature of hetero atoms. Chemistry of heterocyclic compounds, synthesis and reactivity of the following systems: Quinoline, Isoquinoline, Indole, Pyrazole, Imidazole, Oxazole, Isoxazole, Pyridazine, pyrimidine and Pyrazine.

UNIT - IV

**Chemistry of some typical natural products (Alkaloids and Terpenoids)**

10 Hrs

A study of the following compounds involving their isolation, structure elucidation, synthesis and biogenesis of *Alkaloids*; Atropine, Nicotine, and Quinine.

*Terpenoids*:  $\alpha$ - Terpineol,  $\alpha$ -Pinene and Camphor.





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**Books Suggested:**

1. Advanced Organic Chemistry-Reactions, Mechanism and structure, Jerry March, 6th Ed. (John Wiley & Sons).
2. Organic Chemistry, Paula Yurkanis Bruice, 4th Ed. (Printice Hall)
3. Organic chemistry-Clayden J. (Oxford)
4. Organic Chemsitry, Wade, L.G. Jr. 5th Ed. (Pearson)
5. Advanced Organic Chemistry: Reactions and mechanisms, Miller Bernard & Other, 2nd Ed. (Pearson)
6. Mechanism and Theory in Organic Chemistry, Thomas H. Lowry, Kathleen S. Richardson, Harper & Row, (Publishers, Inc.).
7. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, 6th Ed., (Longman).
8. Reaction Mechanism in Organic Chemistry, P.S. Kalsi, 2nd Ed. (New Age International).
9. Organic Chemistry, R. T. Morrison and R. N. Boyd (Prentice-Hall)
10. Stereochemistry to Organic Compounds, E.L. Eliel (John Wiley).
11. Stereochemistry, P.S. Kalsi, 5th Ed. (New Age International).
12. Organic Chemistry Structure and Reactivity, Ege Seyhan, 3rd Ed. (AITBS)
13. Heterocyclic Chemistry, J.A.Joule, K. Kills and G. F. Smith, Chapman and Hall
14. Heterocyclic Chemistry, T.L.Gilchrist, Longman Scientific Technical
15. Heterocyclic Chemistry, Raj.K. Bansal.
16. An Introduction to the Heterocyclic Compounds, R. M. Acheson, John Wiley.

**REFERENCE BOOKS:**

1. Chemistry of Natural Products, K.W.Bentley
2. Stereochemistry of carbon compounds by E.Eliel, John Wiley & Sons, Inc.
3. Stereochemistry to Organic Compounds, D. Nasipuri, 2nd Ed. (New Age International).
4. Chemistry of Natural products by R.S. Kalsi Kalyani Publishers. 1983.



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Paper – IV: PHYSICAL CHEMISTRY-I

UNIT-I:

**Thermodynamics-I:** Concepts of partial molar properties – partial molar volume and its significance; Determination of partial molar volume: Graphical method, intercept method and apparent molar volume method. Partial molar free energy, chemical potential, Variation of chemical potential with T and P. Gibbs-Duhem equation-derivation and significance. Phase equilibrium- Derivation of phase rule from the concept of chemical potential. *Ideal solutions* - Thermodynamic properties of ideal solutions mixing quantities; Vapour pressure-Raoult's law; Thermodynamic properties of ideally dilute solutions. Vapour pressure- Henry's law.

*Non-ideal systems* -Concept of fugacity, fugacity coefficient. Determination of fugacity; Non ideal solutions. Activities and activity coefficients; Standard-state conventions for non ideal solutions; Determination of activity coefficients from vapour pressure measurements. Activity coefficients of non-volatile solutes using Gibbs-Duhem equation. Chemical equilibrium-effect of temperature on equilibrium constant- Van'tHoff equation

UNIT-II:

**Micelles and Macro molecules:** Surface active agents, classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization- phase separation and mass action models, Solubilization, micro emulsion, reverse micelles.

Polymer- definition, types of polymers, electrically conducting, fire resistant, liquid crystal polymers, kinetics of free radical polymerization. Molecular mass- Number and mass average molecular weight, molecular weight determination-End group analysis, Osmometry, viscometry, ultracentrifugation and light scattering methods.

UNIT-III:

**Chemical Kinetics:** Theories of reaction rates- Collision theory- Limitations, Transition state theory. Effect of ionic strength - Debye Huckel theory-Primary and secondary salt effects; Effect of dielectric constant, effect of substituent, Hammett equation-limitations, Taft equation; Prediction of rate constants- Consecutive reactions, parallel reactions, opposing reactions (Uni molecular steps only, no derivation). Specific and general acid-base catalysis; Skrabal diagram; Fast reactions- different methods of studying fast reactions- flow methods, relaxation methods- temperature jump and pressure jump methods.

UNIT-IV:

**Photochemistry:** Electronic transitions in molecules, Franck-Condon principle. Electronically excited molecules- singlet and triplet states, spin-orbit interaction. Quantum yield and its determination; Actinometry - ferrioxalate and uranyl oxalate actinometers-problems. Derivation of fluorescence and phosphorescence quantum yields. Quenching effect- Stern Volmer equation. Photochemical equilibrium and delayed fluorescence - E type and P type. Photochemical primary processes, types of photochemical reactions-photodissociation, addition and isomerisation reactions with examples.



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**Books:**

1. Physical Chemistry by Peter Atkins and Julio de Paula, Oxford University Press.
2. Physical Chemistry by G.W. Castellon, Narosha Publishing House
3. Physical Chemistry by W.J.Moore, Prentice Hall
4. Thermodynamics for Chemists, Samuel Glasstone
5. Chemical Kinetics by K.J.Laidler, McGraw Hill Pub.
6. Photochemistry, R.P. Kundall and A. Gilbert, Thomson Nelson.
7. Polymer Chemistry by Billmayer
8. Introduction to Polymer Science, V.R. Gowriker, N.V.Viswanadhan and J. Sreedhar., Wiley Easter.
9. Micells, Theoretical and applied aspects, V.Morol, Plenum publishers.



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LABORATORY WORK (6 hrs/week)

**INORGANIC CHEMISTRY - I**

*I. Inorganic Synthesis: Preparation of*

- (i) Tetraamminecopper(II) sulphate
- (ii) Potassium tris-oxalato ferrate(III) trihydrate
- (iii) Tris-thiourea copper(I) sulphate

*II. Semi micro qualitative analysis of six radical mixtures*

(One interfering anion and one less familiar cation for each mixture)

*Anions:*  $\text{CO}_3^{2-}$ ,  $\text{S}^{2-}$ ,  $\text{SO}_3^{2-}$ ,  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{I}^-$ ,  $\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{CH}_3\text{COO}^-$   
 $\text{C}_2\text{O}_4^{2-}$ ,  $\text{C}_4\text{H}_4\text{O}_6^{2-}$ ,  $\text{PO}_4^{3-}$ ,  $\text{CrO}_4^{2-}$ ,  $\text{AsO}_4^{3-}$ ,  $\text{F}^-$ ,  $\text{BO}_3^{3-}$

*Cations :* Ammonium ( $\text{NH}_4^+$ )  
1<sup>st</sup> group: Hg, Ag, Pb, Tl, W  
2<sup>nd</sup> group: Hg, Pb, Bi, Cu, Cd, As, Sb, Sn, Mo  
3<sup>rd</sup> group: Fe, Al, Cr, Ce, Th, Ti, Zr, V, U, Be  
4<sup>th</sup> group: Zn, Mn, Co, Ni  
5<sup>th</sup> group: Ca, Ba, Sr  
6<sup>th</sup> group: Mg, K, Li

**ORGANIC CHEMISTRY - I**

*Preparation, recrystallization, and determination of melting point & yield of the following compounds:*

- (i) Aspirin, (ii) Nerolin, (iii) Chalcone,
- (iv) *p*-Nitro acetanilide, (v) 2,4,6- Tribromoaniline, (vi) *m*-Dinitrobenzene,
- (vii) Phthalimide, (viii) Diels-Alder adduct.

**Books Suggested**

1. Vogel's Text Book of Quantitative Chemical Analysis, J. Mendham, R. C. Denney, J. D. Barnes and M. J. Thomas, 4th & 6th Ed. (Pearson Education Asia).
2. Vogel's Text Book of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, P.W.G. Smith, A.R. Tatchell, 5 Ed. (Longman Scientific & Technical)



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**PHYSICAL CHEMISTRY-I**

1. Determination of critical solution temperature of phenol-water system.
2. Effect of added electrolyte on the CST of phenol-water system.
3. Conductometric titration of Strong acid versus Strong base
4. Dissociation constant of weak acid ( $\text{CH}_3\text{COOH}$ ) by conductometric method.
5. Conductometric titration of Weak acid vs Strong base.
6. Determination of cell constant
7. Adsorption of acetic acid on animal charcoal or silica gel.
8. Acid-catalyzed hydrolysis of methyl acetate
9. Determination of partial molar volume of solute - $\text{H}_2\text{O}$  system by apparent molar volume method.



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**Paper- I: GENERAL CHEMISTRY-II**

UNIT-1

**Basic Quantum Chemistry-III-** Hydrogen atom- solution of  $R(r)$ ,  $\Phi(\phi)$  and  $\Theta(\theta)$  equations. Probability density in orbitals- shapes of orbitals- Perturbation theory- Time independent perturbation theory(only first order perturbation is to be dealt with)- application to ground state energy of Helium atom- Variation principle- applications- calculation of zero-point energy of harmonic oscillator- many electron atom- Hartee-Fock self-consistent field method(qualitative treatment only)

UNIT-II

**Molecular symmetry and Group Theory in chemistry:** Basic concepts of symmetry and Group theory-Symmetry elements, symmetry operations and point groups- Schoenflies symbols- Classification of molecules into point groups- Axioms of Group theory- Group multiplication tables for  $C_{2v}$  and  $C_{3v}$  point groups- Similarity transformations- and classes- Representations- reducible and irreducible representations, Mullikan symbols, Orthogonality theorem and its implications, Character table and its anatomy.

UNIT-III

**Treatment of analytical data:** Accuracy and precision- Classification of errors- Determination of Indeterminate errors- Minimization of errors- Absolute and Relative errors, propagation of errors-Distribution of Indeterminate errors- Gaussian distribution- Measures of central tendency-Measures of precision- Standard deviation- Standard error of mean- student's t-test- Confidence interval of mean- Testing for significance- Comparison of two means- F-test- Criteria of rejection of an observation- Significant figures and computation rules.

UNIT- IV

**Introduction to computer programming- FORTRAN 77:** Basic structures and functioning of computer with P.C. as an illustrative example- Main memory- Secondary storage memory- input/output devices- computer languages- operating systems- principles of algorithms-and flow charts-constants and variables- Arithmetic expressions- Arithmetic statements- Replacement statement- IF statement- logical IF and BLOCK IF statements- GOTO statements-subscripted variable and DIMENSION statement. DO statement- Rules for DO statement- Functions and subroutines- Development of FORTRAN statements for simple formulae in chemistry such as Vander Waals equation- pH of a solution- First order rate equation- Cell constant-Electrode potential.

Flowcharts and computer programs for

- Program for the calculation of Cell Constant, Specific Conductance and Equivalence.
- Rate Constant of First order reaction or Beer's law by linear least square method.
- Hydrogen ion concentration of a strong acid solution/Quadratic equation.
- Solution for Vander Waals equation or Hydrogen ion concentration of a monoprotic weak acid
- Standard deviation and Variance of univariant data

**References/ Text books:**

- Introductory Quantum chemistry: by A.K. Chandra
- Group theory for Chemistry: by A.K. Bhattacharya
- Introductory Group theory for chemists : by George Davidson
- Vogel's text book of quantitative analysis: byVogel
- Fundamentals of Analytical chemistry: by Skog and West
- Principles of computer programming(FORTRAN 77 IBM PC): by V.Rajaraman
- Basics of computers for chemists: by P.C. Jurs



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**Paper- II: INORGANIC CHEMISTRY-II**

UNIT-I

**Metal cluster compounds** - definition – evidences for existence of M-M bonds - conditions favorable for formation of M-M bonds – preparation, structure and bonding of the following metal cluster compounds.

$\text{Re}_2\text{Cl}_8^{2-}$ ,  $\text{Mo}_2\text{Cl}_8^{4-}$ ,  $\text{Re}_2(\text{RCOO})_4\text{X}_2$ ,  $\text{Mo}_2(\text{RCOO})_4(\text{H}_2\text{O})_2$ ,  $\text{Cr}_2(\text{RCOO})_4(\text{H}_2\text{O})_2$ ,  $\text{Cu}_2(\text{RCOO})_4(\text{H}_2\text{O})_2$ ,  $\text{Cr}_2\text{Cl}_9^{3-}$ ,  $\text{Mo}_2\text{Cl}_9^{3-}$ ,  $\text{W}_2\text{Cl}_9^{3-}$ ,  $\text{Re}_3\text{Cl}_9$ ,  $\text{Re}_3\text{Cl}_{12}^{3-}$ ,  $\text{Mo}_6\text{Cl}_8^{4+}$ ,  $\text{Nb}_6\text{X}_{12}^{2+}$  and  $\text{Ta}_6\text{X}_{12}^{2+}$ .

Polyatomic clusters – Zintl ions, Chevrel phases.

UNIT-II

**Organometallic compounds** - 16 and 18 electron rules. Isoelectronic relationship - Synthesis, structure, bonding and reactions of carbon monoxide, dinitrogen and nitric oxide complexes. Isolobal relationship – H, Cl,  $\text{CH}_3$ ,  $\text{Mn}(\text{CO})_5$ ; S,  $\text{CH}_2$ ,  $\text{Fe}(\text{CO})_4$ ; P, CH,  $\text{Co}(\text{CO})_3$ ; Synthesis, structure, bonding and reactions of metallocenes with special reference to ferrocene.

UNIT-III

**Metal Ligand equilibria in solution:** Step wise and overall formation constants and their interaction– trends in stepwise constants – factors affecting the stability of metal complexes–Pearson's theory of hard and soft acids and bases (HSAB), chelate effect and its thermodynamic origin, determination of stability constants of complexes–spectrophotometric method and pH–metric method. Reactivity of metal complexes–inert and labile complexes. Explanation of lability on the basis of VBT & CFT.

**Bio-Inorganic Chemistry:** Metalloporphyrins with special reference to Haemoglobin & Myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to  $\text{Ca}^{2+}$ . Biological and abiological Nitrogen Fixation.

UNIT- IV

**Inorganic Reaction Mechanisms:** Substitution reactions of metal complexes – D, Id, Ia and A mechanisms – Ligand replacement reactions of metal complexes – Acid hydrolysis – factors affecting acid hydrolysis – Anation and Base hydrolysis of Cobalt(III) complexes. Ligand displacement reactions of square planar complexes of platinum (II). Factors affecting square planar substitution – trans effect (theories).

Electron transfer reactions of complexes – concept of complementary and non-complementary reactions with examples. Inner and outer sphere mechanisms.

**Text books:**

1. Advanced Inorganic Chemistry by F.A. Cotton and R.G. Wilkinson, IV Edition, John, John Wiley and Sons, New York, 1980.
2. Inorganic Chemistry by J.E. Huheey, III edition, Harper International Edition, 1983.
3. Organometallic Chemistry-A unified approach by A. Singh and R.C. Mehrotra, Wiley Eastern Ltd.
4. Inorganic Chemistry by Shriver and Atkins, Oxford University Press (1999)
5. Theoretical Inorganic Chemistry, II Edition by M.C. Day and J. Selbin, Affiliated East-West press Pvt. Ltd., New Delhi.
6. Mechanisms of Inorganic reactions in solution by D.Benson, McGraw Hill, London, 1968.
7. Inorganic chemistry by K.F. Purcell and J.C.Kotz, W.B. Saunders company, New York, 1977.
8. Elements of Bioinorganic Chemistry by G.N. Mukherjee and Arabinda Das, U.N. Dhur & sons Pvt. Ltd, Calcutta.



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**Paper-III: ORGANIC CHEMISTRY-II**

UNIT-I

**Reaction Mechanism**

**15Hrs**

(A) *Aliphatic Nucleophilic Substitution and Nucleophilic Aromatic substitution*: Stereochemistry of  $S_N^2$  and  $S_N1$  mechanisms, Neighboring Group Participation (Anchimeric assistance), NGP by O, S, N: Aromatic Nucleophilic substitution:  $S_N2$  (Ar) (Addition – Elimination),  $S_N1$ (Ar) and benzyne mechanisms (Elimination - Addition); evidence for the structure of benzyne. Von Richter Sommelet-Hauser and Smiles rearrangements.

(B) *Elimination Reactions*: Type of elimination reactions, mechanisms, Stereochemistry and Orientation, Hofmann and Saytzeff rules, Syn elimination versus anti-elimination, competition between elimination and substitution, dehydration, dehydrogenation, dehalogenation, decarboxylative eliminations and pyrolytic eliminations

UNIT-II

**Addition Reactions**

**15 Hrs**

(A) *Addition to Carbon – Carbon Multiple Bonds*: Mechanistic and stereo chemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, region and chemo selectivity, orientation and reactivity, Hydrogenation of double and triple bonds, hydrogenation of aromatic rings, Hydroboration.

(B) *Addition to Carbon-Hetero Multiple Bonds*: Steric course of addition reactions to C=O and C=N, Aldol, Cannizzaro, Perkin, Knoevenagel, Claisen-Schmidt, Claisen, Dieckman, Benzoin and Stobbe condensations, Reformatsky reaction, Tollen's reaction, Prins reaction: Wittig, Grignard, Mannich, and Michael reaction, Hydrolysis of Carbon-Nitrogen bond, Isocyanates and isothioyanates.

UNIT-III

**Molecular Rearrangements**

**15 Hrs**

Types of molecular rearrangements, migratory aptitude;

*Rearrangements to electron deficient carbon*: Pinacol-pinacolone, Wagner-Meerwein, Tiffeneau – Demjanov, Dienone – Phenol, Arndt-Eistert synthesis;

*Rearrangements to electron deficient nitrogen*: Beckmann, Hofmann, Curtius, Schmidt and Lossen rearrangements;

*Rearrangements to electron deficient oxygen*: Baeyer-villiger, Hydro peroxide rearrangement and Dakin rearrangements; Neber rearrangement, Benzil-Benzilic acid and Favorskii rearrangements

UNIT-IV

**Spectroscopy and Protecting Groups**

**15 Hrs**

- Basic principles and importance of UV, IR, NMR and Mass.
- Protection of carbonyl, Hydroxyl, carboxylic and Amine groups





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**Books Suggested:**

1. Advanced Organic Chemistry-Reactions, Mechanism and structure, Jerry March, 6th Ed. (John Wiley & Sons).
2. Modern Organic Reactions, H. O. House (Benjamin)
3. Structure and Mechanism in Organic Chemistry C. K. Ingold (Cornell University Press).
4. Organic Chemistry, Paula Yurkanis Bruice, 4th Ed. (Prentice Hall)
5. Organic chemistry-Clayden J. (Oxford)
6. Organic Chemistry, Wade, L.G. Jr. 5th Ed. (Pearson)
7. Organic Chemistry, Salmons, P.W. & Others, 8th Ed. (John Wiley & Sons)
8. Advanced Organic Chemistry: Reactions and mechanisms, Miller Bernard & Other, 2nd Ed. (Pearson)
9. Mechanism and Theory in Organic Chemistry, Thomas H. Lowry, Kathleen S. Richardson, Harper & Row, (Publishers, Inc.).
10. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, 6th Ed., (Longman).
11. Reaction Mechanism in Organic Chemistry, P.S. Kalsi, 2nd Ed. (New Age International).
12. Stereochemistry to Organic Compounds, E.L. Eliel (John Wiley).
13. Stereochemistry to Organic Compounds, Nasipuri, 2nd Ed. (New Age International).
14. Stereochemistry, P.S. Kalsi, 5th Ed. (New Age International). Organic Chemistry Structure and Reactivity, Ege Seyhan, 3rd Ed. (AITBS)
15. Spectroscopic Methods in Organic Chemistry- Forth Edition, D.H. Williams and I. Fleming Tata - McGraw Hill, New Delhi, 1990.
16. Organic Spectroscopy- Second Edition, W.Kemp, ELBS Macmillan, 1987.
17. Applications of absorption spectroscopy of Organic Compounds J.R.Dyer, Prentice Hall of India, New Delhi, 1984.
18. Spectrometric identification of Organic Compounds-Fourth Edition, R.M. Silverstein: G.C.Vassillir and T.C. Merrill, John Wiley, Singapore, 1981.
19. Introduction to spectroscopy-D.L.Pavia, G.M.Lampman, G.S.Kriz, 3rdEd (Harcourt college publishers).



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**Paper – IV: PHYSICAL CHEMISTRY-II**

UNIT-I:

**Physical methods of molecular structural elucidation:** NMR: Principle and theory, Nature of spinning particle and its interaction with magnetic field. Chemical shift and its origin. Spin-Spin interaction, Application of NMR to structural elucidation- Structure of ethanol, dimethylformamide, styrene and acetophenone.

Electron Spin Resonance: Principle and experimental technique- g-factor, line shapes and line widths- hyperfine interactions- applications of ESR studies.

UNIT -II:

**Thermodynamics-II-** Brief review on entropy; entropy changes accompanying specific process – expansion, phase transition, heating, measurement of entropy. Nernst heat theorem; Third law of thermodynamics- Determination of the absolute entropy- Apparent exceptions to Third law of thermodynamics.

**Statistical Thermodynamics:** Objectives of statistical thermodynamics, Concept of distributions, Types of ensembles. Thermodynamic probability, Most probable distribution Law – Partition Function, (Definition and significance): Molar and molecular partitions-translational, rotational, vibrational and electronic partition functions- Relation between thermodynamic functions (E, H, S, G and  $C_v$ ) and the partition functions

UNIT-III:

**Electrochemistry I:** Electrochemical cell- Galvanic and electrolytic cell. Concentration cell with and without transference, Effect of complexation on redox potential- ferricyanide/ ferrocyanide couple, Iron (III) phenanthroline / Iron (II) phenanthroline couple. Determination of standard potential, solubility product equilibrium constant and activity coefficients from EMF data.

Bjerrum theory of ion association (elementary treatment) Concept of activity and activity coefficients in electrolytic solutions. The mean ionic activity coefficient. Debye-Huckel theory of electrolytic solutions. Debye-Huckel limiting law (derivation not required), Calculation of mean ionic activity coefficient; Limitations of Debye-Huckel theory. Effect of dilution on equivalent conductance of electrolytes - Anomalous behavior of strong electrolytes. Debye Huckel-Onsagar equation – verification and limitations, Fuel Cells.

UNIT-IV:

**Electrochemistry II:** The electrode-electrolyte interface. The electric double layer. The Helmholtz-Perrin parallel-plate model, the Gouy-Chapman diffuse-charge model and the Stern model.

Electrodics: Charge transfer reactions at the electrode-electrolyte interface. Exchange current density and over-potential. Derivation of Butler-Volmer equation. High field approximation, Tafel equation, Low field equilibrium, Nernst equation. Voltametry-Concentration polarization, experimental techniques.



ADIKAVI NANNAYA UNIVERSITY  
SECOND SEMESTER CHEMISTRY SYLLABUS  
(Common for M.Sc Analytical, Physical & Organic Chemistry )  
(With effect from 2016-17 admitted batch)

**Books:**

1. Text book of Physical Chemistry by Samuel Glasstone, McMillan Pub.
2. Physical Chemistry by W.J.Moore, Prentice Hall
3. Physical Chemistry by G.W. Castellon, Narosha Publishing House
4. Physical Chemistry by Peter Atkins and Julio de Paula, Oxford University Press.
5. Modern Electrochemistry, 2A & 2B, JOM Bockris & A.K.N.Reddy, Plenum publishers
6. Introduction to Electrochemistry, S.Glasstone.
7. Fundamentals of Molecular Spectroscopy, Banwell
8. Spectroscopy by Straw & Walker.
9. Statistical thermodynamics , M.C.Gupta
10. Statistical Thermodynamics, M.Dole



ADIKAVI NANNAYA UNIVERSITY  
SECOND SEMESTER CHEMISTRY SYLLABUS  
(Common for M.Sc Analytical, Physical & Organic Chemistry )  
(With effect from 2016-17 admitted batch)

**LABORATORY WORK (6 hrs/ week)**

**INORGANIC CHEMISTRY PRACTICALS –II**

**Quantitative analysis:**

*Volumetric:*

1. Determination of Ferric iron by photochemical reduction
2. Determination of Nickel by EDTA
3. Determination of Calcium and Magnesium in a mixture by EDTA
4. Determination of Ferrocyanide by Ceric sulphate
5. Determination of Copper(II) in presence of iron(III)

*Gravimetric:*

6. Determination of Zinc as Zinc pyrophosphate
7. Determination of Nickel from a mixture of Copper and Nickel.

**ORGANIC CHEMISTRY PRACTICALS –II**

*Systematic qualitative analysis of an organic mixture containing two compounds*

Identification of method of separation and the functional group(s) present in each of them and preparation of one solid derivative for the confirmation of each of the functional group(s).

**PHYSICAL CHEMISTRY PRACTICALS –II**

1. Distribution of iodine between  $\text{CHCl}_3$  and water
2. Distribution of  $\text{I}_2$  between  $\text{CHCl}_3$  and aq. KI solution- calculation of equilibrium constant.
3. Determination of Coordination number of cuprammonium cation.
4. Titration of mixture Strong acid and weak acid versus Strong base by conductometry.
5. Titration of Strong acid Vs Strong Base – pH – metry.
6. Titration of mixture of ( $\text{NaHCO}_3 + \text{Na}_2\text{CO}_3$ ) Vs HCl – pH- metry.
7. Titration of Strong acid Vs Strong Base using Quinhydrone electrode.
8. Titration of  $\text{Fe}^{+2}$  Vs  $\text{K}_2\text{Cr}_2\text{O}_7$  – potentiometry
9. Verification of Beer-Lambert's law by Iron-thiocyanate system –colorimetry.
10. Determination of single electrode potential of  $\text{Cu}^{2+}/\text{Cu}$  and estimate the given unknown concentration.



ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY

**THIRD SEMESTER**

**Paper – I- ORGANIC REACTION MECHANISMS-I and  
PERICYCLIC REACTIONS**

(Effective from the 2016-17 Admitted Batch)

UNIT – I

15 Hrs

**A) Aliphatic Nucleophilic Substitution:**

Neighboring group participation by Bromine, Phenyl group, Non-Classical carbocations, NGP by Pi bond, Sigma bond and Cyclopropyl group,  $S_N$  at Allylic carbon (allylic rearrangements),  $S_N$  at Aliphatic trigonal carbon,  $S_N$  at Vinylic carbon, Ambident nucleophiles, Hydrolysis of esters ( $B_{AC}^2$ ,  $A_{AC}2$ ,  $A_{AC}1$ ,  $A_{AL}1$ ,  $B_{AL}1$ ), Mechanism of estrification of carboxylic acid with an alcohol using DCC, Mayers Synthesis of aldehydes, ketones and carboxylic acids Mitsunobu reaction, Von-Braun reaction

**B) Aliphatic Electrophilic Substitution:**

Mechanisms of  $S_E^2$ ,  $S_E^1$ ,  $S_{Ei}$ , *Hydrogen as electrophile*: Hydrogen exchange; Migration of double bonds, *Halogen electrophiles*. Mechanism of Halogenation of aldehydes and ketones; HVZ reaction; Halogenation of Sulphoxides & Sulphones, *Nitrogen Electrophiles*: Aliphatic diazo coupling, Diazo transfer reaction, Insertion of nitrenes, *Metal Electrophiles*: Metallation with Organometallic Compounds (Orthometallation), *Carbon as Leaving groups*: Decarboxylation of Aliphatic Acids; Dakin – West reaction; Haller–Bauer reaction.

UNIT – II

15 Hrs

**Principles of asymmetric synthesis:**

Introduction and terminology: Topicity in molecules Homotopic, stereoheterotopic (enantiotopic and diastereotopic) groups and faces, symmetry, substitution and addition criteria. Prochirality nomenclature: Pro-R, Pro-S, Re and Si. Stereoselective reactions: Substrate stereoselectivity, product stereoselectivity, enantioselectivity and diastereoselectivity. Conditions for stereoselectivity: Symmetry and transition state criteria, kinetic and thermodynamic control. Methods for inducing enantio and diastereoselectivity. Analytical methods: % Enantiomeric excess, enantiomeric ratio, optical purity, % diastereomeric excess and diastereomeric ratio. Techniques for determination of enantiomeric excess, specific rotation, Chiral NMR; Chiral derivatizing agents, Chiral solvent, Chiral shift reagents and Chiral HPLC.

UNIT – III

15 Hrs

**Pericyclic Reactions-I**

Molecular orbital symmetry, frontier orbitals of ethylene, 1,3 Butadiene, 1,3,5- Hexatriene, allyl system, classification of pericyclic reactions FMO approach, Woodward- Hoffman correlation diagram method and perturbation of molecular (PMO) approach for the explanation of pericyclic reactions under thermal and photochemical conditions.

Electrocyclic Reactions: Conrotatory and disrotatory motions ( $4n$ ) and ( $4n+2$ ), allyl systems  
Cycloadditions: Antarafacial and suprafacial additions, notation. of cycloadditions, ( $4n$ ) and ( $4n+2$ ) systems with a greater emphasis on ( $2+2$ ) and ( $4+4$ ) - cycloadditions, ( $2+2$ ) - additions of ketenes and chelotropic reactions.



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UNIT-IV

15 Hrs

**Pericyclic Reactions-II**

FMO approach and perturbation of molecular (PMO) approach for the explanation of sigma tropic rearrangements under thermal and photochemical conditions. suprafacial and antarafacial shifts of H Sigmatropic shift involving carbon moieties, retention and inversion of configurations, (3, 3) and (5, 5) sigmatropic rearrangements detailed treatment of Claisen and Cope rearrangements, fluxional tautomerism, aza-Cope rearrangement and Barton reaction.

Text Books and Reference Books:

- 1) Advanced Organic Chemistry: Reactions Mechanisms and Structure by Jerry March, Mc.Graw Hill and Kogakush.
- 2) Molecular reactions and Photochemistry by Charles Dupey and O. Chapman, Prentice Hall.
- 3) Pericyclic reactions by S.N. Mukharji, Mcmilan.
- 4) Mechanisms and Theory in Organic Chemistry by T.H. Lowery and K.S. Rich gardson.
- 5) The modern structural theory in Organic Chemistry by L.N.Ferguson, Pretice Hall
- 6) Physical Organic Chemistry by jack Hine, Mc. Graw Hill
- 7) Advanced Organic Synthesis, Part B-Reactions and Synthesis, Francis A. Carey and Richard J. Sudenburg, Fourth edition, Kluwer academic publishers, New York
- 8) Organic Synthesis, Christine Willis and Martin Willis, Oxford Chemistry primers.
- 9) Principles of Organic Synthesis, ROC Norman and JM Coxon, third edition, CBS, Publisher, Delhi.
- 10) Organic Synthesis, M. B. Smith, Mc Graw Hill, International Edition.
- 11) Organic Chemistry, Clayden, Greeves and Stuwart Warren.
- 12) Modern Organic Synthesis-an introduction by George S.Zweifel and Michael H. Nantz, W. H. Freeman & company, New York.
- 13) Pericyclic Reactions — a problem solving approach, Lehr and Merchand.
- 14) Conservation of Orbital Symmetry by Woodward and Hoffmann.



ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY

**THIRD SEMESTER**

**Paper – II- ORGANIC SPECTROSCOPY-I**

**(Effective from the 2016-17 Admitted Batch)**

UNIT-I 15 Hrs

**UV-Visible spectroscopy:**

A) Beer-Lambert's law-Deviations from Beers law-Instrumentation-Mechanics of measurement- Energy transitions-Simple chromophores- Auxochrome, Absorption shifts (Bathochromic, Hypsochromic, Hyper chromic and Hypo chromic shifts) UV absorption of Alkenes-Polyenes unsaturated cyclic systems.

B) UV absorption of carbonyl compounds:  $\alpha,\beta$ -unsaturated carbonyl systems-UV absorption of aromatic systems-solvent effects-geometrical isomerism-acid and base effects-typical examples-calculation of  $\lambda$  max values using Woodward Fieser rules, applications.

UNIT-II 15 Hrs

**Infrared spectroscopy:**

A) Mechanics of measurement-Fundamental modes of vibrations-stretching and bending vibrations-Factors effecting Vibrational frequency-hydrogen bonding.

B) Finger print region and its importance, typical group frequencies for  $-\text{CH}, -\text{OH}, \text{N-H}, \text{CC}, -\text{CO}$  and aromatic systems-Application in structural determination-Examples-simple problems.

UNIT-III 15 Hrs

**Nuclear Magnetic Resonance Spectroscopy ( $^1\text{H}$ NMR):**

A) Introduction: Basic principle of- NMR Nuclear spin- nuclear resonance-saturation-Relaxation-Instrumentation (CW&FT).

B) Shielding and deshielding of magnetic nuclei-chemical shift and its measurements, factors influencing chemical shift – spin-spin interactions- factors influencing –coupling constant J and factors effecting J value.

C)  $^{13}\text{C}$  NMR Spectroscopy: Similarities and Differences between PMR and CMR, general considerations, chemical shift (aliphatic, olefinic, alkyne, aromatic, hetero aromatic and carbonyl carbon), coupling constants, typical examples of CMR spectroscopy-simple systems.

UNIT-IV 15 Hrs

**Mass spectrometry**

A) Introduction: Ion production-E1, C1, ES, MALDI and FAB- determination of Molecular weight and formulae-Behavior of organic compounds in mass spectrometer- factors affecting fragmentation, ion analysis, and ion abundance.

B) Mass spectral fragmentation of organic compounds, Common functional groups, molecular ion peak, meta stable peak, Mc Lafferty rearrangement, Nitrogen rule, High resolution mass spectrometry, Examples of mass spectral fragmentation of organic compounds with respect of their structure determination.



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Suggested Books:

- 1) Spectroscopic Methods in Organic Chemistry- Forth Edition, D.H. Williams and I.Fleming  
Tata McGraw Hill, New Delhi, 1990.
- 2) Organic Spectroscopy- Second Edition, W.Kemp, ELBS Macmillan, 1987.
- 3) Applications of absorption spectroscopy of Organic Compounds J.R.Dyer,  
Prentice Hall of India, New Delhi, 1984.
- 4) Spectrometric identification of Organic Compounds-Fourth Edition, R.M.  
Silverstein: G.C.Vassiellr and T.C. Merrill, Johne Willey, Singapore, 1981.
- 5) Introduction to spectroscopy-D.L.Pavia, G.M.Lampman, G.S.Kriz, 3rdEd  
(Harcourt college publishers).
- 6) Absorption spectroscopy of organic molecules-V.M.Parkih.
- 7) Nuclear Magnetic Resonance-Basic principles-Atta-Ur-Rehman, Springer-Verlag, 1986.





ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY

**THIRD SEMESTER**

**Paper – III- MODERN ORGANIC SYNTHESIS-I**  
**(Effective from the 2016-17 Admitted Batch)**

UNIT-I

**Formation of C-C single bonds** 15 Hrs

Alkylations via enolate, Thermodynamic and kinetic enolate, Asymmetric Aldol reaction: a) Chiral enolate and achiral aldehyde b) Achiral enolate and chiral aldehyde – explanation by Zimmerman Traxler model; Stork enamine reaction and its synthetic applications; Organo sulphur chemistry: Umpolung and its synthetic applications (Corey Seebach Reaction), sulphur ylides: dimethyl sulphonium methylide, dimethyloxosulphonium methylide preparations and their synthetic applications; Organo Palladium Chemistry: Heck Reaction, Stille coupling, Suzuki coupling, Sonogashira coupling, Negishi coupling, Wacker Oxidation; Organo copper chemistry: Gilman's reagent and synthetic applications; Synthetic applications of carbenes and carbenoids; Baylis Hilman reaction.

UNIT-II

**Formation of Carbon-Carbon double bonds** 15 Hrs

Stereochemistry of E1 and E2 reactions (Different examples of acyclic and cyclic molecules, Saytzeff rule, Hofmann rules and Bredt's rule); Pyrolytic Syn eliminations (focus should be given on stereochemistry of syn eliminations of amine oxides, xanthates and esters of acyclic and cyclic molecules); Sulphoxide-Sulphenate rearrangement (Mislow-Evans rearrangement); Wittig reaction, Wadsworth Emmons reaction, Corey-Fuchs reaction, Aza Wittig reaction, Wittig-Horner reaction and stereo chemistry of Wittig reaction; Shapiro reaction, Eschen-Moser Tanabe fragmentation, Claisen rearrangement of allyl vinyl ethers, Julia Lythgoe olefination, Mc Murray coupling, Peterson Olefination, Tebbs reagent and its application, Metathesis: Grubbs 1st and 2nd generation catalyst, Olefin cross coupling (OCM), ring closing (RCM) and ring opening (ROM) metathesis, applications, olefination by Nysted reagent.

UNIT-III

**Reactions of unactivated C-H bonds and organoboranes** 15 Hrs

The Hoffmann Loeffler- Freytag reaction, the Barton reaction and Photolysis of organic hypothalites;

Organoboranes: Preparation of Organoboranes



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viz hydroboration with  $\text{BH}_3\text{-THF}$ , dicyclohexyl borane, disiamyl borane, theryl borane, 9-BBN mono isopinacamplyl borane ( $\text{IPC}_2\text{BH}_2$ ) and diisopinacamplyl borane ( $\text{IPC}_2\text{BH}$ ) functional group transformations of Organo boranes-Oxidation, protonolysis and isomerisation. Formation of carbon-carbon-bonds viz organo boranes carbonylation and cyanidation, reactions of alkenyl boranes and trialkyl alkynyl borates.

UNIT-IV

**Protecting groups and simple applications of microwave and ultrasound assisted reactions** 15 Hrs

(A) Protecting Groups

- 1) Protection of **alcohols** as **ethers** [methyl ether ( $\text{RO-Me}$ ), Tertiary butyl ether ( $\text{ROCM}_3$ ), Benzyl ethers ( $\text{RO-Bn}$ ), *p*-methoxybenzylethers ( $\text{RO-PMB}$ )], as **Silyl ethers** [Trimethyl silylether ( $\text{R-OTMS}$ ), tri ethyl silyl ethers ( $\text{RO-TEs}$ ), *t*-butyldimethylsilyl ether ( $\text{R-OTBDMS}$  in the presence of imidazole), tri isopropylsilyl ether ( $\text{RO-TIPS}$ ), *t*-butyl diphenylsilyl ether ( $\text{RO-TBDPS}$ )], as **acetals** [tetrahydropyranyl ethers ( $\text{RO-THP}$ ), methoxymethyl ethers ( $\text{RO-CH}_2\text{-OCH}_3 = \text{RO-MOM}$ ) and **ester formation** (carboxylic acid ester and *p*-toluene sulphonate esters).
- 2) Protection of 1,2-diols by acetal, ketal and carbonate formation.
- 3) Protection of amines by acetylation, benzoylation, benzoyloxy carbonyl, Fmoc and triphenyl methyl groups.
- 4) Protection of carbonyl by acetal, ketal and thio acetal (Umpolung) groups.
- 5) Protection of carboxylic acids by esters and ortho ester formation.

(B)

Synthetic applications of PTC and crown ethers

1. Microwave Technology: Microwave equipment, activation-benefits, limitations, microwave effects. Microwave assisted reactions in organic solvents-Esterification reactions, Fries rearrangement, Orthoester Claisen rearrangement, Diels- Alder reaction, decarboxylation.
2. Ultrasound assisted reactions: introduction, substitution reactions, addition, oxidation, reduction reactions.
3. Click chemistry: criterion for click reaction, Sharpless azides cycloadditions



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DEPARTMENT OF CHEMISTRY

Textbooks and Books for Reference:

- 1) Some Modern Methods of Organic Synthesis W. Carruthers, Third & Fourth Edition, Cambridge University Press, Cambridge, 1988.
- 2) Modern Organic Synthesis-an introduction by George S.Zweifel and Michael H. Nantz, W. H. Freeman & company, New York.
- 3) Advanced Organic Synthesis, Part B-Reactions and Synthesis, Francis A. Carey and Richard J. Sudenburg, Fourth edition, Kluwer academic publishers, New York
- 4) Organic Synthesis, Christine Willis and Martin Willis, Oxford Chemistry primers.
- 5) Principles of Organic Synthesis, ROC Norman and JM Coxon, third edition, CBS, Publisher, Delhi.
- 6) Organic Synthesis, M. B. Smith, McGraw Hill, International Edition.
- 7) Organic Chemistry, Clayden, Greeves and Stuart Warren.
- 8) Guide Book to Organic Synthesis (3<sup>rd</sup> edition), R. Mackie, D. M. Smith and Aitken.
- 9) Organo Boranes and Silanes, Thomson, Oxford Chemistry primers.
- 10) Strategic applications of named reactions in organic synthesis, Laszlo Kurti and Barbara Czako.
- 11) Modern Synthetic Reactions, Herbert O. House, Second Edition, W.A. Benzamine Inc. Menio Park, California, 1972.
- 12) Organic Synthesis viz Boranes, Herbert C. Brown Gray, W. Kramer Alan B. Levy and M. Mark Midland John Wiely &. Sons, New York, 1975.
- 13) Organic Synthesis: Special Techniques, V. K. Ahluwalia and Renu Agarwal.
- 14) Organic Synthesis, Jagadamba Singh and Dr. A. Yadav, Pragati Edition.



ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY

**THIRD SEMESTER**

**Paper – IV- : CHEMISTRY OF NATURAL PRODUCTS**

**(Effective from the 2016-17 Admitted Batch)**

**UNIT–I: Alkaloids** 15 Hrs

Introduction, isolation, general methods of structure elucidation and physiological action, degradation, classification based on nitrogen heterocyclic ring, structure, stereochemistry, synthesis and biosynthesis of morphine, strychnine, vincristine, colchicine, camptothecin and reserpine.

**UNIT–II: Terpenoids** 15 Hrs

Occurrence, isolation, general methods of structure determination, isoprene rule. Structure determination, stereochemistry, biosynthesis and synthesis of Farnesol, Zingiberene, Forskolin, Taxol, Azadirachtin and  $\beta$ -amyrin.

**UNIT–III: Steroids** 15 Hrs

Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and its stereochemistry. Isolation, structure determination and synthesis of cholesterol (total synthesis not expected), androsterone, testosterone, estrone and progesterone, Biosynthesis of steroids.

**UNIT–IV: Flavonoids and Isoflavonoids** 15 Hrs

Occurrence, nomenclature and general methods of structure determination, Isolation, structure elucidation and synthesis of Kaempferol, Quercetin, Cyanidin, Genestein, Butein and Daidzein. Biosynthesis of flavonoids and Isoflavonoids: Acetate Pathway and Shikimic acid Pathway.

Books Suggested:

1. Natural Products: Chemistry and Biological Significance, J. Mann, R.S.Davidson, J. B. Hobbs, D. V. Banthrope and J. B. Hatrbnome, Longman, Essex.
2. Organic Chemistry, Vol. 2, I. L. Finar, ELBS.
3. Chemistry of Organic Natural Products, O. P. Agrawal, Vols. 1 &2, Goel Pubs.
4. Natural Products Chemistry K. B. G. torsell, John Wiley, 1983
5. New Trends in Natural Products Chemistry, Atta-ur-Rahman and M.I.Choudhary, Harwood Academic Publisher.
6. Chemistry of Natural products P. S. Kalsi, Kalyani Publishers
7. Biosynthesis of steroids, terpenes and acetogenins, J. H. Richards & J. R. Hendrieson
8. The biosynthesis of secondary metabolites, R. D. Herbert, Chapman & Hall
9. The Biosynthesis of Secondary Metabolite, R. D. Herbert, Second edn, Chapman and Hall 1984
10. Chemical aspects of Biosynthesis, John Mann, Oxford University Press, Oxford, 1996.



ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY

FOURTH SEMESTER

Paper – I- ORGANIC REACTION MECHANISMS-II and  
ORGANIC PHOTO CHEMISTRY

(Effective from the 2016-17 Admitted Batch)

UNIT – I 15 Hrs

A) **Free Radical Reactions:**

Free radical substitution mechanisms; Mechanism at an aromatic substrate; Neighboring group assistance in free radical reactions; Reactivity for aliphatic substrates; Reactivity in aromatic substrates; Reactivity at bridge head; Reactivity in the attacking radical; Effect of solvent on reactivity, Allylic halogenations using NBS (Wohl – Ziegler bromination); Hydroxylation at aromatic carbon by Fentons reagent; Oxidation of aldehydes to carboxylic acids; Formation of cyclic ethers using Leadtetraacetate; Formation of hydroperoxides (autooxidation); Coupling of alkynes (Eglinton reaction and Glacer reaction); Arylation of Aromatic compounds by diazonium salts(Gomberg – Bachman reaction); Mechanisms of Sandmeyer reaction, Kolbes reaction, Hunsdiecker reaction, Reed reaction; free radical rearrangements.

B) **Quantitative relationships between Molecular structure and Chemical reactivity:**

Hammett and Taft Equations

C) **Rearrangements:** Wagner – Meerwein Rearrangement, Demjanov Rearrangement, Wittig Rearrangement and Stevens Rearrangement

Unit – II: 15 Hrs

**Methodologies in asymmetric synthesis**

Strategies in Asymmetric Synthesis: 1. Chiral substrate controlled, 2. Chiral auxiliary controlled, 3. Chiral reagent controlled and 4. Chiral catalyst controlled.

1. **Chiral Substrate controlled asymmetric synthesis:** Nucleophilic additions to chiral carbonyl compounds. 1, 2- asymmetric induction, Cram's rule and Felkin-Anh model.

2. **Chiral auxiliary controlled asymmetric synthesis:**  $\alpha$ -Alkylation of chiral enolates, azaenolates, imines and hydrazones. 1, 4-Asymmetric induction and Prelog's rule. Use of chiral auxiliaries in Diels-Alder reaction.

3. **Chiral reagent controlled asymmetric synthesis:** Asymmetric reductions using BINAL-H. Asymmetric hydroboration using IPC2 BH and IPCBH2.

4. **Chiral catalyst controlled asymmetric synthesis:** Sharpless and Jacobsen asymmetric epoxidations. Sharpless asymmetric dihydroxylation. Asymmetric hydrogenations using chiral Wilkinson biphosphine and Noyori catalysis. Enzyme mediated enantioselective synthesis

5. **Asymmetric aldol reaction:** Diastereoselectivity aldol reaction (chiral enolate & achiral aldehydes and achiral enolate & chiral aldehydes) its explanation by Zimmerman-Traxel model.

UNIT – III 15 Hrs

**Photo Chemistry-I**

Photochemical energy, Frank Condon Principle, Types of Electronic Excitation and Molecular orbital view of excitation, Jablonski Diagram, singlet and triplet states, dissipation of photochemical energy, photosensitization, quenching, quantum efficiency and quantum yield, Determination of Quantum yield

Photo Chemistry of Carbonyl Compounds: Norrish Type I reaction (alpha cleavage reaction), Norrish Type – II reaction, Paterno- Buchi reaction, Photo reduction & photo enolisation; photochemical Oxidations [Backstrom mechanism], Photo oxidation of alkenes with singlet oxygen.



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Unit – IV

**Photochemistry-II**

Di – Pi methane Rearrangement, Aza di – Pi methane rearrangement; Photochemistry of Benzene and substituted benzene, 1, 2 , 1,3 ,& 1, 4-additions; Photo Fries rearrangement of Phenolic acetates and Anilides; Photochemistry of unsaturated systems, Cis- Trans Isomerisation of alkenes (Direct and sensitized) (Photoisomerisation of Stilbene), Photochemistry of Butadiene; Dimerisations of alkenes, Intramolecular dimerisation.

Photochemical rearrangement of Cyclohexadienenones; Photochemistry of alpha, beta Unsaturated ketones (dimerisations and addition across the double bond); Photochemical rearrangement reactions of Cyclohexenone, Photorearrangements of Beta, gamma unsaturated systems (Mechanism of 1,2 & 1,3 – acyl shifts); Photochemistry of Nitrite esters (Barton reaction); Photochemistry of alpha diazoketones; Photo Aromatic Substitutions; Photochemistry of Pyridinium ylides.

Text Books and Reference Books:

- 1) Advanced Organic Chemistry: Reactions Mechanisms and Structure by Jerry March, Mc.Graw Hill and Kogakush.
- 2) Molecular reactions and Photochemistry by Charles Dupey and O. Chapman, Prentice Hall.
- 3) Mechanisms and Theory in Organic Chemistry by T.H. Lowery and K.S. Richardson.
- 4) The modern structural theory in Organic Chemistry by L.N.Ferguson, Prentice Hall
- 5) Physical Organic Chemistry by Jack Hine, Mc. Graw Hill
- 6) Advanced Organic Synthesis, Part B-Reactions and Synthesis, Francis A. Carey and Richard J. Sudenburg, Fourth edition, Kluwer academic publishers, New York
- 7) Organic Synthesis, Christine Willis and Martin Willis, Oxford Chemistry primers.
- 8) Principles of Organic Synthesis, R.C. Norman and J.M. Coxon, third edition, CBS, Publisher, Delhi.
- 9) Organic Synthesis, M. B. Smith, Mc Graw Hill, International Edition.
- 10) Organic Chemistry, Clayden, Greeves and Stuart Warren.
- 11) Modern Organic Synthesis-an introduction by George S.Zweifel and Michael H. Nantz, W. H. Freeman & company, New York.
- 12) Organic Photochemistry by D Coyle
- 13) Molecular Photochemistry by Gilbert & Baggo
- 14) Organic Photochemistry by Turro
- 15) Photochemistry by C W J Wells



ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY

**FOURTH SEMESTER**

**Paper – II- ORGANIC SPECTROSCOPY-II**

**(Effective from the 2016-17 Admitted Batch)**

**UNIT-I:**

A) Optical Rotatory Dispersion: Theory of Optical Rotatory Dispersion-Cotton effect –CD curves-types of ORD and CD curves–similarities and difference between ORD and CD curves

B) The octant rule-application in structural studies- $\alpha$ - halo keto rule.

**UNIT-II**

A) Improving the PMR spectrum: Chemical and Magnetic Equivalence. Chemical exchange, First and Non-First Order Spectra and analysis of AB, AMX and ABX systems.

B) Simplification of complex spectra-: Nuclear Magnetic double resonance, Lanthanide shift reagents, solvent effects, Fourier transforms technique, Nuclear Overhauser Effect (NOE), Deuterium Exchange, spectra at higherfields. Hindered Rotations and Rate processes. Resonance of other nuclei- $^{19}\text{F}$  and  $^{31}\text{P}$

C) 2D NMR spectroscopy: Definitions and importance of COSY, DEPT, HOMCOR, HETCOR, INADEQUATE, INDOR INEPT, NOESY, HOM2DJ, HET2DJ and DQFCOSY.

**UNIT-III**

Solution of structural problems by joint application of UV, IR, NMR ( $^1\text{H}$ & $^{13}\text{C}$ ) and mass spectrometry.

**UNIT-IV**

A) Separation Techniques: Solvent extraction chromatography-paper-thin layer partition-column chromatography, Electrophoresis.

B) Instrumentation – Gas Chromatography, High performance Liquid Chromatography, X – Ray diffraction (XRD)

**Suggested Books:**

- 1) Spectroscopic Methods in Organic Chemistry- Forth Edition, D.H. Williams and I. Fleming  
Tata - McGraw Hill, New Delhi, 1990.
- 2) Organic Spectroscopy- Second Edition, W.Kemp, ELBS Macmillan, 1987.
- 3) Spectrometric identification of Organic Compounds-Fourth Edition, R.M. Silverstein: G.C.Vassillr and T.C. Merill, John Willey, Singapore, 1981.
- 4) Introduction to spectroscopy-D.L.Pavia, G.M.Lampman, G.S.Kriz, 3rdEd  
(Harcourt college publishers).
- 5) "Applications of Optical rotation and Circular Dichroism", G.C. Barret, in  
"Elucidation of Organic structures by Physical and Chemical Methods"  
Part I (Eds) K.W. Bentley and G.W.Rirty John Wiley, 1972, Chapter VIII  
(only those aspects mentioned in the syllabus).
- 6) Instrumental methods of chemical analysis by H.Kaur, Pragati Prakasan,meerut.
- 7) Separation Techniques by M.N.Sastri, Himalaya publishing House (HPH), Mumbai.



ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY

**FOURTH SEMESTER**

**Paper – III- MODERN ORGANIC SYNTHESIS-II**  
**(Effective from the 2016-17 Admitted Batch)**

UNIT-I

**Organo Silanes**

15 Hrs

Synthetic applications of trimethylsilyl chloride dimethyl-*t*-butylsilyl chloride, trimethylsilyl cyanide, trimethylsilyl iodide and trimethylsilyl triflate, synthetic applications of  $\alpha$ -silyl carbanion and  $\beta$ -silyl carbonium ions. Synthetic applications of silyl enol ethers, Preparation and synthetic applications of alkynyl silanes, aryl silanes, allyl silanes and vinyl silanes, Nazarov cyclization, Synthetic conversion of  $\alpha$ ,  $\beta$ -epoxy silanes, Peterson Olefination, Brook rearrangement and Rubottom oxidation.

UNIT-II

15 Hrs

**Oxidation**

Synthetic applications of the following reagents in the oxidation of functional groups like alkenes, alkynes, alcohols, aldehydes and ketones: 1)  $\text{Pb}(\text{OAc})_4$  2)  $\text{HIO}_4$  3)  $\text{SeO}_2$  4)  $\text{CrO}_3$  (Sodium or potassium dichromate in  $\text{H}_2\text{SO}_4$ , Collins reagent, Jones reagent, Etard reagent,  $\text{CrO}_3$  in acetic anhydride, PCC (Coreys reagent), PDC, Babler oxidation), 4)  $\text{MnO}_2$  5)  $\text{KMnO}_4$  6)  $\text{OsO}_4$  7) Oxidations by using DMSO involving alkoxy sulphonium salts (Kornblum oxidation), DCC- DMSO (Pfitzner-Muffat reagent), Swern oxidation, Corey-Kim oxidation, Albright-Goldman oxidation 8) Oxidations by using IBX, DMP, TPAP, TEMPO, CAN 9) Bayer villager oxidation and Prilezhev epoxidation 10) Oxidation of alkenes using Woodward and Prevost reagents 11) Oxidation by using DDQ 12) Sharpless asymmetric epoxidation and Sharpless asymmetric dihydroxylation 13) Thallium nitrate 14) Oxidative coupling of phenols and alkynes.

UNIT-III

**Reduction**

15 Hrs

- (1) Catalytic reductions: Homogeneous (Wilkinson's Catalytic reduction) and heterogeneous catalytic reductions and their synthetic applications.
- (2) Reductions by using electrophilic nucleophilic metal hydrides:  $\text{LiAlH}_4$  (Various examples of reductions and Cram's rule), related reagents of LAH,  $\text{NaBH}_4$ ,  $\text{NaBH}_3\text{CN}$ , Trialkyl Borohydrides (Super Hydride and Selectride).
- (3) Reductions by using electrophilic metal hydrides:  $\text{BH}_3$ , DIBAL





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- (4) Reductions by dissolving metals: Clemenson reduction, Acyloin condensation, Bouveault-Blanc reduction, Birch reduction (Various examples should be discussed).
- (5) Reductions by using Diimide and Wolf-Kishner Reduction (6) Hydrogenolysis
- (7) Reductions by using tri n-butyl tin hydride.

UNIT-IV

**Retro Synthetic Analysis**

15 Hrs

1. Basic definitions of the following:
  - a) Retro synthetic analysis b) Disconnection c) Target molecule d) Synthone
  - e) Synthetic equivalent f) Functional Group Inter Conversion (FGI) g) Functional Group Addition (FGA)
2. Guidelines for the order of events: One group C-X disconnections One Group C-X disconnections (Carbonyl derivatives, ethers, sulphides and alcohols); Two group C-X disconnections (1,1-difunctionalised, 1,2-difunctionalised and 1,3-difunctionalised compounds), One group C-C disconnections (Alcohols and carbonyl compounds, 1,1-C-C, 1,2-C-C and 1,3-C-C); Synthesis of alkenes (Wittig disconnections and diene synthesis), Two group disconnections (Diels Alder reaction and 1,3-difunctionalised compounds); Linear and convergent synthesis.

Textbooks and Books for Reference:

- 1) Some Modern Methods of Organic Synthesis W. Carothers, Third Edition, Cambridge University Press, Cambridge, 1988.
- 2) Modern Organic Synthesis-an introduction by George S.Zweifel and Michael H. Nantz, W. H. Freeman & company, New York.
- 3) Advanced Organic Synthesis, Part B-Reactions and Synthesis, Francis A. Carey and Richard J. Sudenburg, Fourt edition, Kluwer academic publishers, New York.
- 4) Organic Synthesis, Christine Willis and Martin Willis, Oxford Chemistry primers.
- 5) Principles of Organic Synthesis, ROC Norman and JM Coxon, third edition, CBS, Publisher, Delhi.
- 6) Organic Synthesis, M. B. Smith, McGraw Hill, International Edition.
- 7) Organic Chemistry, Clayden, Greeves and Stewart Warren.
- 8) Guide Book to Organic Synthesis (3<sup>rd</sup> edition), R. Mackie, D. M. Smith and Aitken.
- 9) Organo Boranes and Silanes, Thomson, Oxford Chemistry primers.
- 10) Strategic applications of named reactions in organic synthesis, Laszlo Kurti and Barbara Czako.
- 11) Organic Synthesis: The disconnection approach, S. Warrant John Wiley & sons, New York, 1984.
- 12) Modern Synthetic Reactions, Herbet O. Horase, Second Edition, W.A. Benzamine Inc. Menio Park, California, 1972.



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**FOURTH SEMESTER**

**Paper – IV- BIO-ORGANIC CHEMISTRY**  
**(Effective from the 2016-17 Admitted Batch)**

UNIT-I 15 Hours

**Biopolymers and Enzymes**

Peptides:  $\alpha$ -Amino acids, their general properties and synthesis, Synthesis of peptides by Merrified solid phase synthesis. Chemistry of oxytocin and dolastain-10  
Enzymes-Oxidoreductases, hydrolases, transferases, synthesis of ATP, Baker's Yeast.  
Enzyme models-NADH models, Bio transformations, Remotefunctionalization

UNIT-II 15 Hours

**Antimalarials & Antibiotics**

**i. Antimalarials**

Chemotherapy, synthesis and activity of antimalarial drugs- quinoline group-quinine, acridine group-quinacrine and guanidine group-paludrine.

**ii. Antibiotics**

General characteristics, structure- activity relationships, synthesis and activity of antibiotics: Pencillin G, Cephalosporin-C and streptomycin.

UNIT-III 15 Hours

**Vitamins and Prostaglandins**

Definition, occurrence, structural formulae, physiological functions and synthesis of Vitamins.

Vitamins: Structure determination and synthesis of Retinol (A), Thiamine (B<sub>1</sub>), Riboflavin (B<sub>2</sub>), Pyridoxine (B<sub>6</sub>) and Biotins (H), Nicotininc acid.

**Prostaglandins**

Occurrence, nomenclature, classification, biogenesis and physiological effects. Synthesis of PGE<sub>2</sub> and PGF<sub>2</sub>

UNIT-IV 15 Hours

**Nucleic Acids:**

Nucleic acids: Basic concepts of the structures of RNA and DNA and their hydrolysis products, nucleotides, nucleosides and heterocyclic bases, Genetic Code, Finger Print test.

Application of recombinant DNA technology in production of pharmaceuticals, diagnosis of diseases, insect control, improved biological detergents, gene therapy-examples.



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Reference Books and Material:

1. Chemical Aspects of Biosynthesis, John Man, Oxford University Press, Oxford, 1996.
2. Chemistry of Natural Products: A Unified Approach, N. R. Krishnaswamy, University Press (India) Ltd., Orient Longman Limited, Hyderabad, 1999.
3. Introduction to Organic Chemistry, A Streitwieser, CH Heathcock and E.M./Kosover IV Edition, McMillan, 1992. (For Merrifield synthesis of peptides and also for other aspects of Unit IV)
4. Bio-organic Chemistry, H.Dugas and C. Penney, springer, New York, 1981.
5. Details of Primary literature: Nomenclature: Structure: Dolastatin-10: JACS, 1987, 109, 6883 (structure), ibdi, 1989, 111, 5463, JCS, Parkin I, 1996, 859 (synthesis).



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**III SEMESTER**  
**Laboratory Course-1**

**100 M**

**Multistep Synthesis of Organic Compounds:**

The experiments should illustrate the use of organic reagents and may involve purification of the products by chromatographic techniques.

1. Beckmann rearrangement: Benzanilide from Benzophenone  
Benzophenone → Benzophenone oxime → Benzanilide
2. Benzilic acid rearrangement: Benzilic acid from benzoin  
Benzoin → Benzil → Benzilic acid
3. P-Bromo Aniline from Aniline :  
Aniline → Acetanilide → P-Bromo Acetanilide → P-Bromo Aniline
4. Symmetrical Tribromo Benzene from aniline:  
Aniline → Tribromoaniline → Tribromobenzene
5. 2,4,6-trimethylquinoline from p-toluidine  
p-toluidine → 4-(p-tolylamino) pent-3-ene-2-one → 2,4,6-trimethylquinoline
6. Flavone from o-hydroxy acetophenone  
o-hydroxy acetophenone → o-benzoyl acetophenone → o-hydroxy- dibenzoylmethane → Flavone
7. 2-phenylindole from phenylhydrazine  
phenylhydrazine → acetophenone phenylhydrazone → 2-phenylindole

**Laboratory Course-2**

**100 M**

**Spectral Identification of Organic Compounds (UV, IR,  $1^{\text{H}}$ - and  $^{13}\text{C}$ - NMR, MASS).**

A minimum of 40 representative examples should be studied

**Books Suggested**

1. Modern Organic Synthesis in the Laboratory *A Collection of Standard Experimental Procedures*, Jie Jack Li, Chris Limberakis, Derek A. Pflum
2. Practical organic chemistry by Mann & Saunders
3. Text book of practical organic chemistry by Vogel
4. Spectrometric Identification of organic compounds, R.M. Silverstein, F.X. Webster and D.J. Kiemle, 7th Ed., (Wiley)



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**IV – SEMESTER**  
**Laboratory Course-1**

**100 M**

**Chromatographic Separation and Isolation & identification of Natural Products**

1. Thin layer chromatography: Determination of purity of a given sample, monitoring the progress of chemical reactions, identification of unknown organic compounds by comparing the R<sub>f</sub> values of known standards.
2. Isolation and identification of Natural Products
  - (a) Isolation of caffeine from tea leaves
  - (b) Isolation of eugenol from cloves
  - (c) Isolation of casein and lactose from milk
  - (d) Isolation of limonene from lemon peel
  - (e) Isolation of piperines from black pepper
  - (f) Isolation of lycopene from tomatoes
  - (g) Isolation of β-carotene from carrots

**Laboratory Course-2**  
**Estimations and Chromatography**

**100 M**

1. Estimation of (a) Glucose (b) Phenol (c) Aniline (d) Acetone (e) Aspirin (f) Ibuprofen (g) Paracetamol
2. Separation by column chromatography: Separation of a mixture of *ortho* and *para* nitroanilines using silicagel as adsorbent and chloroform as the eluent. The column chromatography should be monitored by TLC.

**Books Suggested:**

1. Ikan, R. *Natural Products, A Laboratory Guide*, 2nd ed.; Academic Press: New York, 1991.
2. Adapted from *Introduction to Organic Laboratory Techniques: A Microscale Approach*. Pavia, Lampman, Kriz and Engel. (1999) Saunders College Publishing.
3. Pharmaceutical drug analysis by Ashutoshkar
4. Quantitative analysis of drugs in pharmaceutical formulations by P D Sethi
5. Practical pharmaceutical chemistry part-1 and part-2 by A H Beckett and J B Stenlake
6. Practical organic chemistry by Mann & Saunders
7. Text book of practical organic chemistry including qualitative organic analysis by A.I. Vogel (Longman)



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DEPARTMENT OF CHEMISTRY  
**THIRD SEMESTER**  
PAPER-I: ADVANCED CHEMICAL KINETICS AND PHYSICAL  
CHEMISTRY OF POLYMERS  
(Effective from the 2016-17 admitted Batch)

UNIT-I

Theories of reaction rates – Potential energy surfaces – Reaction coordinate – theories of unimolecular gas phase reactions – Lindemann hypothesis – Hinshelwood treatment – Reactions in solutions – Kinetic Isotope effect – Linear free energy relationships – Hammett equation – Okamoto–Brown Equation – Taft Equation; Chain Reactions  $H_2-Cl_2, H_2-Br_2$  and  $H_2-O_2$  reaction – Explosion limits.

UNIT-II

Complex reactions – Consecutive – Parallel and Opposing reactions – Equilibrium and Steady state technique – Michaelis – Menten Models. Flow and relaxation Technique for fast reactions – NMR methods determining exchange rates.

UNIT-III

Characteristics of macro molecules (addition & condensation of polymerization), degree of polymerization. Shapes of macro – molecules, bulk, solution and emulsion polymerization – Co-Polymerization, block and graft copolymers, Ziegler natta catalysis. The structure and properties of polymers – Crystallinity. Glass-transition temperature, Rheology and solubility of polymers, processing of polymers – Additives.

UNIT-IV

Interaction of polymers and liquids – Flory – Huggins treatment and its limitation, Fractionation, Viscosities of polymer solutions, Synthesis and properties of polyesters, polyamides, polyurethanes, polystyrene and bakelite. Determination of molecular Weights of polymers by osmometry, light scattering, Ultra centrifuge and Viscometry.

Suggested books :

1. Chemical Kinetics by Laidler.
2. Physical Organic Chemistry by Wiberg.
3. Kinetics and Mechanism by Frost and Pearson.
4. Molecular connectivity in Chemistry and Drug Research L.B.Kier and L.H.Hall Academic press, 1976.
5. Chemical Kinetics – The study of Reaction Rates in solution – Kenneth A. CANNORSV – VCH Publishers.
6. An introducer to polymer Chemistry – W.R. Moore.
7. Introduction to polymer Chemistry – R.B. Seymour.
8. Fundamentals of Polymer Science and Engineering – Anil Kumar and S.K. Gupta.



ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY  
**THIRD SEMESTER**  
PAPER II: QUANTUM CHEMISTRY –II AND CHEMICAL  
APPLICATIONS OF SYMMETRY AND GROUP THEORY  
(Effective from the 2016-17 admitted Batch)

UNIT –I:

Wave mechanics of simple systems –Systems with discontinuity in the Potential field  
–Quantum Mechanical tunneling effect –potential barrier with finite thickness.

Wave mechanics of systems with variable potential energy – Harmonic Oscillator –  
Hermite polynomials –recursion formula –Energy levels of three dimensional harmonic  
oscillator – degeneracy of the energy levels.

UNIT –II:

Hydrogen like atoms –Solutions of the wave equation –solution of  $R(r)$ ,  $\phi(\phi)$  and  $\theta(\theta)$   
equations – Shapes of atomic orbitals – Space quantization of electronic orbitals.

Angular momentum – Commutation relations – Commutation with Hamiltonian-Spin-  
Orbit interaction – Vector model of the atom.

UNIT–III:

Representation – reducible and irreducible representations – Orthogonality theorem and  
its consequences – Constructions of Character table for  $C_{2v}$  and  $C_{3v}$  point groups – Wave  
functions as bases for irreducible representations – Direct Product

Hybridization scheme for  $AB_n$  type of molecules –  $AB_3$ ,  $AB_4$ ,  $AB_5$  and  $AB_6$  under point  
groups  $D_{3h}$ ,  $D_{4h}$ ,  $T_d$ ,  $C_{4v}$  and  $O_h$

Ligand field theory: Splitting of d-orbitals under  $D_{4h}$ ,  $T_d$ ,  $C_{4v}$  and  $O_h$  environments.

Construction of molecular orbital correlation diagram (1) for  $\sigma$  bonds in octahedral  
environment and (2) for  $H_2O$  molecule.

UNIT-IV:

Symmetry selection rules for I.R. and Raman activity – transition moment integral –  
application of direct product.

Determination of symmetries of total degrees of freedom: Calculation of Character per  
un-shifted atom for different symmetry operations and evaluation of  $SF_6$ .

Determination of symmetries of I.R. and Raman active vibrational modes for different  
molecules  $SO_2$ ,  $NO_2$ ,  $CCl_4$ ,  $POCl_3$ ,  $PCl_5$  and  $SF_6$ .

Accidental degeneracy and Fermi Resonance.

Recommended Text Books:

1. Chemical Applications of Group Theory, F.A.Cotton Wiley Eastern Limited, New Delhi.
2. Group Theory and its Applications to Chemistry, K.V.Ramana, Tata McGraw-Hill Publishing Company Limited New Delhi.
3. Introductory Quantum Chemistry, A.K.Chandra, TATA MCGRAW-HILL Publishing Company Ltd., New Delhi.
4. Quantum Chemistry, Iran Levine, Pearson Education.
5. Theoretical Chemistry, S.Glastone.





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DEPARTMENT OF CHEMISTRY  
**THIRD SEMESTER**  
PAPER-III: STATISTICAL THERMODYNAMICS AND SOLUTION  
EQUILIBRIA OF PROTON LIGAND COMPELXES  
(Effective from the 2016-17 admitted Batch)

UNIT-I:

Statistical mechanics : Ensembles (Canonical and micro canonical ) –Basic definition distribution and microstates ,thermodynamic probability . The classical distribution law . The Maxwell – Boltzmann distribution law ,method of lagrangian multiplies ,indistinguishable particles, quantum statistics – Bose –Einstein and Fermi Dirac Statistics, Conditions for the applicability of Maxwell – Boltzmann statistics, Bose – Einstein statistics and radiation, extreme gas degeneration, degenerate electron gas.

UNIT-II :

Statistical thermodynamics: Partition function. Thermodynamics functions from partition functions for multiple degree of freedom, theories of heat capacities of solids, stastical evaluation of entropy, comparison of statistical values with third law entropies (thermal entropies).

UNIT-III :

Gran analysis of acid base titrations –Determination of Carbonate content and correction factors for  $P^H$  meter dial readings ; Secondary formation function  $nbarh$ ; Calculation of stability constants of proton ligand complexes –successive approximation method –half  $nbarh$  method; Simulation of  $p^H$  metric titration data for proton –ligand systems.

UNIT –IV :

Prediction of proton –ligand formation constants using Molecular mechanics/ Quantum Chemical methods; Effect of solvent on stability – Abraham multi layer model –LD model; Components of expert systems – knowledge base, inference engine and user interface.

Suggested Books:

1. M.T.Beck,Complex Equilibria,1991
2. Alcock,solution Equilibria,1992
3. Richard E. Dickerson,Molecular Thermodynamics
4. S.Glasstone, Theoretical Chemistry
5. S.Glasstone,Thermodynamics for Chemists
6. C.Andrews ,Equilibrium Statistical Mechanics
7. Davies, Thermodynamics
8. Yeremin, Thermodynamics
9. J. Rajaram, and T.C. Kuriacose, Thermodynamics for student of chemistry.



ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY  
**THIRD SEMESTER**

PAPER –IV : INSTRUMENTATION

**(Effective from the 2016-17 admitted Batch)**

UNIT –I :

Spectrophotometry – deviations from Beer - lamberts law Instrumentation –Errors in Spectrophotometry – photometric titrations composition and stability constants of mononuclear complexes by linear extrapolation methods.Fundamental principles of Fluorescence spectroscopy and basic instrumentation of spectrofluorimeter.

UNIT –II :

Chromatographic methods - Ion exchange chromatography separation of transition metal ion – solvent extraction - partition coefficient – distribution ratio - classification of solvent extraction systems and evaluation of formation constants and applications Gas liquid Chromatography principal - Instrumentation - retention time - retention volume – Elementary principles of HPLC and hyphenated instruments.

UNIT –III :

Techniques and instrumentation of IR , Microwave and Raman. Theory and instrumentation Atomic absorption spectroscopy - Atomic emission spectroscopy with ICP source - Elementary principles of laser mass spectrometry.

UNIT – IV :

Polarography - Introduction - types of currents - qualitative and quantitative aspects of polarography – analytical applications to organic and inorganic compounds - Evaluation of stability constants by deford and hume method – amperometric titrations. Principles of thermo gravimetry - Apparatus and working, Differential methods of analysis - principle factors affecting DTA curve. Application of DTA .

Suggested Books:

1. Quantitative Analysis – R.A.Day and A.L.Underwood
2. Quantitative Inorganic Analysis – A . I . Vogel
3. Spectroscopy S.Walker and Straw Volumes I, II and III
4. Instrumental Methods of Chemical Analysis - Kudesla Snwheny (Pragati Prallesan Meerut) 1988.
5. Instrumental Techniques for Analytical Chemistry-Frank settle (Pearson Eddition )2004.

2015-16

DEPARTMENT OF PHYSICAL AND NUCLEAR CHEMISTRY AND CHEMICAL  
OCEANOGRAPHY  
ANDHRA UNIVERSITY

S.K. Anju Begum

M.Sc. (Final) PHYSICAL CHEMISTRY  
IV SEMESTER

**Paper I: ADVANCED CHEMICAL KINETICS AND PHOTO CHEMISTRY**

**UNIT - I:**

Correlation analysis - Marcus Theory of electron transfer adiabatic and non adiabatic electron transfer - outer and inner sphere mechanism - effect of solvent on rates - effect of dielectric constants on ion - ion, ion - molecule, molecule - molecule reactions - BET isotherm determination of surface area - semiconductor catalysis - Homogeneous catalysis - acid base and redox catalysis.

**UNIT - II:**

Correlation of rate with  $H_0$ ,  $H_R$ , acidity functions and their use in the illustration of mechanism in acid base catalysis - catalysis by transition metal ions and their complexes - Industrially important processes - substitution reactions in Octahedral complexes.

**UNIT - III:**

Photochemistry : Absorption Excitation - photochemical laws - quantum yield of electronically excited states - measurements of life times - Flash photolysis - Stopped flow Techniques: energy dissipation by radiative and non - radiative processes, absorption spectra - Franck - Condon principles. Photochemical stages - Primary processes and secondary processes - Rate constants and life times of reactive excited states.

**UNIT - IV:**

Properties of excited states : structure, dipole moment acid base strengths - reactivity, kinetics of bimolecular processes - quenching, Stern - Volmer equation. Photo-reduction and oxidation. Cyclo addition reactions, Woodward - Hoffmann's rules.

**Suggested Books**

1. Chemical kinetics by Laidler
2. Physical Organic Chemistry by Wiberg
3. Kinetics and mechanism by Frost and Pearson
4. Techniques in Organic Reaction Mechanism by Zuman and Patel.
5. Chemical kinetics - The study of Reaction Rates in solution - Kenneth A. CONNORS - VCH Publishers.
6. Fundamentals of photochemistry - k.k.Rohatgi - Mukherjee
7. Photochemistry - Cox and Kemp
8. Photochemistry - Calvert by Pitts,

ANDHRA UNIVERSITY  
M.Sc. (Final) PHYSICAL CHEMISTRY  
IV SEMESTER

PAPER II: QUANTUM CHEMISTRY-III, NUMERICAL METHODS FOR CHEMISTS AND  
ADVANCED COMPUTER PROGRAMMING

QUANTUM CHEMISTRY:

**UNIT I:**

Approximation methods. Variation method and its application- Ground state of helium atom- ground state energy of one dimensional harmonic oscillator- Perturbation theory- time dependent perturbation- First and second order approximations- Stark effect- Calculation of first and second order perturbation effects on simple systems. Time dependent perturbations- Interaction of matter with radiation; Zeeman effect- Derivation of Fermi's Golden rule.

**UNIT II:**

Born-Oppenheimer approximation- The LCAO approximation- application to  $H_2^+$  ion- MO theory and its application- Correlation diagrams- Hartee-Fock self consistent field method. Chemical bonding in poly atomic molecules- Hybrid orbitals- Huckel theory of linear conjugated systems and cyclic conjugated molecules- Aromaticity- Calculations of delocalization energy of simple conjugated systems.

**UNIT III:**

**NUMERICAL METHODS:**

Precision and Accuracy, Determinate and indeterminate errors, computational errors truncation and rounding off errors, algorithm errors-absolute and relative errors-Error propagation. Measures of Dispersion – range, arithmetic mean, mean deviation variance and standard deviation – moments – skewness and kurtosis.

Interpolation: interpolation for linear fit, linear interpolation in non-linear fit, polynomial interpolation – Lagrange interpolation formula – Application to complex equilibria.

Numerical techniques of solving ordinary first order differential equations:- Euler's method, Predictor-corrector method, Rungae-Kutta method- application to chemical kinetics.

**UNIT IV:**

Fortan programming: Concepts of algorithms and flow-charts, logical variables and logical expressions, order of evaluation of logical expressions, logical assignment statements, logical if and block if statements, computed GO TO statement, writing a decision, chain of decisions, arrays-one dimensional and two dimensional arrays. DO loop and its application in Input and Output statements. Statement Function, Function and Subroutine sub-programs.

Application to Chemical Problems: : Flowcharts and Programs for

1. Calculation of skewness and kurtosis of replicate measurements.
2. Polynomial interpolation using Lagrange interpolation formula
3. Euler's step by step iteration method for solving ordinary first order differential equation.
4. Calculation of first order rate constant of acid catalyzed hydrolysis of an ester, using a subprogram for the calculation of slope by linear least-squares method.

**RECOMMENDED TEXT BOOKS:**

1. Introductory Quantum Chemistry, A.K.Chandra, TATA McGRAW-HILL Publishing company Ltd., New Delhi.
2. Quantum Chemistry, Iran Levine, Pearson Education.
3. Theoretical Chemistry, S.Glastone
4. Computer programming in Fortan-IV by V.Rajaraman, Prentice-Hall of India Pvt. Ltd., New Delhi.

**DEPARTMENT OF PHYSICAL AND NUCLEAR CHEMISTRY AND CHEMICAL  
OCEANOGRAPHY  
ANDHRA UNIVERSITY  
M.Sc. (Final) PHYSICAL CHEMISTRY  
IV SEMESTER**

**Paper- III: ADVANCED THERMODYNAMICS AND SOLUTION EQUILIBRIA OF  
METAL-LIGAND COMPLEXES**

**UNIT - I:**

Thermodynamics and phase changes – Free energy and meaning of phase changes, calculation of phase equilibrium curves, Pressure as a measure of escaping tendency, single components phase diagrams, free energy diagrams and the critical point, first and second order transitions, partial molar quantities and their determination, chemical potential and phase rule. Thermodynamics of chemical reactions, Real gases and fugacity and its determination from PVT data.

**UNIT - II:**

Thermodynamics of living systems: Simultaneous coupled reactions, coupled reactions and metabolism free energy utilization, free energy utilization in metabolism, citric acid cycle, Terminal oxidation, Chain aerobic metabolism. Elementary aspects of non-equilibrium thermodynamics conservation of mass and energy – entropy production and flow in open system – Onsager theory – principles of microscopic reversibility.

**UNIT - III:**

Calvin Wilson Titration Techniques for metal ligand complexes – Determination of Stability constants using formation function, hydroxylated complexes stability constant by Martell method – Leden's procedure. Solution of a non – linear function of two variables – A Algorithm of MINQUAD programme – criteria of best fit model.

**UNIT - IV:**

Prediction of metal ligand stability constants – Irving and William order. Neural networks – Processing element, Transfer function, Training algorithm – BFGS, MAFQUARDT and back propagation. Multi layer perception and radial basis function NN's. Features of Trajan software – Input Output – Intelligent problem solver.

**Suggested Books**

1. M.T.Beck, complex Equilibria, 1991
2. Alcock, Solution Equilibria, 1992
3. Neural Networks systems Techniques and Applications – Ciornelices T. leondes; Vol.1:Algorithms and Architectures.
4. J.Zupan, Neural Network for Chemists, VCH,1992
5. Richard E.Dickerson , molecular Thermodynamics
6. S.Glasstone, Theroretical Chemistry
7. S.Glasstone, Thermodynamics for chemists
8. C.Andrews, Equilibrium Statistical Mechanics
9. Davies, Thermodynamics
10. Yereimin, thermodynamics
11. J.Rajaram, and T.C.Kuriacose, Thermodynamics for students of chemistry.

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DEPARTMENT OF PHYSICAL AND NUCLEAR CHEMISTRY AND CHEMICAL  
OCEANOGRAPHY  
M.Sc. (Final) PHYSICAL CHEMISTRY  
IV SEMESTER

Paper IV: SPECTROSCOPY  
(Common for Physical Chemistry and Marine Chemistry)  
Effective from 2010-11 admitted batch

**UNIT - I:**

Rotational (Microwave) Spectroscopy - The rotational energies of polyatomic molecules - Rotational selection rules for linear molecules - symmetric top - Asymmetric top molecules - degeneracy of rotational energy levels - The Stark effect in molecular rotational spectra - Molecular Rotation - Nuclear spin coupling - Application of Rotation Spectra - Determination of Inter Nuclear distance - Moment of Inertia and Dipole moment.

**UNIT - II:**

Rotation vibration spectra - selection rules and transitions for the rigid rotator - harmonic oscillator model - parallel and perpendicular bands of linear and symmetric top molecules - Raman active fundamental - Criterion for their appearance - Rotational and vibrational Raman; Raman and Infrared studies of  $AB_2$ ,  $AB_3$  type molecules - correlation of infrared and Raman spectra.

**UNIT - III:**

ESR spectroscopy - the resonance condition - anisotropy in g-factor - Theory and applications of ESR method - Crystalline solids - free radicals in solutions - interpretation of ESR spectra of typical radicals and ion like  $Mn^{2+}$ ,  $Cr^{3+}$ ,  $Cu^{2+}$  - Hyperfine interactions in the following systems. P-Benzoquinone - (semi) naphthalene radical anion and anthracene radical anion.

NMR spectroscopy - chemical shifts and shielding - some application of NMR spectra - effect of chemical exchange on spectra - Effect of quadrupole interactions on NMR spectra - an elementary study of isotopes other than proton - Fluorine -19, phosphorous-31, Carbon-13, Boron-11 - NQR spectroscopy - Electric field gradient and quadrupole coupling constant - Splitting in NQR spectra - Applications of NQR spectroscopy

**UNIT - IV:**

Electron Spectroscopy - basic principles of Photo Electron Spectroscopy (PES) - Koopman's theorem and chemical shift. PES of simple molecules. Electron Spectroscopy for Chemical Analysis (ESCA) - Chemical information from ESCA. Principles and applications of Auger Electron Spectroscopy (AES) - comparison between PES, ESCA and AES - X-ray methods - X-ray fluorescence (XRF) - techniques of X-ray absorption and X-ray emission methods and their applications.

**Suggested Books**

1. Spectroscopy S. Walker and straw, volumes I, II and III
2. Molecular Spectroscopy, - Gordon M. barrow
3. Fundamentals of Molecular Spectroscopy - Banwell
4. Spectroscopy - B.K.Sharma - Goe! Publishing House Meerut. 1990.

AC IIIsem - Paper 1 Syllabus.doc

AC IIIsem - Paper 2 Syllabus.doc

AC IIIsem - Paper 3 Syllabus.doc

AC IIIsem - Paper 4 Syllabus.doc

AC IVsem - Paper 1 Syllabus.doc

AC IVsem - Paper 2 Syllabus.doc

AC IVsem - Paper 3 Syllabus.doc

AC IVsem - Paper 4 Syllabus.doc

M.Sc\_Analytical Chemistry Practical\_Syllabus.doc

**Adikavi Nannaya University :: Rajahmundry**  
**Department of Chemistry**  
**M.Sc. (Final) Chemistry Syllabus for III-Semester**  
**Specialization: Analytical Chemistry**  
**Paper - I: Separation Methods – I**  
(Effective from 2016-17 Admitted batch)

**Unit – I Chromatography - 1**

**Chromatography:** classification of different chromatographic methods, methods of development-Elution development, Gradient elution development, displacement development, and frontal analysis.

Principles of chromatography, different migration, adsorption phenomena, partition, adsorption coefficient, retardation factor, retention time and volume, column capacity, temperature effects, partition isotherm.

Dynamics of chromatography-efficiency of chromatographic column, zone spreading, High Equivalent Theoretical Plate (HETP), Van Deemter equation, resolution, choice of column, length and flow velocity, qualitative and quantitative analysis.

**Unit - II Chromatography – 2**

**Column chromatography (adsorption chromatography):** principles, general aspects, adsorption isotherms, chromatographic media, nature of forces between adsorbent and solutes, eluents (mobile phase), column chromatography without detectors and liquid chromatography with detectors and applications.

**Gel Exclusion chromatography or Gel filtration chromatography:** principles, properties of xerogels, apparatus and detectors, resolution of gel type, applications to organic compounds.

**Capillary Electrophoresis :** Principle, Details of the Instrument, Applications to Inorganic and Organic compounds.

**Unit – III Chromatography – 3**

**Gas chromatography:** Theory, Instrument description of equipment and different parts, columns (packed and capillary columns), detector specifications-thermal conductivity detector, flame ionization detector, electron capture detector, nitrogen-phosphorus detector, photo ionization detector, programmed temperature gas chromatography; applications in the analysis of gases, petroleum products etc., other detectors used their Principles and Applications.

**Inorganic molecular sieves:** structure of zeolites, crystals, types of sieves, application in the separation of gases including hydrocarbons, ion exclusion-principles and applications,



Counter current chromatography-principles and application, Affinity chromatography- principles and applications

### ***GC-MS – Introduction***

Instrumentation – GC – MS interface – Mass spectrometer (MS) Instrument operation, processing GC – MS data – ion chromatogram Library searching – Quantitative measurement – sample preparation Selected ion monitoring – Application of GC-MS for Trace constituents. Drugs analysis, Environmental analysis and others.

## **Unit – IV Chromatography – 4**

***Liquid-liquid partition chromatography:*** principle, supports, partitioning liquids, eluents, reverse phase chromatography, apparatus, applications

***High performance liquid chromatography:*** Theory, Instrument description of the different parts of the equipment, columns, detectors-UV detector, refractometric detector, Fluorescence detector, Diode Array detector, applications in the separation of organic compounds, names of other detectors used their Principles and Applications.

***LC-MS*** – Introduction – Instrumentation – liquid chromatograph – Mass spectrometer Interface – Instrumental details – Processing LC-MS data – ion chromatograms – Library searching – Quantitative measurements. Sample preparation – selected ion monitoring. Application of LC-MS for Drug analysis, Environmental samples and others.

### **Text books:**

1. R.P.W Scott, Techniques and practice of Chromatography, Marel Dekker Inc., New York
2. M.N. Sastri ,Separation methods, Himalaya Publishing Company, Mumbai

### **Reference books:**

1. E. Helfman, Chromatography, Van Nostrand, Reinhold, New York
2. E. Lederer and M. Lederer, Chromatography, Elsevier, Amsterdam.
3. Chemical separation methods, John A Dean, Von Nostrand Reinhold, New York
4. R.P.W Scott, Techniques and practice of Chromatography, Marel Dekker Inc., New York
5. H.M Mc Nair and J. M. Miller, Basic Gas Chromatography, John Wiley, New York
6. W. Jeumings, Analytical Gas chromatography, Academic Press, New York
7. H. Eugelhardt (ed), Practice of HPLC, Springer Verrag, Berrin

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**Specialization: Analytical Chemistry**  
**Paper- II: Quality control and Traditional methods of Analysis-I**  
(Effective from 2016-17 Admitted batch)

**Unit – I: Quality control in Analytical Chemistry**

- (a) **Characteristics of an analysis:** quality of an analytical procedure, limit of detection, sensitivity, safety, cost measurability, selectivity and specificity, quality control-principles of Ruggedness test, control charts, Youden plot, and ranking test.
- (b) **Evaluation and reliability of analytical data:** limitation of analytical methods, accuracy, precision, errors in chemical analysis, classification of errors, minimization of errors, significant figures, computations and propagation of errors.
- (c) **Statistical analysis:** Mean deviation, Standard deviation, coefficient of variance, normal distribution, F test, T test, rejection of results, presentation of data.
- (d) **Quality assurance and management systems:** elements of quality assurance, quality assurance in design, development, production and services, quality and quantity management system, **ISO 9000** and **ISO 14000** series-meaning of quality, quality process model, customer requirement of quality calibration and testing, statistical process control, process control tools, control chart, statistical quality control, acceptance sampling.  
Good laboratory practices (GLP) – need for GLP, GLP implementation and organization, GLP status in India.
- (e) Brief out line of ICH guide lines on drug substances and products.

**Unit – II Decomposition techniques in analysis**

**(a) Inorganic Compounds**

Principle of decomposition and Dissolution. Difference between dissolution / decomposition of Organic and Inorganic substances.

Importance of Decomposition Techniques in Analysis.

Principle of Dissolution of an inorganic substance.

Decomposition of samples with acids – H<sub>2</sub>O, HCl, HF, HNO<sub>3</sub>, H<sub>2</sub>SO<sub>4</sub> and HClO<sub>4</sub>

Decomposition of samples by fusion, Principle and with two examples each

Alkali Fusion--- Na<sub>2</sub>CO<sub>3</sub>, NaOH,

Acidic Fusion--- Sodium Hydro Sulphate, Sodium Pyro Sulphate

Oxidation Fusion---Na<sub>2</sub>O<sub>2</sub>, Sodium Chlorate

Reductive Fusion Na<sub>2</sub>CO<sub>3</sub> + Na<sub>4</sub>BO<sub>4</sub>

What is Sintering process, How is it different from Fusion.

Fusion with alkali carbonates, alkali hydroxides, Sodium Peroxide

Decomposition of samples by sintering with sodium peroxide, sodium carbonate.

Principles of decomposition at high temperatures, high pressures .

Principles of Microwave and ultrasonic decomposition techniques.

### **(b) Organic Compounds**

Principles of solubility of organic compounds, non polar, polar solvents.  
Recrystallisation methods and application of solubility and Recrystallisation.

### **Unit – III Oxidant systems – Principles and applications in analysis**

Analytical chemistry of some selected oxidant systems – formal, standard and normal potentials in various media, species responsible for the oxidation properties, stability of the solutions, standardization, requirement for the selections of the oxidants, selection of suitable indicators for Oxidant systems.

- a) Inorganic Systems Mn (III), Mn (VII), Ce (IV), Cr (VI), V (V), periodate, iodate,
- b) Organic Systems chloramine-T.

### **Unit – IV Organic Functional group analysis**

Classification of functional groups with suitable examples.

Determination of:

- 1) Functional groups imparting acidic nature – thiol, enediol, phenolic hydroxyl.
- 2) Functional groups imparting basic nature – Aliphatic and Aromatic primary, secondary and tertiary amines – hydrazine derivatives.
- 3) Functional groups which impart neither acidic nor basic nature – Aldehydes, Ketones, Nitro, Methoxy, Olifinic.

### **Text books:**

1. Technical methods of analysis – Griffin, Mc Graw Hill Book Co.
2. Chemical Separation and measurements – D.G Peterseti, John M.Haves Sanders Co.
3. Chemical analysis – H.A Laitinan, Mc Graw Hill Book Co.
4. Newer redox titrants – Berka, Zyka and Vulterin, Pergamon Press
5. Volumetric Analysis, Vol III – I.M Kolthoff and R. Belcher, Interscience Public, New York
6. Vogel's Text Book of Inorganic Quantitative Analysis – J. Bassett et al, ELBS
7. Organic functional groups – S. Siggia

### **Reference Books:**

1. D.A Skoog, D.M West and F.J Holler, Analytical Chemistry, An Introduction, Sanders College Publishing, New York
2. K.V.S.G Murali Krishna, An Introduction ISO 9000, ISO 1400 Series, Environmental Management
3. Quality Assurance and Good Laboratory Practices, Prof. Y. Anjaneyulu, In Now Publication, New York
4. Quality Assurance in Analytical Chemistry – G.Kateman and F.W Pijpers, John Wiley and Sons, New York
5. Quantitative Chemical Analysis – I.M Kolthoff, E.B Sandel, E.J Meehan, S. Bruckenstein, Macmillan Company, London
6. Decomposition Techniques in Inorganic Analysis – J.Dolezal, P.Povondra, Z.Sulcek

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**Paper – III: Applied Analysis-I**  
(Effective from 2016-17 Admitted batch)

**Unit – I Analysis of Ores**

- (a) General techniques of analysis applied to complex materials - Scope of metallurgical analysis -  
General methods of dissolution of complex materials - Various chemical methods for the effective separation of the constituents in the complex materials.
- (b) Analysis of ores: Iron ore- Analysis of the Constituents – Moisture , loss of ignition, Total Iron, ferrous Iron ,Ferric Iron, alumina , silica, Titania, Lime, Magnesia, Sulphur, phosphorous, manganese, alkalies, combined water, Carbon in blast furnace, flue dust and sinter.
- (c) Manganese Ore - Analysis of the Constituents – Total Manganese,  $MnO_2$ ,  $SiO_2$ ,  $BaO$ ,  $Fe_2O_3$ ,  $Al_2O_3$ ,  $CaO$ , P and S
- (d) Chromite Ore - Analysis of the Constituents – Chromium,  $SiO_2$ ,  $FeO$ ,  $Al_2O_3$   $CaO$ , &  $MgO$ .
- (e) Phosphate rock Ore - Analysis of the Constituents -  $CaO$ ,  $P_2O_5$ , F,  $SiO_2$ ,  $CO_2$ , S,  $Na_2O$ ,  $Al_2O_3$ ,  $Fe_2O_3$ ,  $MgO$ ,  $K_2O$ ,  $Cl$ ,  $MnO$ . Organic carbon, Moisture, Loss of ignition.
- (f) Aluminium Ore (Bauxite) - Analysis of the Constituents – Silica, Alumina,  $Fe_2O_3$ , Titania,  $MnO$ ,  $P_2O_5$ ,  $CaO$ ,  $MgO$ , vanadium, zirconium, and alkalies.

**Unit – II Analysis of Finished Products – I**

- (a) Analysis of steel for C, Si ,S, P, Mn, Ni, Cr; Mg and analysis of blast furnace slag .
- (b) Analysis of refractory materials: fire clay, flour spar, and magnesite
- (c) Analysis of fluxes - limestone and dolomite.

**Unit – III Analysis of Finished Products – II**

- (a) Chemical Analysis of cement-silica,  $NH_4OH$  group, ferric oxide, alumina, lime, magnesia, Sulphide Sulphur ,  $K_2O$ ,  $Na_2O$ , free  $CaO$  in Cement and Clinker,  $SO_3$  and loss on ignition.
- (b) Analysis of oils - saponification number, iodine number, and acid number..
- (c) Analysis of soaps - moisture, volatile matter, total alkali, total fatty matter, free caustic alkali or free fatty acids, sodium silicate , chloride.
- (d) Analysis of paints-vehicle and pigment,  $BaSO_4$ , total lead and lead chromate

## Unit – IV Assessment of water Quality

Sources of water, classification of water for different uses, types of water pollutants and their effects,

Analytical methods for the determination of the following ions in water:

Anions:  $\text{CO}_3^{2-}$ ,  $\text{HCO}_3^-$ ,  $\text{F}^-$ ,  $\text{Cl}^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{PO}_4^{3-}$ ,  $\text{NO}_3^-$ ,  $\text{NO}_2^-$ ,  $\text{CN}^-$ ,  $\text{S}^{2-}$

Cations:  $\text{Fe}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{Cr}^{3+}$ ,  $\text{As}^{5+}$ ,  $\text{Pb}^{2+}$ ,  $\text{Hg}^{2+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Cd}^{2+}$ ,  $\text{Co}^{2+}$

Determination of Dissolved oxygen (D.O), Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD), standards for drinking water.

### Text books

1. Handbook of Analytical Control of Iron and Steel Production, Harrison John, Wiley 1979
2. Standard methods of Chemical Analysis, Welcher
3. Technical Methods of Analysis, Griffin, Mc Graw Hill
4. Commercial Methods of Analysis, Foster Dee Sneel and Frank M. Griffin, Mc Graw Hill Book Co.
5. Water Pollution, Lalude, Mc Graw Hill
6. Environmental Chemistry, Anil Kumar De, Wiley Eastern Ltd.
7. Environmental Analysis, S.M. Khopkar (IIT Bombay)

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**Paper – IV: INSTRUMENTAL METHODS OF ANALYSIS - I**

(Effective from 2016-17 Admitted batch)

**Unit – I : Spectroscopic Methods - 1**

- (a) **UV-Visible Spectroscopy:** laws of absorption, deviation from Beer's law, single and double beam spectrophotometers-instrumentation, sources of radiation, detectors, qualitative analysis by absorption measurements, general precautions in colorimetric determinations, determination of certain metal ions by using ligands –  $\text{Fe}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Al}^{3+}$ ,  $\text{NH}_4^+$ ,  $\text{Cr}^{3+}$ ,  $\text{Cr}^{6+}$ ,  $\text{Co}^{3+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Ni}^{2+}$  and anions –  $\text{NO}_2^-$ ,  $\text{PO}_4^{3-}$  using suitable reagents, simultaneous determinations of dichromate and permanganate in a mixture, spectrophotometric titrations, principle of diode array spectrophotometers.
- (b) **Spectrofluorimetry:** Theory of fluorescence, phosphorescence, factors affecting the above, quenching, relation between intensity of fluorescence and concentration, instrumentation, application with reference to  $\text{Al}^{3+}$ , chromium salts, fluorescence, thiamin (B1) and riboflavin (B2) in drug samples.

**Unit – II : Spectroscopic Methods - 2**

- (a) **Infrared spectroscopy:** units of frequency, wavelength and wave number molecular vibrations, factors influencing vibrational frequencies, instrumentation, sampling techniques, detectors, characteristic frequencies of organic molecules, qualitative and quantitative analysis with reference to (petroleum refinery and polymer industry), selected molecules like CO, CO<sub>2</sub>, non-destructive IR method for the analysis of CO and other organic compounds, principles of Fourier transform IR.
- (b) **Raman Spectroscopy:** Raman effect and spectra, differences between Raman spectra and IR spectra, instrumentation, Raman spectra of CO, CO<sub>2</sub>, N<sub>2</sub>O, H<sub>2</sub>O.

**Unit – III : Spectroscopic Methods -3**

- (a) **NMR Spectroscopy:** resonance condition, origin of NMR spectra, instrumentation, chemical shift, factors affecting chemical shift, shielding, spin-spin splitting, mechanism for spin-spin coupling, interpretation of NMR spectra of typical organic compounds, factors influencing NMR spectra, fast chemical reactions, magnitude of I, nuclei with quadrupole moments, FT NMR, study of isotopes other than proton-<sup>13</sup>C, <sup>15</sup>N, <sup>19</sup>F, <sup>31</sup>P, <sup>11</sup>B, double resonance, spin tickling, shift reagents, applications.

(b) *ESR Spectroscopy*: principle, g value, hyper fine splitting, qualitative analysis, Krammers degeneracy, fine splitting, instrumentation, introduction to double resonance technique, difference between ESR and NMR spectra, quantitative analysis, application to study of free radicals and other analytical applications.

#### **Unit – IV : Spectroscopic Methods -4**

(a) *Mass Spectroscopy*: Principle, basic instrumentation, energetics of ion formation, types of peaks observed, resolution, qualitative analysis, molecular weight determination, quantitative analysis, advantages

(b) *X-ray Spectroscopy (XRF)*: chemical analysis by X-ray spectrometers, energy dispersive and wavelength dispersive techniques, evaluation methods, instrumentation, matrix effects, applications.

#### **Text Books:**

1. Instrumental methods of analysis – H.H Willard, Meritt Jr. and J.A Dean
2. Principles of instrumental analysis – Skoog and West
3. Vogels Textbook of Quantitative Inorganic analysis – J. Basset, R.C Denney, G.H Jefferey and J.Madhan
4. Instrumental methods of analysis – B.K Sarma, Goel Publishing House, Meerut
5. Instrumental methods of Analysis – Chatwal and Anand
6. Instrumental methods of Analysis – Ewing
7. Handbook of ICP
8. The ICP – Bogdain B.

#### **Reference Books:**

1. Applications of ICP-MS, A.R Date and A.L Glay, London (Eds), Blackie, London
2. A. Moutaser and D.W Golightly (Eds), ICP in Analytical Atomic Spectrometry, VeH Publishers, New York
3. G.I Moore, Introduction to ICP emission Spectrometry in Analytical Spectroscopy, Elsevier, Amsterdam

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**Paper-1: Separation Methods – II**  
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**Unit – I Chromatography - 5**

- (a) **Paper chromatography:** principle, papers as a chromatographic medium, modified papers, solvent systems, mechanism of paper chromatography, experimental technique, different development methods-ascending, descending, horizontal, circular spreading, multiple development, two dimensional development, reverse phase paper chromatographic technique-visualization and evaluation of chromatograms, applications.
- (b) **Thin layer chromatography:** principle, chromatographic media-coating materials, applications, activation of adsorbent, sample development, solvent systems, development of chromatoplate, types of development, visualization methods, documentation, applications in the separation, HPTLC-principle, technique, applications.

**Unit – II Chromatography - 6**

- (a) **Ion Exchange:** principles of ion-exchange systems, synthetic ion-exchange resins, properties of anion and cation exchange resins, ion-exchange mechanism, ion-exchange equilibria, selectivity, ion-exchange capacity, applications of ion-exchangers in different fields.
- (b) **Ion exchange chromatography:** Principle, Equipment, Application Specifically Separations of Lanthanides, Actinides, amino acids.
- (c) **Ion chromatography:** principles of separation, instrumentation, detectors, separation of cations and anions, applications in the analysis of water and air pollutants.

**Unit – III Sampling of Solids, Liquids and Gases**

**Sampling:** Basis of sampling, purpose of sampling, homogeneous and heterogeneous samples, statistical criteria for good sampling, sample size, sampling unit, gross sample, laboratory sample.

Sampling of Solids: Cone and Quartering method, Long pile and alternative shovel method, precautions in preservation of solid samples, sampling of metals and other solids rods, wires, sheets, plates, especially Gold, Silver, Iron and other metals.

Sampling of different types of liquids: different sampling techniques, sampling of drinking water, industrial effluents, precautions in sampling and preservation of collected liquid samples.



Sampling of gases: sampling and Preconcentration by adsorption or absorption method, instantaneous monitoring, sampling in samplers and subsequent monitoring, different types of gas samplers, precautions in preservation of samples, systematic sampling and random sampling.

#### **Unit – IV Importance of Analytical chemistry & Solvent Extraction**

**(a) Importance of Analytical Chemistry to Industrial Research:** Importance of Qualitative and Quantitative analysis in research and development, industries and other branches of science.

Development and validation of an analytical method, units, concentrations, calculations, standards, chemical reactions, expressions of concentrations, importance of separation methods with examples.

**(b) Solvent Extraction:** principles and processes of solvent extraction, Distribution Law and Partition coefficient, nature of partition forces, different types of solvent extraction systems – Batch extraction, Continuous extraction, Counter current extraction, solvent extraction systems, applications in metallurgy, general applications in analysis and pre-concentration, special extraction systems like crown ethers, super fluid and surfactant extractions-examples.

#### **Text books:**

1. R.P.W Scott, Techniques and practice of Chromatography, Marel Dekker Inc., New York
2. Separation methods, M.N Sastri, Himalaya Publishing Company, Mumbai

#### **Reference books:**

1. E. Helfman, Chromatography, Van Nostrand, Reinhold, New York
2. E. Lederer and M. Lederer, Chromatography, Elsevier, Amsterdam.
3. Chemical separation methods, John A Dean, Von Nostrand Reinhold, New York
4. R.P.W Scott, Techniques and practice of Chromatography, Marel Dekker Inc., New York
5. E.Stahl, Thin layer chromatography, Academic Press, New York
6. James, G.Tartor (Ion chromatography)

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**Paper – II : Traditional Methods of Analysis - II**  
(Effective from 2016-17 Admitted batch)

**Unit – I Precipitation methods - 1**

- (a) Crystal habit and super saturation, nucleation and crystal growth, homogeneous and heterogeneous nucleation, solubility and particle size, colloids, completeness of precipitation, effect of excess precipitant, pH, complex formation, temperature, purity of precipitates, aging.
- (b) **Co-precipitation and post precipitation** : theory of adsorption of salts having an ion in common with the main precipitate, co-precipitation in colloidal precipitates, adsorption of solvents, mixed crystal formation by occlusion and entrapment, re-precipitation with examples, Post-precipitation – theory of post-precipitation, examples of post-precipitation, conditions for obtaining pure and quantitative precipitates.
- (c) **Precipitation Titrations**: Principle, Indicators for precipitation titrations, determination of halides.

**Unit – II Precipitation methods - 2**

- (a) **Precipitation from Homogeneous Solution (PFHS)**: theory of PFHS, methods of PFHS – increase in pH, decrease in pH, cation release, anion release, reagent synthesis, change in oxidation state, photochemical reactions, precipitation from mixed solvents. Applications of PFHS methods.
- (b) **Gravimetric determinations**: nature of species, preparation of solutions, limitations, interferences, inorganic precipitants-chloride and sulphate, organic precipitants dimethyl glyoxime (DMG), oxine, benzidine, salicylaldehyde, benzoin oxime, sodium tetraphenyl boron, tetraphenyl arsonium chloride.
- (a) **Electro-gravimetric analysis**: principle, important terms in electrogravimetry, decomposition voltage or decomposition potential, over voltage and their importance, instrumentation, electrolysis at constant current, determination of  $\text{Cu}^{2+}$  by constant current electrolysis, electrolysis at controlled potentials, determination of Cu, Pb, Sn in brass and bronze by controlled potential electrolysis.

**Unit – III Reductant system – Principles and applications in analysis**

Analytical chemistry of some selected reductant systems – formal, standard and normal potentials in various media, stability of the solutions, species responsible for

the reduction properties, standardization, requirement for the selection of the reductants, selection of suitable indicators for various reductant systems,

- (a) Inorganic Systems – Cr (II), V (II), Ti (III), Sn (II), Fe (II) in  $H_3PO_4$  and hydrazine,
- (b) Organic Systems – hydroquinone and Ascorbic acid.

#### **Unit – IV Analysis of some selected Drugs:**

Basic considerations of drugs – Classification

Determination of the following Drugs:

- 1) Acetyl salicylic acid ( Antipyretic – Analgesic )
- 2) Testosterone, progesterone and cortisone (Steroids and corticoids)
- 3) Sulphadiazine ( sulphadruugs)
- 4) Phenobarbitone (Barbituric acid derivatives)
- 5) Chloramphenicol, Benzyl penicillin and Tetracycline (Antibiotics)
- 6) Thiamine (B1), Riboflavin (B2) and ascorbic acid (c) [Vitamins]
- 7) Isoniazid ( Antimicrobial agents)
- 8) Methyldopa (Antihypertensive agents)
- 9) Metronidazole (Antiamoebic agents).

#### **Text books:**

- 1. Technical methods of analysis – Griffin, Mc Graw Hill Book Co.
- 2. Chemical Separation and measurements – D.G Peterseti, John M.Haves Sanders Co.
- 3. Chemical analysis – H.A Laitinan, Mc Graw Hill Book Co.
- 4. Newer redox titrants – Berka, Zyka and Vulterin, Pergamon Press
- 5. Volumetric Analysis, Vol III – I.M Kolthoff and R.Belvher, Interscience Public, New York
- 6. Vogel's Text Book of norganic Quantitative Analysis – J.Bassett et al, ELBS
- 7. Pharmaceutical analysis – T. Higuchi, Brochmann hausfen

#### **Reference Books:**

- 1. D.A Skoog, D.M West and F.J Holler, Analytical Chemistry, An Introduction, Sanders College Publishing, New York
- 2. Quantitative Chemical Analysis – I.M Kolthoff, E.B Sandel, E.J Meehan, S. Bruckenstein, Macmillan Company, London

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**Paper – III: Applied Analysis – II**  
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**Unit – I Analysis of raw materials**

- (a) Analysis of non-ferrous alloys:
- (i) Brass – Analysis of the constituents – Cu, Zn, Sn, Pb and Fe.
  - (ii) Bronze - Analysis of the constituents – Cu, Sn, Zn, Pb and Fe.
  - (iii) Solder - Analysis of the constituents – Sn, Pb and Sb.
- (b) Analysis of Ferro alloys :
- (i) Ferro silicon - Analysis of the constituents – Si, C, P, S
  - (ii) Ferro vanadium - Analysis of the constituents – V, C, P, S, Si, Al.
  - (iii) Ferro manganese - Analysis of the constituents – Mn, S, C, P, Si
  - (iv) Silico manganese - Analysis of the constituents – Mn, S, C, P, Si
  - (v) Ferro chromium - Analysis of the constituents – Cr, C, Si.

**Unit – II Analysis of Soil, Fertilizer and Fuel**

- (a) Analysis of soils: sampling, determination of moisture, total N, P, Si, lime, humus nitrogen, alkali salts, soil absorption ratio.
- (b) Analysis of fertilizers: ammonical fertilizers, Phosphate fertilizers, Nitrate fertilizers.
- (c) Analysis of fuels: solid fuels-coal, proximate analysis, ultimate analysis, heating value, grading of coal based on Ultimate Heat Value(UHV).

**Unit – III Assessment of Air Quality**

Composition of pure air, classification of air pollutants, toxic elements present in dust and their sources – collection of air samples.

Sources, effects, control of pollution and chemical analysis for the following.

- (a) Primary pollutants:
- (i) Carbon compounds - Carbon monoxide(CO) and Carbon dioxide(CO<sub>2</sub>).
  - (ii) Sulphur compounds- sulphur dioxide (SO<sub>2</sub>), Sulphur trioxide (SO<sub>3</sub>) and Hydrogen Sulphide (H<sub>2</sub>S).
  - (iii) Nitrogen compounds - nitric oxide (NO), and nitrogen dioxide (NO<sub>2</sub>),
  - (iv) Hydrocarbons - Aliphatic hydrocarbons and polycyclic aromatic hydrocarbons (PAH).
  - (v) Particulate matter - Respirable and Suspended particulate matter, Inorganic and Organic particulates.

- (b) Secondary pollutants - ozone ( $O_3$ ), peroxy acetyl nitrate (PAN), peroxy benzyl nitrate (PBN)
- (c) Standards for ambient air quality.

#### **Unit- IV Kinetic Methods of Analysis & Non aqueous Titrimetry**

- (a) Kinetic methods of analysis: introduction, slow reactions, catalyzed reactions, methods of determination of catalyst concentration, extrapolation method for the determination of catalyst, variable time method, fixed time method, examples for the determination of toxic metals and anions using some typical kinetic reactions.
- (b) Non aqueous titrimetry : Classification of solvents and titrations for non aqueous titrimetry- Types of reactions - Indicators .
- (i) Determination of acids
  - (ii) Determination of bases
  - (iii) Karl-Fisher reagent for the determination of moisture content in drugs and other samples.

#### **Text books**

1. Chemical analysis – H.A Laitinan, Mc Graw Hill Book Co
2. Standard methods of Chemical Analysis, Welcher
2. Technical Methods of Analysis, Griffin, Mc Graw Hill
3. Commercial Methods of Analysis, Foster Dee Sneel and Frank M. Griffin, Mc Graw Hill Book Co.
4. Environmental Chemistry, Anil Kumar De, Wiley Eastern Ltd.
5. Environmental Analysis, S.M Khopkar (IIT Bombay)
6. Environmental Air Analysis, Trivedi and Kudesia, Akashdeep Pub.

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**Paper - IV: Instrumental Methods of Analysis -II**  
(Effective from 2016-17 Admitted batch)

**Unit – I: Spectro-analytical Methods of Analysis**

(a) *Flame photometry*: theory, instrumentation, combustion flames, detectors, and analysis of Na, K, Ca, Mg

(b) *Atomic Absorption Spectrometer*: theory, instrumentation, flame and non-flame techniques, resonance line sources, hollow cathode lamp, instrumentation, chemical and spectral interferences, applications with special reference to analysis of trace metals in oils, alloys and toxic metals in drinking water and effluents

(c) *Inductively coupled plasma spectrometer (ICP-AES, ICP-MS)*: principles, instrumentation, plasma, AES detectors, quadrupole mass spectrometers, difference between the two detectors, analysis methods for liquids and solids, applications in the analysis of trace and toxic metals in water, geological and industrial samples.

(d) *Arc and Spark spectrographic Direct analysis of solid for metals.*

**Unit – II Thermal methods of Analysis**

(a) Thermo gravimetry-theory, instrumentation, applications with special reference to  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ ,  $\text{CaC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ ,  $\text{CaCO}_3$ ,  $(\text{COOH})_2 \cdot 2\text{H}_2\text{O}$

(b) Differential thermal analysis-principle, instrumentation, difference between TG and DTA - applications with special reference to the clays and minerals, coals (fuels)

(c) Differential scanning calorimetry-principle, instrumentation, applications to inorganic materials like chlorates and per chlorates, ammonium nitrate, organic compounds and Drugs.

**Unit- III : Electro analytical Methods of Analysis - 1**

(a) *Voltametry and polarographic analysis* : principle of polarography, residual current, migration current, diffusion current, half-wave potential, Ilkovic equation, instrumentation, Dropping mercury electrode (DME), advantages and disadvantages of DME, qualitative and quantitative analysis of inorganic ions-Cu, Bi, Pb, Cd, Zn, AC polarography, pulse polarography

(b) *Anode stripping voltametry*: principle, instrumentation, Hanging mercury drop electrode, application in the analysis of Pb and Cd in environmental samples, principle of cathode stripping voltametry.

- (c) **Coulometric analysis:** principles of coulometric analysis with constant current, coulometric analysis with controlled potential, applications of coulometric methods for the analysis of cations-As (III), Fe (II) and I<sup>-</sup> and S<sup>2-</sup> by using I<sub>2</sub> liberations and Ce<sup>4+</sup> liberation in solutions

#### **Unit – IV Electro Analytical and Radio chemical methods of analysis - 2**

- (a) **Ion Selective Electrodes:** reference electrodes - hydrogen electrode, calomel electrode, silver chloride electrode; indicator electrodes – hydrogen and glass electrodes, theory of membrane potentials and liquid junction potentials, types of ion selective electrodes, basic properties, potentials and construction, calibration of ion selective electrodes, ion selective electrodes with fixed membrane sites, silver, lead, cadmium, sulfide, fluoride, cyanide and glass electrodes, applications in the analysis of air and water pollutants, principles of liquid membrane, gas sensing and enzyme based electrode
- (b) **Radio chemical methods of analysis:** detection and measurement of radioactivity, introduction to radioactive tracers, applications of tracer technique, isotope dilution analysis - applications, activation analysis – application, advantages and disadvantages, radio carbon dating technique

#### **Text Books:**

1. Instrumental methods of analysis – H.H Willard, Meritt Jr. and J.A Dean
2. Principles of instrumental analysis – Skoog and West
1. Vogels Textbook of Quantitative Inorganic analysis – J. Basset, R.C Denney, G.H Jefferey and J.Madhan
2. Instrumental methods of analysis – B.K Sarma, Goel Publishing House, Meerut
3. Instrumental methods of Analysis – Chatwal and Anand
4. Instrumental methods of Analysis – Ewing

#### **Reference Books:**

W.Wendtlandt, Thermal Analysis, John Wiley Sons, New York

**Adikavi Nannaya University :: Rajahmundry**  
**Department of Chemistry**  
**M.Sc. (Final) Chemistry Syllabus for III-Semester**  
**Specialization: *Analytical Chemistry***  
**ANALYTICAL CHEMISTRY PRACTICAL – I**  
(With effect from 2016-2017 admitted batch)

**Classical Methods of Analysis-1**

1. Water analysis
  - (i) Determination of total hardness ( $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$ ) of water samples
  - (ii) Determination of chloride ( $\text{Cl}^-$ ) present in water samples
  - (iii) Determination of dissolved oxygen (DO) of drinking water and sewage water
  
2. Complexometric titrations
  - (i) Determination of the concentration of calcium in milk powder by complexometric titration (EDTA)
  - (ii) Determination of Calcium and Magnesium in limestone or dolomite samples using EDTA.
  
3. Fertilizer analysis
  - (i) Determination of ammonia from ammonia containing fertilizer
  - (ii) Determination of phosphate from fertilizer
  
4. Analysis of iron ore
  - (i) Complete analysis of iron ore
  - (ii) Determination of percentages of Fe (II) and Fe (III) present in iron ore sample
  
5. Analysis of Coal
  - (i) Determination of moisture content of coal sample
  - (ii) Determination of volatile matter of coal sample
  - (iii) Determination of fixed carbon of coal sample
  - (iv) Determination of ash content of coal sample



## **Instrumental Methods of Analysis-1**

1. pH metry
  - (i) Determination of alkalinity of a coloured effluent using pH metric titration.
  - (ii) Determination of purity of commercial HCl using pH metric titration.
  - (iii) Determination of purity of commercial H<sub>2</sub>SO<sub>4</sub> using pH metric titration.
  
2. Potentiometry
  - (i) Determination of Cr(VI) with Fe(II) using potentiometric end point
  - (ii) Determination of Fe (II) using ceric sulphate by potentiometric end point
  - (iii) Determination of a mixture of Ce(IV) and V(V) with Fe(II) by potentiometric end point
  - (iv) Determination of KSCN with AgNO<sub>3</sub> by potentiometric end point.
  
3. Spectrophotometry
  - (i) Determination of Fe (III) using potassium thiocyanate
  - (ii) Determination of Iron(II) using orthophenanthroline
  - (iii) Determination of phosphate in fertilizer and cola drinks by Molybdenum blue method
  - (iv) Determination of Manganese (II) -periodate method
  
4. Flame photometry
  - (i) Determination of sodium present in bread samples
  - (ii) Determination of sodium and potassium in a given sample of fertilizer
  
5. Thin layer chromatography: Determination of R<sub>f</sub> values and identification of organic compounds in a given mixture by TLC
  - (i) Separation of mixture of benzil and 2-nitrophenol
  - (ii) Mixture of benzophenone and naphthalene
  - (iii) Mixture of 2-nitrophenol and 4-nitrophenol

### References:

1. A Text Book of Quantitative Inorganic Analysis (3<sup>rd</sup> Edition) – A. I. Vogel

**Adikavi Nannaya University :: Rajahmundry**  
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**Specialization: *Analytical Chemistry***  
**ANALYTICAL CHEMISTRY PRACTICAL – II**

(With effect from 2016-2017 admitted batch)

**Classical Methods of Analysis-2**

1. Water analysis
  - (i) Determination of alkalinity ( $\text{CO}_3^{2-}$ ,  $\text{HCO}_3^-$ ) of water samples.
  - (ii) Determination of chemical oxygen demand (COD) of drinking water and sewage water
  - (iii) Determination of biological oxygen demand (BOD) of drinking water and sewage water
  
2. Redox titrations
  - (i) Determination of oxalate in kidney stones by permanganometric titration.
  - (ii) Determination of Fe(II) present in an Iron tablet using  $\text{KMnO}_4$
  
3. Fertilizer analysis
  - (i) Determination of nitrate from fertilizer
  - (ii) Determination of sulfur (as sulfate) from sulfur containing fertilizer.
  
4. Analysis of oils and soaps
  - (i) Determination of saponification value, acid value and iodine value of oil sample
  - (ii) Determination of moisture content and total alkali of soaps
  
5. Separation and determination of ions by ion-exchanger resins
  - (i) Determination of  $\text{Na}^+$  by cation exchanger resin
  - (ii) Determination of  $\text{Na}^+$  and  $\text{K}^+$  in a mixture by cation exchanger resin
  - (iii) Determination of  $\text{Cl}^-$  and  $\text{Br}^-$  in a mixture by anion exchanger resin

## Instrumental Methods of Analysis-2

### 1. pH metry

- (i) Determination of purity of commercial  $\text{H}_3\text{PO}_4$  by pH metric titration
- (ii) Determination of  $\text{CH}_3\text{COOH}$  by pH metric titration.
- (iii) Determination of stability constant of copper glycinate

### 2. Potentiometry

- (i) Determination of Fe(II) using Mn(VII) of by potentiometric titration
- (ii) Determination of Fe (II) using V(V) of by potentiometric titration
- (iii) Determination of a mixture of Mn(VII) and V(V) with Fe(II) using potentiometric end point
- (iv) Determination of a mixture of bromide and chloride with  $\text{AgNO}_3$  using potentiometric end point

### 3. Spectrophotometry

- (i) Determination of nitrite in drinking water samples by diazotization method
- (ii) Determination of nitrate -phenoldisulphonic acid method
- (iii) Simultaneous Determination of Cr(VI) and Mn(VII) in a mixture without separation
- (iv) Determination of Cu(II) using EDTA – Photometric titration method.

### 4. Flame photometry

- (i) Determination of Lithium by flame photometry
- (ii) Determination of calcium from milk samples using flame photometry

### 5. Thin layer chromatography

- (i) Separation and identification of the given mixture of colourless compounds (Diphenylamine, Benzophenone and Naphthalene)
- (ii) Separation and identification of the given mixture of coloured compounds (azobenzene, hydroxyazobenzene, p-aminoazobenzene).

### References:

1. A Text Book of Quantitative Inorganic Analysis (3<sup>rd</sup> Edition) – A. I. Vogel



ADIKAVI NANNAYA UNIVERSITY  
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## General Chemistry - I

### UNIT-1

**Basic Quantum Chemistry-I-** Wave equation-interpretation of wave function-properties of wave function-normalization and orthogonalisation, Operators- linear and non-linear- commutators of operators. Postulates of quantum mechanics; setting up of operators to observables; Hermitian operator- Eigen values and Eigen functions of Hermitian operator; Expansion theorems. Eigen functions of commuting operators-significance. Simultaneous measurement of properties and the uncertainty principle.

### UNIT-II

**Basic Quantum Chemistry-II-** Wave mechanics of simple systems with constant potential energy, particle in one-dimensional box- factors influencing color transition- dipole integral, Symmetry arguments in deriving the selection rules, the concept of tunneling- particle in three -dimensional box. Calculations using wave functions of the particle in a box- Orthogonality, measurability of energy, position and momentum, average values and probabilities. Rigid rotor, Wave mechanics of systems with variable potential energy-simple harmonic oscillator- solution of wave equation- selection rules.

### UNIT-III

**Fundamentals of Molecular Spectroscopy-I:** Microwave and IR- Spectroscopy- Rotational spectra of diatomic molecules- Rigid rotor-Selection rules- Calculations of bond length- Isotopic effect, Second order stark effect and its applications. Infrared spectra of diatomic molecules- harmonic and anharmonic oscillators- Selection rules- Overtones- Combination bands- Calculation of force constant, anharmonicity constant and zero point energy. Fermi resonance, simultaneous vibrational-rotational spectra of diatomic molecules.

### UNIT- IV

**Fundamentals of Molecular Spectroscopy-II:** Raman and Electronic Spectra- Classical and quantum mechanical explanations- Rotational Raman and Vibrational Raman spectra. Electronic spectra of diatomic molecules- Vibrational Coarse structure- intensities of spectral lines- Franck-Condon principle- applications, Rotational Fine structure- band head and band shading. Charge transfer spectra

### References/ Text books

1. Fundamentals of Molecular spectroscopy: by C.N. Banwell
2. Molecular spectroscopy: by B.K.Sharma
3. Molecular spectroscopy: by Aruldas
4. Introductory quantum mechanics: by A.K. Chandra
5. Quantum chemistry: by R.K. Prasad



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Paper- II: INORGANIC CHEMISTRY-I

UNIT-1

**Structure & Bonding:** Applications of VSEPR, Valence Bond and Molecular orbital theories in explaining the structures of simple molecules- role of p and d orbitals in pi bonding. Application of MO theory to square planar ( $\text{PtCl}_4^{2-}$ ) and Octahedral complexes ( $\text{CoF}_6^{3-}$ ,  $\text{Co}(\text{NH}_3)_6^{3+}$ ). Walsh diagram for  $\text{H}_2\text{O}$  molecule.

UNIT-II

**Inorganic cage and ring compounds** – preparation, structure and reactions of boranes, carboranes, metallocarboranes, boron–nitrogen ( $\text{H}_3\text{B}_3\text{N}_3\text{H}_3$ ), phosphorus–nitrogen ( $\text{N}_3\text{P}_3\text{Cl}_6$ ) and sulphur-nitrogen ( $\text{S}_4\text{N}_4$ ,  $(\text{SN})_x$ ) cyclic compounds. Electron counting in boranes – Wades rules (Polyhedral skeletal electron pair theory). Isopoly and heteropoly acids.

UNIT-III

**Coordination compounds:** Crystal field theory - crystal field splitting patterns in octahedral, tetrahedral, tetragonal, square planar, square pyramidal and trigonal bipyramidal geometries. Calculation of crystal field stabilization energies. Factors affecting crystal field splitting energies – Spectrochemical series – Jahn – Teller effect, nephelauxetic effect – ligand field theory. Term symbols – Russell – Sanders coupling – derivation of term symbols for various configurations. Spectroscopic ground states.

UNIT- IV

**Electronic spectra of transition metal complexes:** Selection rules, break down of selection rules – Orgel and Tanabe-Sugano diagrams for  $d^1$  –  $d^9$  octahedral and tetrahedral transition metal complexes of 3d series – Calculation of  $Dq$ ,  $B$  and  $\beta$  parameters. Charge transfer spectra. Magnetic properties of transition and inner transition metal complexes – spin and orbital moments – quenching of orbital momentum by crystal fields in complexes.

**Text books:**

1. Advanced Inorganic Chemistry by F.A. Cotton and G. Wilkinson, IV Edition, John Wiley and Sons, New York, 1980.
2. Inorganic Chemistry by J.E. Huheey, III Edition, Harper International Edition, 1983.
3. Theoretical Inorganic Chemistry, II Edition by M.C. Day and J. Selbin, Affiliated East-West press pvt. Ltd., New Delhi.
4. Inorganic Chemistry by Shriver and Atkins, Oxford University Press (1999).



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Paper –III: ORGANIC CHEMISTRY -I

UNIT – I

**Nature of bonding in organic molecules and Aromaticity**

15 Hrs

(A) *Electronic Effects and Reactive intermediates*:-Inductive effect, Mesomeric effect (Resonance), Hyperconjugation, Steric effect, Tautomerism, acidity and basicity of organic molecules Generation, structure, stability and reactivity of carbocations, carbanions, free radicals, carbenes, nitrenes and arynes

(B) *Criteria of Aromaticity*:-The Energy, Structural and Electronic Criteria for Aromaticity, Relationship among the Energetic, Structural, and Electronic Criteria of Aromaticity. Huckle's rule and MO Theory, aromaticity in benzenoid non-benzenoid compounds, Aromaticity in Charged and Fused-Ring Systems, Hetero-aromatic Systems, Annulenes: Cyclobutadiene, Benzene, 1,3,5,7-Cyclooctatetraene, [10] Annulenes- [12], [14], [16] and [18] annulenes, azulenes, fulvenes, fullerenes, ferrocene, anti-aromaticity and homo-aromaticity.

UNIT – II

**Stereo Chemistry & Molecular representation of organic molecules**

20 Hrs

(A) *Molecular Symmetry and Chirality*:-Symmetry elements, Definition and classification of Stereoisomers, Enantiomer, Diastereomer, Invertomer, Homomer, Epimer, Anomer, Configuration and Conformation Configurational nomenclature: D,L and R, S nomenclature, Molecules with a single chiral center: Tetra and Tri coordinate chiral center, Molecules with two or more chiral centers; constitutionally unsymmetrical and symmetrical molecules.

(B) *Geometrical Isomerism and Conformations of Cyclic Systems*:- Cis-trans, E, Z- and Syn & anti nomenclature, Methods of determining configuration of Geometrical isomers using physical, spectral and chemical methods, Stability, Cis-trans inter conversion. Conformations of cyclobutane, cyclopentane, cyclohexane, mono and disubstituted cyclohexanes.

(C) *Prochirality and Prostereoisomerism*:- Homotopic ligands and faces; enantiotopic ligands and faces; diastereotopic ligands and faces; nomenclature of enantiotopic ligands and faces (Pro-R, Pro-S, Re, Si carbonyl compounds and Alkenes)

(D) *Stereoisomerism in molecules without chiral Center* -Axial chirality Allenes, Alkylidene cycloalkanes, spiranes, nomenclature. *Atropisomerism*: Biphenyl derivatives, nomenclature. *Planar chirality*: Ansa compounds, paracyclophanes, trans-cyclooctene and Helicity.

UNIT – III

**Heterocyclic compounds**

15 Hrs

Importance of heterocyclic compounds as drugs. Nomenclature of heterocyclic systems based on ring size, number and nature of hetero atoms. Chemistry of heterocyclic compounds, synthesis and reactivity of the following systems: Quinoline, Isoquinoline, Indole, Pyrazole, Imidazole, Oxazole, Isoxazole, Pyridazine, pyrimidine and Pyrazine.

UNIT - IV

**Chemistry of some typical natural products (Alkaloids and Terpenoids)**

10 Hrs

A study of the following compounds involving their isolation, structure elucidation, synthesis and biogenesis of *Alkaloids*; Atropine, Nicotine, and Quinine.

*Terpenoids*:  $\alpha$ - Terpineol,  $\alpha$ -Pinene and Camphor.



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**Books Suggested:**

1. Advanced Organic Chemistry-Reactions, Mechanism and structure, Jerry March, 6th Ed. (John Wiley & Sons).
2. Organic Chemistry, Paula Yurkanis Bruice, 4th Ed. (Printice Hall)
3. Organic chemistry-Clayden J. (Oxford)
4. Organic Chemsitry, Wade, L.G. Jr. 5th Ed. (Pearson)
5. Advanced Organic Chemistry: Reactions and mechanisms, Miller Bernard & Other, 2nd Ed. (Pearson)
6. Mechanism and Theory in Organic Chemistry, Thomas H. Lowry, Kathleen S. Richardson, Harper & Row, (Publishers, Inc.).
7. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, 6th Ed., (Longman).
8. Reaction Mechanism in Organic Chemistry, P.S. Kalsi, 2nd Ed. (New Age International).
9. Organic Chemistry, R. T. Morrison and R. N. Boyd (Prentice-Hall)
10. Stereochemistry to Organic Compounds, E.L. Eliel (John Wiley).
11. Stereochemistry, P.S. Kalsi, 5th Ed. (New Age International).
12. Organic Chemistry Structure and Reactivity, Ege Seyhan, 3rd Ed. (AITBS)
13. Heterocyclic Chemistry, J.A.Joule, K. Kills and G. F. Smith, Chapman and Hall
14. Heterocyclic Chemistry, T.L.Gilchrist, Longman Scientific Technical
15. Heterocyclic Chemistry, Raj.K. Bansal.
16. An Introduction to the Heterocyclic Compounds, R. M. Acheson, John Wiley.

**REFERENCE BOOKS:**

1. Chemistry of Natural Products, K.W.Bentley
2. Stereochemistry of carbon compounds by E.Eliel, John Wiley & Sons, Inc.
3. Stereochemistry to Organic Compounds, D. Nasipuri, 2nd Ed. (New Age International).
4. Chemistry of Natural products by R.S. Kalsi Kalyani Publishers. 1983.



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Paper – IV: PHYSICAL CHEMISTRY-I

UNIT-I:

**Thermodynamics-I:** Concepts of partial molar properties – partial molar volume and its significance; Determination of partial molar volume: Graphical method, intercept method and apparent molar volume method. Partial molar free energy, chemical potential, Variation of chemical potential with T and P. Gibbs-Duhem equation-derivation and significance. Phase equilibrium- Derivation of phase rule from the concept of chemical potential. *Ideal solutions* - Thermodynamic properties of ideal solutions mixing quantities; Vapour pressure-Raoult's law; Thermodynamic properties of ideally dilute solutions. Vapour pressure- Henry's law.

*Non-ideal systems* -Concept of fugacity, fugacity coefficient. Determination of fugacity; Non ideal solutions. Activities and activity coefficients; Standard-state conventions for non ideal solutions; Determination of activity coefficients from vapour pressure measurements. Activity coefficients of non-volatile solutes using Gibbs-Duhem equation. Chemical equilibrium-effect of temperature on equilibrium constant- Van'tHoff equation

UNIT-II:

**Micelles and Macro molecules:** Surface active agents, classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization- phase separation and mass action models, Solubilization, micro emulsion, reverse micelles.

Polymer- definition, types of polymers, electrically conducting, fire resistant, liquid crystal polymers, kinetics of free radical polymerization. Molecular mass- Number and mass average molecular weight, molecular weight determination-End group analysis, Osmometry, viscometry, ultracentrifugation and light scattering methods.

UNIT-III:

**Chemical Kinetics:** Theories of reaction rates- Collision theory- Limitations, Transition state theory. Effect of ionic strength - Debye Huckel theory-Primary and secondary salt effects; Effect of dielectric constant, effect of substituent, Hammett equation-limitations, Taft equation; Prediction of rate constants- Consecutive reactions, parallel reactions, opposing reactions (Uni molecular steps only, no derivation). Specific and general acid-base catalysis; Skrabal diagram; Fast reactions- different methods of studying fast reactions- flow methods, relaxation methods- temperature jump and pressure jump methods.

UNIT-IV:

**Photochemistry:** Electronic transitions in molecules, Franck-Condon principle. Electronically excited molecules- singlet and triplet states, spin-orbit interaction. Quantum yield and its determination; Actinometry - ferrioxalate and uranyl oxalate actinometers-problems. Derivation of fluorescence and phosphorescence quantum yields. Quenching effect- Stern Volmer equation. Photochemical equilibrium and delayed fluorescence - E type and P type. Photochemical primary processes, types of photochemical reactions-photodissociation, addition and isomerisation reactions with examples.





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**Books:**

1. Physical Chemistry by Peter Atkins and Julio de Paula, Oxford University Press.
2. Physical Chemistry by G.W. Castellon, Narosha Publishing House
3. Physical Chemistry by W.J.Moore, Prentice Hall
4. Thermodynamics for Chemists, Samuel Glasstone
5. Chemical Kinetics by K.J.Laidler, McGraw Hill Pub.
6. Photochemistry, R.P. Kundall and A. Gilbert, Thomson Nelson.
7. Polymer Chemistry by Billmayer
8. Introduction to Polymer Science, V.R. Gowriker, N.V.Viswanadhan and J. Sreedhar., Wiley Easter.
9. Micells, Theoretical and applied aspects, V.Morol, Plenum publishers.



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LABORATORY WORK (6 hrs/week)

**INORGANIC CHEMISTRY - I**

*I. Inorganic Synthesis: Preparation of*

- (i) Tetraamminecopper(II) sulphate
- (ii) Potassium tris-oxalato ferrate(III) trihydrate
- (iii) Tris-thiourea copper(I) sulphate

*II. Semi micro qualitative analysis of six radical mixtures*

(One interfering anion and one less familiar cation for each mixture)

*Anions:*  $\text{CO}_3^{2-}$ ,  $\text{S}^{2-}$ ,  $\text{SO}_3^{2-}$ ,  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{I}^-$ ,  $\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{CH}_3\text{COO}^-$   
 $\text{C}_2\text{O}_4^{2-}$ ,  $\text{C}_4\text{H}_4\text{O}_6^{2-}$ ,  $\text{PO}_4^{3-}$ ,  $\text{CrO}_4^{2-}$ ,  $\text{AsO}_4^{3-}$ ,  $\text{F}^-$ ,  $\text{BO}_3^{3-}$

*Cations :* Ammonium ( $\text{NH}_4^+$ )  
1<sup>st</sup> group: Hg, Ag, Pb, Tl, W  
2<sup>nd</sup> group: Hg, Pb, Bi, Cu, Cd, As, Sb, Sn, Mo  
3<sup>rd</sup> group: Fe, Al, Cr, Ce, Th, Ti, Zr, V, U, Be  
4<sup>th</sup> group: Zn, Mn, Co, Ni  
5<sup>th</sup> group: Ca, Ba, Sr  
6<sup>th</sup> group: Mg, K, Li

**ORGANIC CHEMISTRY - I**

*Preparation, recrystallization, and determination of melting point & yield of the following compounds:*

- (i) Aspirin, (ii) Nerolin, (iii) Chalcone,
- (iv) *p*-Nitro acetanilide, (v) 2,4,6- Tribromoaniline, (vi) *m*-Dinitrobenzene,
- (vii) Phthalimide, (viii) Diels-Alder adduct.

**Books Suggested**

1. Vogel's Text Book of Quantitative Chemical Analysis, J. Mendham, R. C. Denney, J. D. Barnes and M. J. Thomas, 4th & 6th Ed. (Pearson Education Asia).
2. Vogel's Text Book of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, P.W.G. Smith, A.R. Tatchell, 5 Ed. (Longman Scientific & Technical)



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**PHYSICAL CHEMISTRY-I**

1. Determination of critical solution temperature of phenol-water system.
2. Effect of added electrolyte on the CST of phenol-water system.
3. Conductometric titration of Strong acid versus Strong base
4. Dissociation constant of weak acid ( $\text{CH}_3\text{COOH}$ ) by conductometric method.
5. Conductometric titration of Weak acid vs Strong base.
6. Determination of cell constant
7. Adsorption of acetic acid on animal charcoal or silica gel.
8. Acid-catalyzed hydrolysis of methyl acetate
9. Determination of partial molar volume of solute - $\text{H}_2\text{O}$  system by apparent molar volume method.



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SECOND SEMESTER CHEMISTRY SYLLABUS  
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**Paper- I: GENERAL CHEMISTRY-II**

UNIT-1

**Basic Quantum Chemistry-III-** Hydrogen atom- solution of  $R(r)$ ,  $\Phi(\phi)$  and  $\Theta(\theta)$  equations. Probability density in orbitals- shapes of orbitals- Perturbation theory- Time independent perturbation theory(only first order perturbation is to be dealt with)- application to ground state energy of Helium atom- Variation principle- applications- calculation of zero-point energy of harmonic oscillator- many electron atom- Hartee-Fock self-consistent field method(qualitative treatment only)

UNIT-II

**Molecular symmetry and Group Theory in chemistry:** Basic concepts of symmetry and Group theory-Symmetry elements, symmetry operations and point groups- Schoenflies symbols- Classification of molecules into point groups- Axioms of Group theory- Group multiplication tables for  $C_{2v}$  and  $C_{3v}$  point groups- Similarity transformations- and classes- Representations- reducible and irreducible representations, Mullikan symbols, Orthogonality theorem and its implications, Character table and its anatomy.

UNIT-III

**Treatment of analytical data:** Accuracy and precision- Classification of errors- Determination of Indeterminate errors- Minimization of errors- Absolute and Relative errors, propagation of errors-Distribution of Indeterminate errors- Gaussian distribution- Measures of central tendency-Measures of precision- Standard deviation- Standard error of mean- student's t-test- Confidence interval of mean- Testing for significance- Comparison of two means- F-test- Criteria of rejection of an observation- Significant figures and computation rules.

UNIT- IV

**Introduction to computer programming- FORTRAN 77:** Basic structures and functioning of computer with P.C. as an illustrative example- Main memory- Secondary storage memory- input/output devices- computer languages- operating systems- principles of algorithms-and flow charts-constants and variables- Arithmetic expressions- Arithmetic statements- Replacement statement- IF statement- logical IF and BLOCK IF statements- GOTO statements-subscripted variable and DIMENSION statement. DO statement- Rules for DO statement- Functions and subroutines- Development of FORTRAN statements for simple formulae in chemistry such as Vander Waals equation- pH of a solution- First order rate equation- Cell constant-Electrode potential.

Flowcharts and computer programs for

- Program for the calculation of Cell Constant, Specific Conductance and Equivalence.
- Rate Constant of First order reaction or Beer's law by linear least square method.
- Hydrogen ion concentration of a strong acid solution/Quadratic equation.
- Solution for Vander Waals equation or Hydrogen ion concentration of a monoprotic weak acid
- Standard deviation and Variance of univariant data

**References/ Text books:**

- Introductory Quantum chemistry: by A.K. Chandra
- Group theory for Chemistry: by A.K. Bhattacharya
- Introductory Group theory for chemists : by George Davidson
- Vogel's text book of quantitative analysis: byVogel
- Fundamentals of Analytical chemistry: by Skog and West
- Principles of computer programming(FORTRAN 77 IBM PC): by V.Rajaraman
- Basics of computers for chemists: by P.C. Jurs



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**Paper- II: INORGANIC CHEMISTRY-II**

UNIT-I

**Metal cluster compounds** - definition – evidences for existence of M-M bonds - conditions favorable for formation of M-M bonds – preparation, structure and bonding of the following metal cluster compounds.

$\text{Re}_2\text{Cl}_8^{2-}$ ,  $\text{Mo}_2\text{Cl}_8^{4-}$ ,  $\text{Re}_2(\text{RCOO})_4\text{X}_2$ ,  $\text{Mo}_2(\text{RCOO})_4(\text{H}_2\text{O})_2$ ,  $\text{Cr}_2(\text{RCOO})_4(\text{H}_2\text{O})_2$ ,  $\text{Cu}_2(\text{RCOO})_4(\text{H}_2\text{O})_2$ ,  $\text{Cr}_2\text{Cl}_9^{3-}$ ,  $\text{Mo}_2\text{Cl}_9^{3-}$ ,  $\text{W}_2\text{Cl}_9^{3-}$ ,  $\text{Re}_3\text{Cl}_9$ ,  $\text{Re}_3\text{Cl}_{12}^{3-}$ ,  $\text{Mo}_6\text{Cl}_8^{4+}$ ,  $\text{Nb}_6\text{X}_{12}^{2+}$  and  $\text{Ta}_6\text{X}_{12}^{2+}$ .

Polyatomic clusters – Zintl ions, Chevrel phases.

UNIT-II

**Organometallic compounds** - 16 and 18 electron rules. Isoelectronic relationship - Synthesis, structure, bonding and reactions of carbon monoxide, dinitrogen and nitric oxide complexes. Isolobal relationship – H, Cl,  $\text{CH}_3$ ,  $\text{Mn}(\text{CO})_5$ ; S,  $\text{CH}_2$ ,  $\text{Fe}(\text{CO})_4$ ; P, CH,  $\text{Co}(\text{CO})_3$ ; Synthesis, structure, bonding and reactions of metallocenes with special reference to ferrocene.

UNIT-III

**Metal Ligand equilibria in solution:** Step wise and overall formation constants and their interaction– trends in stepwise constants – factors affecting the stability of metal complexes–Pearson's theory of hard and soft acids and bases (HSAB), chelate effect and its thermodynamic origin, determination of stability constants of complexes–spectrophotometric method and pH–metric method. Reactivity of metal complexes–inert and labile complexes. Explanation of lability on the basis of VBT & CFT.

**Bio-Inorganic Chemistry:** Metalloporphyrins with special reference to Haemoglobin & Myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to  $\text{Ca}^{2+}$ . Biological and abiological Nitrogen Fixation.

UNIT- IV

**Inorganic Reaction Mechanisms:** Substitution reactions of metal complexes – D, Id, Ia and A mechanisms – Ligand replacement reactions of metal complexes – Acid hydrolysis – factors affecting acid hydrolysis – Anation and Base hydrolysis of Cobalt(III) complexes. Ligand displacement reactions of square planar complexes of platinum (II). Factors affecting square planar substitution – trans effect (theories).

Electron transfer reactions of complexes – concept of complementary and non-complementary reactions with examples. Inner and outer sphere mechanisms.

**Text books:**

1. Advanced Inorganic Chemistry by F.A. Cotton and R.G. Wilkinson, IV Edition, John, John Wiley and Sons, New York, 1980.
2. Inorganic Chemistry by J.E. Huheey, III edition, Harper International Edition, 1983.
3. Organometallic Chemistry-A unified approach by A. Singh and R.C. Mehrotra, Wiley Eastern Ltd.
4. Inorganic Chemistry by Shriver and Atkins, Oxford University Press (1999)
5. Theoretical Inorganic Chemistry, II Edition by M.C. Day and J. Selbin, Affiliated East-West press Pvt. Ltd., New Delhi.
6. Mechanisms of Inorganic reactions in solution by D.Benson, McGraw Hill, London, 1968.
7. Inorganic chemistry by K.F. Purcell and J.C.Kotz, W.B. Saunders company, New York, 1977.
8. Elements of Bioinorganic Chemistry by G.N. Mukherjee and Arabinda Das, U.N. Dhur & sons Pvt. Ltd, Calcutta.



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**Paper-III: ORGANIC CHEMISTRY-II**

UNIT-I

**Reaction Mechanism**

**15Hrs**

(A) *Aliphatic Nucleophilic Substitution and Nucleophilic Aromatic substitution*: Stereochemistry of  $S_N^2$  and  $S_N1$  mechanisms, Neighboring Group Participation (Anchimeric assistance), NGP by O, S, N: Aromatic Nucleophilic substitution:  $S_N2$  (Ar) (Addition – Elimination),  $S_N1$ (Ar) and benzyne mechanisms (Elimination - Addition); evidence for the structure of benzyne. Von Richter Sommelet-Hauser and Smiles rearrangements.

(B) *Elimination Reactions*: Type of elimination reactions, mechanisms, Stereochemistry and Orientation, Hofmann and Saytzeff rules, Syn elimination versus anti-elimination, competition between elimination and substitution, dehydration, dehydrogenation, dehalogenation, decarboxylative eliminations and pyrolytic eliminations

UNIT-II

**Addition Reactions**

**15 Hrs**

(A) *Addition to Carbon – Carbon Multiple Bonds*: Mechanistic and stereo chemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, region and chemo selectivity, orientation and reactivity, Hydrogenation of double and triple bonds, hydrogenation of aromatic rings, Hydroboration.

(B) *Addition to Carbon-Hetero Multiple Bonds*: Steric course of addition reactions to C=O and C=N, Aldol, Cannizzaro, Perkin, Knoevenagel, Claisen-Schmidt, Claisen, Dieckman, Benzoin and Stobbe condensations, Reformatsky reaction, Tollen's reaction, Prins reaction: Wittig, Grignard, Mannich, and Michael reaction, Hydrolysis of Carbon-Nitrogen bond, Isocyanates and isothioyanates.

UNIT-III

**Molecular Rearrangements**

**15 Hrs**

Types of molecular rearrangements, migratory aptitude;

*Rearrangements to electron deficient carbon*: Pinacol-pinacolone, Wagner-Meerwein, Tiffeneau – Demjanov, Dienone – Phenol, Arndt-Eistert synthesis;

*Rearrangements to electron deficient nitrogen*: Beckmann, Hofmann, Curtius, Schmidt and Lossen rearrangements;

*Rearrangements to electron deficient oxygen*: Baeyer-villiger, Hydro peroxide rearrangement and Dakin rearrangements; Neber rearrangement, Benzil-Benzilic acid and Favorskii rearrangements

UNIT-IV

**Spectroscopy and Protecting Groups**

**15 Hrs**

- A. Basic principles and importance of UV, IR, NMR and Mass.
- B. Protection of carbonyl, Hydroxyl, carboxylic and Amine groups



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**Books Suggested:**

1. Advanced Organic Chemistry-Reactions, Mechanism and structure, Jerry March, 6th Ed. (John Wiley & Sons).
2. Modern Organic Reactions, H. O. House (Benjamin)
3. Structure and Mechanism in Organic Chemistry C. K. Ingold (Cornell University Press).
4. Organic Chemistry, Paula Yurkanis Bruice, 4th Ed. (Prentice Hall)
5. Organic chemistry-Clayden J. (Oxford)
6. Organic Chemistry, Wade, L.G. Jr. 5th Ed. (Pearson)
7. Organic Chemistry, Salmons, P.W. & Others, 8th Ed. (John Wiley & Sons)
8. Advanced Organic Chemistry: Reactions and mechanisms, Miller Bernard & Other, 2nd Ed. (Pearson)
9. Mechanism and Theory in Organic Chemistry, Thomas H. Lowry, Kathleen S. Richardson, Harper & Row, (Publishers, Inc.).
10. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, 6th Ed., (Longman).
11. Reaction Mechanism in Organic Chemistry, P.S. Kalsi, 2nd Ed. (New Age International).
12. Stereochemistry to Organic Compounds, E.L. Eliel (John Wiley).
13. Stereochemistry to Organic Compounds, Nasipuri, 2nd Ed. (New Age International).
14. Stereochemistry, P.S. Kalsi, 5th Ed. (New Age International). Organic Chemistry Structure and Reactivity, Ege Seyhan, 3rd Ed. (AITBS)
15. Spectroscopic Methods in Organic Chemistry- Forth Edition, D.H. Williams and I. Fleming Tata - McGraw Hill, New Delhi, 1990.
16. Organic Spectroscopy- Second Edition, W.Kemp, ELBS Macmillan, 1987.
17. Applications of absorption spectroscopy of Organic Compounds J.R.Dyer, Prentice Hall of India, New Delhi, 1984.
18. Spectrometric identification of Organic Compounds-Fourth Edition, R.M. Silverstein: G.C.Vassillr and T.C. Merrill, John Wiley, Singapore, 1981.
19. Introduction to spectroscopy-D.L.Pavia, G.M.Lampman, G.S.Kriz, 3rdEd (Harcourt college publishers).



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**Paper – IV: PHYSICAL CHEMISTRY-II**

UNIT-I:

**Physical methods of molecular structural elucidation:** NMR: Principle and theory, Nature of spinning particle and its interaction with magnetic field. Chemical shift and its origin. Spin-Spin interaction, Application of NMR to structural elucidation- Structure of ethanol, dimethylformamide, styrene and acetophenone.

Electron Spin Resonance: Principle and experimental technique- g-factor, line shapes and line widths- hyperfine interactions- applications of ESR studies.

UNIT -II:

**Thermodynamics-II-** Brief review on entropy; entropy changes accompanying specific process – expansion, phase transition, heating, measurement of entropy. Nernst heat theorem; Third law of thermodynamics- Determination of the absolute entropy- Apparent exceptions to Third law of thermodynamics.

**Statistical Thermodynamics:** Objectives of statistical thermodynamics, Concept of distributions, Types of ensembles. Thermodynamic probability, Most probable distribution Law – Partition Function, (Definition and significance): Molar and molecular partitions-translational, rotational, vibrational and electronic partition functions- Relation between thermodynamic functions (E, H, S, G and  $C_v$ ) and the partition functions

UNIT-III:

**Electrochemistry I:** Electrochemical cell- Galvanic and electrolytic cell. Concentration cell with and without transference, Effect of complexation on redox potential- ferricyanide/ ferrocyanide couple, Iron (III) phenanthroline / Iron (II) phenanthroline couple. Determination of standard potential, solubility product equilibrium constant and activity coefficients from EMF data.

Bjerrum theory of ion association (elementary treatment) Concept of activity and activity coefficients in electrolytic solutions. The mean ionic activity coefficient. Debye-Huckel theory of electrolytic solutions. Debye-Huckel limiting law (derivation not required), Calculation of mean ionic activity coefficient; Limitations of Debye-Huckel theory. Effect of dilution on equivalent conductance of electrolytes - Anomalous behavior of strong electrolytes. Debye Huckel-Onsagar equation – verification and limitations, Fuel Cells.

UNIT-IV:

**Electrochemistry II:** The electrode-electrolyte interface. The electric double layer. The Helmholtz-Perrin parallel-plate model, the Gouy-Chapman diffuse-charge model and the Stern model.

Electrodics: Charge transfer reactions at the electrode-electrolyte interface. Exchange current density and over-potential. Derivation of Butler-Volmer equation. High field approximation, Tafel equation, Low field equilibrium, Nernst equation. Voltametry-Concentration polarization, experimental techniques.





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**Books:**

1. Text book of Physical Chemistry by Samuel Glasstone, McMillan Pub.
2. Physical Chemistry by W.J.Moore, Prentice Hall
3. Physical Chemistry by G.W. Castellon, Narosha Publishing House
4. Physical Chemistry by Peter Atkins and Julio de Paula, Oxford University Press.
5. Modern Electrochemistry, 2A & 2B, JOM Bockris & A.K.N.Reddy, Plenum publishers
6. Introduction to Electrochemistry, S.Glasstone.
7. Fundamentals of Molecular Spectroscopy, Banwell
8. Spectroscopy by Straw & Walker.
9. Statistical thermodynamics , M.C.Gupta
10. Statistical Thermodynamics, M.Dole



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**LABORATORY WORK (6 hrs/ week)**

**INORGANIC CHEMISTRY PRACTICALS –II**

**Quantitative analysis:**

*Volumetric:*

1. Determination of Ferric iron by photochemical reduction
2. Determination of Nickel by EDTA
3. Determination of Calcium and Magnesium in a mixture by EDTA
4. Determination of Ferrocyanide by Ceric sulphate
5. Determination of Copper(II) in presence of iron(III)

*Gravimetric:*

6. Determination of Zinc as Zinc pyrophosphate
7. Determination of Nickel from a mixture of Copper and Nickel.

**ORGANIC CHEMISTRY PRACTICALS –II**

*Systematic qualitative analysis of an organic mixture containing two compounds*

Identification of method of separation and the functional group(s) present in each of them and preparation of one solid derivative for the confirmation of each of the functional group(s).

**PHYSICAL CHEMISTRY PRACTICALS –II**

1. Distribution of iodine between  $\text{CHCl}_3$  and water
2. Distribution of  $\text{I}_2$  between  $\text{CHCl}_3$  and aq.KI solution- calculation of equilibrium constant.
3. Determination of Coordination number of cuprammonium cation.
4. Titration of mixture Strong acid and weak acid versus Strong base by conductometry.
5. Titration of Strong acid Vs Strong Base – pH – metry.
6. Titration of mixture of ( $\text{NaHCO}_3 + \text{Na}_2\text{CO}_3$ ) Vs HCl – pH- metry.
7. Titration of Strong acid Vs Strong Base using Quinhydrone electrode.
8. Titration of  $\text{Fe}^{+2}$  Vs  $\text{K}_2\text{Cr}_2\text{O}_7$  – potentiometry
9. Verification of Beer-Lambert's law by Iron-thiocyanate system –colorimetry.
10. Determination of single electrode potential of  $\text{Cu}^{2+}/\text{Cu}$  and estimate the given unknown concentration.



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**THIRD SEMESTER**

**Paper – I- ORGANIC REACTION MECHANISMS-I and  
PERICYCLIC REACTIONS**

(Effective from the 2016-17 Admitted Batch)

UNIT – I

15 Hrs

**A) Aliphatic Nucleophilic Substitution:**

Neighboring group participation by Bromine, Phenyl group, Non-Classical carbocations, NGP by Pi bond, Sigma bond and Cyclopropyl group,  $S_N$  at Allylic carbon (allylic rearrangements),  $S_N$  at Aliphatic trigonal carbon,  $S_N$  at Vinylic carbon, Ambident nucleophiles, Hydrolysis of esters ( $B_{AC}^2$ ,  $A_{AC}2$ ,  $A_{AC}1$ ,  $A_{AL}1$ ,  $B_{AL}1$ ), Mechanism of esterification of carboxylic acid with an alcohol using DCC, Mayers Synthesis of aldehydes, ketones and carboxylic acids Mitsunobu reaction, Von-Braun reaction

**B) Aliphatic Electrophilic Substitution:**

Mechanisms of  $S_E^2$ ,  $S_E^1$ ,  $S_{Ei}$ , *Hydrogen as electrophile*: Hydrogen exchange; Migration of double bonds, *Halogen electrophiles*. Mechanism of Halogenation of aldehydes and ketones; HVZ reaction; Halogenation of Sulphoxides & Sulphones, *Nitrogen Electrophiles*: Aliphatic diazo coupling, Diazo transfer reaction, Insertion of nitrenes, *Metal Electrophiles*: Metallation with Organometallic Compounds (Orthometallation), *Carbon as Leaving groups*: Decarboxylation of Aliphatic Acids; Dakin – West reaction; Haller–Bauer reaction.

UNIT – II

15 Hrs

**Principles of asymmetric synthesis:**

Introduction and terminology: Topicity in molecules Homotopic, stereoheterotopic (enantiotopic and diastereotopic) groups and faces, symmetry, substitution and addition criteria. Prochirality nomenclature: Pro-R, Pro-S, Re and Si. Stereoselective reactions: Substrate stereoselectivity, product stereoselectivity, enantioselectivity and diastereoselectivity. Conditions for stereoselectivity: Symmetry and transition state criteria, kinetic and thermodynamic control. Methods for inducing enantio and diastereoselectivity. Analytical methods: % Enantiomeric excess, enantiomeric ratio, optical purity, % diastereomeric excess and diastereomeric ratio. Techniques for determination of enantiomeric excess, specific rotation, Chiral NMR; Chiral derivatizing agents, Chiral solvent, Chiral shift reagents and Chiral HPLC.

UNIT – III

15 Hrs

**Pericyclic Reactions-I**

Molecular orbital symmetry, frontier orbitals of ethylene, 1,3 Butadiene, 1,3,5- Hexatriene, allyl system, classification of pericyclic reactions FMO approach, Woodward- Hoffman correlation diagram method and perturbation of molecular (PMO) approach for the explanation of pericyclic reactions under thermal and photochemical conditions.

Electrocyclic Reactions: Conrotatory and disrotatory motions ( $4n$ ) and ( $4n+2$ ), allyl systems  
Cycloadditions: Antarafacial and suprafacial additions, notation. of cycloadditions, ( $4n$ ) and ( $4n+2$ ) systems with a greater emphasis on ( $2+2$ ) and ( $4+4$ ) - cycloadditions, ( $2+2$ ) - additions of ketenes and chelotropic reactions.



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UNIT-IV

15 Hrs

**Pericyclic Reactions-II**

FMO approach and perturbation of molecular (PMO) approach for the explanation of sigma tropic rearrangements under thermal and photochemical conditions. suprafacial and antarafacial shifts of H Sigmatropic shift involving carbon moieties, retention and inversion of configurations, (3, 3) and (5, 5) sigmatropic rearrangements detailed treatment of Claisen and Cope rearrangements, fluxional tautomerism, aza-Cope rearrangement and Barton reaction.

Text Books and Reference Books:

- 1) Advanced Organic Chemistry: Reactions Mechanisms and Structure by Jerry March, Mc.Graw Hill and Kogakush.
- 2) Molecular reactions and Photochemistry by Charles Dupey and O. Chapman, Prentice Hall.
- 3) Pericyclic reactions by S.N. Mukharji, Mcmilan.
- 4) Mechanisms and Theory in Organic Chemistry by T.H. Lowery and K.S. Rich gardson.
- 5) The modern structural theory in Organic Chemistry by L.N.Ferguson, Pretice Hall
- 6) Physical Organic Chemistry by jack Hine, Mc. Graw Hill
- 7) Advanced Organic Synthesis, Part B-Reactions and Synthesis, Francis A. Carey and Richard J. Sudenburg, Fourth edition, Kluwer academic publishers, New York
- 8) Organic Synthesis, Christine Willis and Martin Willis, Oxford Chemistry primers.
- 9) Principles of Organic Synthesis, ROC Norman and JM Coxon, third edition, CBS, Publisher, Delhi.
- 10) Organic Synthesis, M. B. Smith, Mc Graw Hill, International Edition.
- 11) Organic Chemistry, Clayden, Greeves and Stuwart Warren.
- 12) Modern Organic Synthesis-an introduction by George S.Zweifel and Michael H. Nantz, W. H. Freeman & company, New York.
- 13) Pericyclic Reactions — a problem solving approach, Lehr and Merchand.
- 14) Conservation of Orbital Symmetry by Woodward and Hoffmann.



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**THIRD SEMESTER**

**Paper – II- ORGANIC SPECTROSCOPY-I**

**(Effective from the 2016-17 Admitted Batch)**

UNIT-I 15 Hrs

**UV-Visible spectroscopy:**

A) Beer-Lambert's law-Deviations from Beers law-Instrumentation-Mechanics of measurement- Energy transitions–Simple chromophores- Auxochrome, Absorption shifts (Bathochromic, Hypsochromic, Hyper chromic and Hypo chromic shifts) UV absorption of Alkenes-Polyenes unsaturated cyclic systems.

B) UV absorption of carbonyl compounds:  $\alpha,\beta$ -unsaturated carbonyl systems-UV absorption of aromatic systems-solvent effects-geometrical isomerism-acid and base effects-typical examples-calculation of  $\lambda$  max values using Woodward Fieser rules, applications.

UNIT-II 15 Hrs

**Infrared spectroscopy:**

A) Mechanics of measurement-Fundamental modes of vibrations-stretching and bending vibrations-Factors effecting Vibrational frequency-hydrogen bonding.

B) Finger print region and its importance, typical group frequencies for –CH,-OH, N-H, CC,-CO and aromatic systems-Application in structural determination–Examples-simple problems.

UNIT-III 15 Hrs

**Nuclear Magnetic Resonance Spectroscopy ( $^1\text{H}$ NMR):**

A) Introduction: Basic principle of- NMR Nuclear spin- nuclear resonance-saturation-Relaxation-Instrumentation (CW&FT).

B) Shielding and deshielding of magnetic nuclei-chemical shift and its measurements, factors influencing chemical shift – spin-spin interactions- factors influencing –coupling constant J and factors effecting J value.

C)  $^{13}\text{C}$  NMR Spectroscopy: Similarities and Differences between PMR and CMR, general considerations, chemical shift (aliphatic, olefinic, alkyne, aromatic, hetero aromatic and carbonyl carbon), coupling constants, typical examples of CMR spectroscopy-simple systems.

UNIT-IV 15 Hrs

**Mass spectrometry**

A) Introduction: Ion production-E1, C1, ES, MALDI and FAB- determination of Molecular weight and formulae-Behavior of organic compounds in mass spectrometer- factors affecting fragmentation, ion analysis, and ion abundance.

B) Mass spectral fragmentation of organic compounds, Common functional groups, molecular ion peak, meta stable peak, Mc Lafferty rearrangement, Nitrogen rule, High resolution mass spectrometry, Examples of mass spectral fragmentation of organic compounds with respect of their structure determination.



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Suggested Books:

- 1) Spectroscopic Methods in Organic Chemistry- Forth Edition, D.H. Williams and I.Fleming  
Tata McGraw Hill, New Delhi, 1990.
- 2) Organic Spectroscopy- Second Edition, W.Kemp, ELBS Macmillan, 1987.
- 3) Applications of absorption spectroscopy of Organic Compounds J.R.Dyer,  
Prentice Hall of India, New Delhi, 1984.
- 4) Spectrometric identification of Organic Compounds-Fourth Edition, R.M.  
Silverstein: G.C.Vassiellr and T.C. Merrill, Johne Willey, Singapore, 1981.
- 5) Introduction to spectroscopy-D.L.Pavia, G.M.Lampman, G.S.Kriz, 3rdEd  
(Harcourt college publishers).
- 6) Absorption spectroscopy of organic molecules-V.M.Parkih.
- 7) Nuclear Magnetic Resonance-Basic principles-Atta-Ur-Rehman, Springer-Verlag, 1986.



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**THIRD SEMESTER**

**Paper – III- MODERN ORGANIC SYNTHESIS-I**

**(Effective from the 2016-17 Admitted Batch)**

UNIT-I

**Formation of C-C single bonds** 15 Hrs

Alkylations via enolate, Thermodynamic and kinetic enolate, Asymmetric Aldol reaction: a) Chiral enolate and achiral aldehyde b) Achiral enolate and chiral aldehyde – explanation by Zimmerman Traxler model; Stork enamine reaction and its synthetic applications; Organo sulphur chemistry: Umpolung and its synthetic applications (Corey Seebach Reaction), sulphur ylides: dimethyl sulphonium methylide, dimethyloxosulphonium methylide preparations and their synthetic applications; Organo Palladium Chemistry: Heck Reaction, Stille coupling, Suzuki coupling, Sonogashira coupling, Negishi coupling, Wacker Oxidation; Organo copper chemistry: Gilman's reagent and synthetic applications; Synthetic applications of carbenes and carbenoids; Baylis Hilman reaction.

UNIT-II

**Formation of Carbon-Carbon double bonds** 15 Hrs

Stereochemistry of E1 and E2 reactions (Different examples of acyclic and cyclic molecules, Saytzeff rule, Hofmann rules and Bredt's rule); Pyrolytic Syn eliminations (focus should be given on stereochemistry of syn eliminations of amine oxides, xanthates and esters of acyclic and cyclic molecules); Sulphoxide-Sulphenate rearrangement (Mislow-Evans rearrangement); Wittig reaction, Wadsworth Emmons reaction, Corey-Fuchs reaction, Aza Wittig reaction, Wittig-Horner reaction and stereo chemistry of Wittig reaction; Shapiro reaction, Eschen-Moser Tanabe fragmentation, Claisen rearrangement of allyl vinyl ethers, Julia Lythgoe olefination, Mc Murray coupling, Peterson Olefination, Tebbs reagent and its application, Metathesis: Grubbs 1st and 2nd generation catalyst, Olefin cross coupling (OCM), ring closing (RCM) and ring opening (ROM) metathesis, applications, olefination by Nysted reagent.

UNIT-III

**Reactions of unactivated C-H bonds and organoboranes** 15 Hrs

The Hoffmann Loeffler- Freytag reaction, the Barton reaction and Photolysis of organic hypothalites;

Organoboranes: Preparation of Organoboranes



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viz hydroboration with  $\text{BH}_3\text{-THF}$ , dicyclohexyl borane, disiamyl borane, theryl borane, 9-BBN mono isopinacamplyl borane ( $\text{IPC}_2\text{BH}_2$ ) and diisopinacamplyl borane ( $\text{IPC}_2\text{BH}$ ) functional group transformations of Organo boranes-Oxidation, protonolysis and isomerisation. Formation of carbon-carbon-bonds viz organo boranes carbonylation and cyanidation, reactions of alkenyl boranes and trialkyl alkynyl borates.

UNIT-IV

**Protecting groups and simple applications of microwave and ultrasound assisted reactions** 15 Hrs

(A) Protecting Groups

- 1) Protection of **alcohols** as **ethers** [methyl ether ( $\text{RO-Me}$ ), Tertiary butyl ether ( $\text{ROCM}_3$ ), Benzyl ethers ( $\text{RO-Bn}$ ), *p*-methoxybenzylethers ( $\text{RO-PMB}$ )], as **Silyl ethers** [Trimethyl silylether ( $\text{R-OTMS}$ ), tri ethyl silyl ethers ( $\text{RO-TEs}$ ), *t*-butyldimethylsilyl ether ( $\text{R-OTBDMS}$  in the presence of imidazole), tri isopropylsilyl ether ( $\text{RO-TIPS}$ ), *t*-butyl diphenylsilyl ether ( $\text{RO-TBDPS}$ )], as **acetals** [tetrahydropyranyl ethers ( $\text{RO-THP}$ ), methoxymethyl ethers ( $\text{RO-CH}_2\text{-OCH}_3 = \text{RO-MOM}$ ) and **ester formation** (carboxylic acid ester and *p*-toluene sulphonate esters).
- 2) Protection of 1,2-diols by acetal, ketal and carbonate formation.
- 3) Protection of amines by acetylation, benzoylation, benzoyloxy carbonyl, Fmoc and triphenyl methyl groups.
- 4) Protection of carbonyl by acetal, ketal and thio acetal (Umpolung) groups.
- 5) Protection of carboxylic acids by esters and ortho ester formation.

(B)

Synthetic applications of PTC and crown ethers

1. Microwave Technology: Microwave equipment, activation-benefits, limitations, microwave effects. Microwave assisted reactions in organic solvents-Esterification reactions, Fries rearrangement, Orthoester Claisen rearrangement, Diels- Alder reaction, decarboxylation.
2. Ultrasound assisted reactions: introduction, substitution reactions, addition, oxidation, reduction reactions.
3. Click chemistry: criterion for click reaction, Sharpless azides cycloadditions





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Textbooks and Books for Reference:

- 1) Some Modern Methods of Organic Synthesis W. Carruthers, Third & Fourth Edition, Cambridge University Press, Cambridge, 1988.
- 2) Modern Organic Synthesis-an introduction by George S.Zweifel and Michael H. Nantz, W. H. Freeman & company, New York.
- 3) Advanced Organic Synthesis, Part B-Reactions and Synthesis, Francis A. Carey and Richard J. Sudenburg, Fourth edition, Kluwer academic publishers, New York
- 4) Organic Synthesis, Christine Willis and Martin Willis, Oxford Chemistry primers.
- 5) Principles of Organic Synthesis, ROC Norman and JM Coxon, third edition, CBS, Publisher, Delhi.
- 6) Organic Synthesis, M. B. Smith, McGraw Hill, International Edition.
- 7) Organic Chemistry, Clayden, Greeves and Stuart Warren.
- 8) Guide Book to Organic Synthesis (3<sup>rd</sup> edition), R. Mackie, D. M. Smith and Aitken.
- 9) Organo Boranes and Silanes, Thomson, Oxford Chemistry primers.
- 10) Strategic applications of named reactions in organic synthesis, Laszlo Kurti and Barbara Czako.
- 11) Modern Synthetic Reactions, Herbert O. House, Second Edition, W.A. Benzamine Inc. Menio Park, California, 1972.
- 12) Organic Synthesis viz Boranes, Herbert C. Brown Gray, W. Kramer Alan B. Levy and M. Mark Midland John Wiely &. Sons, New York, 1975.
- 13) Organic Synthesis: Special Techniques, V. K. Ahluwalia and Renu Agarwal.
- 14) Organic Synthesis, Jagadamba Singh and Dr. A. Yadav, Pragati Edition.



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**THIRD SEMESTER**

**Paper – IV- : CHEMISTRY OF NATURAL PRODUCTS**

**(Effective from the 2016-17 Admitted Batch)**

**UNIT–I: Alkaloids** 15 Hrs

Introduction, isolation, general methods of structure elucidation and physiological action, degradation, classification based on nitrogen heterocyclic ring, structure, stereochemistry, synthesis and biosynthesis of morphine, strychnine, vincristine, colchicine, camptothecin and reserpine.

**UNIT–II: Terpenoids** 15 Hrs

Occurrence, isolation, general methods of structure determination, isoprene rule. Structure determination, stereochemistry, biosynthesis and synthesis of Farnesol, Zingiberene, Forskolin, Taxol, Azadirachtin and  $\beta$ -amyrin.

**UNIT–III: Steroids** 15 Hrs

Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and its stereochemistry. Isolation, structure determination and synthesis of cholesterol (total synthesis not expected), androsterone, testosterone, estrone and progesterone, Biosynthesis of steroids.

**UNIT–IV: Flavonoids and Isoflavonoids** 15 Hrs

Occurrence, nomenclature and general methods of structure determination, Isolation, structure elucidation and synthesis of Kaempferol, Quercetin, Cyanidin, Genestein, Butein and Daidzein. Biosynthesis of flavonoids and Isoflavonoids: Acetate Pathway and Shikimic acid Pathway.

Books Suggested:

1. Natural Products: Chemistry and Biological Significance, J. Mann, R.S.Davidson, J. B. Hobbs, D. V. Banthrope and J. B. Hatrbnome, Longman, Essex.
2. Organic Chemistry, Vol. 2, I. L. Finar, ELBS.
3. Chemistry of Organic Natural Products, O. P. Agrawal, Vols. 1 &2, Goel Pubs.
4. Natural Products Chemistry K. B. G. torsell, John Wiley, 1983
5. New Trends in Natural Products Chemistry, Atta-ur-Rahman and M.I.Choudhary, Harwood Academic Publisher.
6. Chemistry of Natural products P. S. Kalsi, Kalyani Publishers
7. Biosynthesis of steroids, terpenes and acetogenins, J. H. Richards & J. R. Hendrieson
8. The biosynthesis of secondary metabolites, R. D. Herbert, Chapman & Hall
9. The Biosynthesis of Secondary Metabolite, R. D. Herbert, Second edn, Chapman and Hall 1984
10. Chemical aspects of Biosynthesis, John Mann, Oxford University Press, Oxford, 1996.



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DEPARTMENT OF CHEMISTRY

FOURTH SEMESTER

Paper – I- ORGANIC REACTION MECHANISMS-II and  
ORGANIC PHOTO CHEMISTRY

(Effective from the 2016-17 Admitted Batch)

UNIT – I 15 Hrs

A) **Free Radical Reactions:**

Free radical substitution mechanisms; Mechanism at an aromatic substrate; Neighboring group assistance in free radical reactions; Reactivity for aliphatic substrates; Reactivity in aromatic substrates; Reactivity at bridge head; Reactivity in the attacking radical; Effect of solvent on reactivity, Allylic halogenations using NBS (Wohl – Ziegler bromination); Hydroxylation at aromatic carbon by Fentons reagent; Oxidation of aldehydes to carboxylic acids; Formation of cyclic ethers using Leadtetraacetate; Formation of hydroperoxides (autooxidation); Coupling of alkynes (Eglinton reaction and Glacer reaction); Arylation of Aromatic compounds by diazonium salts(Gomberg – Bachman reaction); Mechanisms of Sandmeyer reaction, Kolbes reaction, Hunsdiecker reaction, Reed reaction; free radical rearrangements.

B) **Quantitative relationships between Molecular structure and Chemical reactivity:**

Hammett and Taft Equations

C) **Rearrangements:** Wagner – Meerwein Rearrangement, Demjanov Rearrangement, Wittig Rearrangement and Stevens Rearrangement

Unit – II: 15 Hrs

**Methodologies in asymmetric synthesis**

Strategies in Asymmetric Synthesis: 1. Chiral substrate controlled, 2. Chiral auxiliary controlled, 3. Chiral reagent controlled and 4. Chiral catalyst controlled.

1. **Chiral Substrate controlled asymmetric synthesis:** Nucleophilic additions to chiral carbonyl compounds. 1, 2- asymmetric induction, Cram's rule and Felkin-Anh model.

2. **Chiral auxiliary controlled asymmetric synthesis:**  $\alpha$ -Alkylation of chiral enolates, azaenolates, imines and hydrazones. 1, 4-Asymmetric induction and Prelog's rule. Use of chiral auxiliaries in Diels-Alder reaction.

3. **Chiral reagent controlled asymmetric synthesis:** Asymmetric reductions using BINAL-H. Asymmetric hydroboration using IPC2 BH and IPCBH2.

4. **Chiral catalyst controlled asymmetric synthesis:** Sharpless and Jacobsen asymmetric epoxidations. Sharpless asymmetric dihydroxylation. Asymmetric hydrogenations using chiral Wilkinson biphosphine and Noyori catalysis. Enzyme mediated enantioselective synthesis

5. **Asymmetric aldol reaction:** Diastereoselectivity aldol reaction (chiral enolate & achiral aldehydes and achiral enolate & chiral aldehydes) its explanation by Zimmerman-Traxel model.

UNIT – III 15 Hrs

**Photo Chemistry-I**

Photochemical energy, Frank Condon Principle, Types of Electronic Excitation and Molecular orbital view of excitation, Jablonski Diagram, singlet and triplet states, dissipation of photochemical energy, photosensitization, quenching, quantum efficiency and quantum yield, Determination of Quantum yield

Photo Chemistry of Carbonyl Compounds: Norrish Type I reaction (alpha cleavage reaction), Norrish Type – II reaction, Paterno- Buchi reaction, Photo reduction & photo enolisation; photochemical Oxidations [Backstrom mechanism], Photo oxidation of alkenes with singlet oxygen.



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Unit – IV

**Photochemistry-II**

Di – Pi methane Rearrangement, Aza di – Pi methane rearrangement; Photochemistry of Benzene and substituted benzene, 1, 2 , 1,3 ,& 1, 4-additions; Photo Fries rearrangement of Phenolic acetates and Anilides; Photochemistry of unsaturated systems, Cis- Trans Isomerisation of alkenes (Direct and sensitized) (Photoisomerisation of Stilbene), Photochemistry of Butadiene; Dimerisations of alkenes, Intramolecular dimerisation.

Photochemical rearrangement of Cyclohexadienenones; Photochemistry of alpha, beta Unsaturated ketones (dimerisations and addition across the double bond); Photochemical rearrangement reactions of Cyclohexenone, Photorearrangements of Beta, gamma unsaturated systems (Mechanism of 1,2 & 1,3 – acyl shifts); Photochemistry of Nitrite esters (Barton reaction); Photochemistry of alpha diazoketones; Photo Aromatic Substitutions; Photochemistry of Pyridinium ylides.

Text Books and Reference Books:

- 1) Advanced Organic Chemistry: Reactions Mechanisms and Structure by Jerry March, Mc.Graw Hill and Kogakush.
- 2) Molecular reactions and Photochemistry by Charles Dupey and O. Chapman, Prentice Hall.
- 3) Mechanisms and Theory in Organic Chemistry by T.H. Lowery and K.S. Richardson.
- 4) The modern structural theory in Organic Chemistry by L.N.Ferguson, Prentice Hall
- 5) Physical Organic Chemistry by Jack Hine, Mc. Graw Hill
- 6) Advanced Organic Synthesis, Part B-Reactions and Synthesis, Francis A. Carey and Richard J. Sudenburg, Fourth edition, Kluwer academic publishers, New York
- 7) Organic Synthesis, Christine Willis and Martin Willis, Oxford Chemistry primers.
- 8) Principles of Organic Synthesis, R.C. Norman and J.M. Coxon, third edition, CBS, Publisher, Delhi.
- 9) Organic Synthesis, M. B. Smith, Mc Graw Hill, International Edition.
- 10) Organic Chemistry, Clayden, Greeves and Stuart Warren.
- 11) Modern Organic Synthesis-an introduction by George S.Zweifel and Michael H. Nantz, W. H. Freeman & company, New York.
- 12) Organic Photochemistry by D Coyle
- 13) Molecular Photochemistry by Gilbert & Baggo
- 14) Organic Photochemistry by Turro
- 15) Photochemistry by C W J Wells



ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY

**FOURTH SEMESTER**

**Paper – II- ORGANIC SPECTROSCOPY-II**

**(Effective from the 2016-17 Admitted Batch)**

UNIT-I:

A) Optical Rotatory Dispersion: Theory of Optical Rotatory Dispersion-Cotton effect –CD curves-types of ORD and CD curves–similarities and difference between ORD and CD curves

B) The octant rule-application in structural studies- $\alpha$ - halo keto rule.

UNIT-II

A) Improving the PMR spectrum: Chemical and Magnetic Equivalence. Chemical exchange, First and Non-First Order Spectra and analysis of AB, AMX and ABX systems.

B) Simplification of complex spectra-: Nuclear Magnetic double resonance, Lanthanide shift reagents, solvent effects, Fourier transforms technique, Nuclear Overhauser Effect (NOE), Deuterium Exchange, spectra at higherfields. Hindered Rotations and Rate processes. Resonance of other nuclei- $^{19}\text{F}$  and  $^{31}\text{P}$

C) 2D NMR spectroscopy: Definitions and importance of COSY, DEPT, HOMCOR, HETCOR, INADEQUATE, INDOR INEPT, NOESY, HOM2DJ, HET2DJ and DQFCOSY.

UNIT-III

Solution of structural problems by joint application of UV, IR, NMR ( $^1\text{H}$ & $^{13}\text{C}$ ) and mass spectrometry.

UNIT-IV

A) Separation Techniques: Solvent extraction chromatography-paper-thin layer partition-column chromatography, Electrophoresis.

B) Instrumentation – Gas Chromatography, High performance Liquid Chromatography, X – Ray diffraction (XRD)

**Suggested Books:**

- 1) Spectroscopic Methods in Organic Chemistry- Forth Edition, D.H. Williams and I. Fleming  
Tata - McGraw Hill, New Delhi, 1990.
- 2) Organic Spectroscopy- Second Edition, W.Kemp, ELBS Macmillan, 1987.
- 3) Spectrometric identification of Organic Compounds-Fourth Edition, R.M. Silverstein: G.C.Vassillr and T.C. Merill, John Willey, Singapore, 1981.
- 4) Introduction to spectroscopy-D.L.Pavia, G.M.Lampman, G.S.Kriz, 3rdEd  
(Harcourt college publishers).
- 5) "Applications of Optical rotation and Circular Dichroism", G.C. Barret, in  
"Elucidation of Organic structures by Physical and Chemical Methods"  
Part I (Eds) K.W. Bentley and G.W.Rirty John Wiley, 1972, Chapter VIII  
(only those aspects mentioned in the syllabus).
- 6) Instrumental methods of chemical analysis by H.Kaur, Pragati Prakasan,meerut.
- 7) Separation Techniques by M.N.Sastri, Himalaya publishing House (HPH), Mumbai.



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**FOURTH SEMESTER**

**Paper – III- MODERN ORGANIC SYNTHESIS-II**

**(Effective from the 2016-17 Admitted Batch)**

UNIT-I

**Organo Silanes**

15 Hrs

Synthetic applications of trimethylsilyl chloride dimethyl-*t*-butylsilyl chloride, trimethylsilyl cyanide, trimethylsilyl iodide and trimethylsilyl triflate, synthetic applications of  $\alpha$ -silyl carbanion and  $\beta$ -silyl carbonium ions. Synthetic applications of silyl enol ethers, Preparation and synthetic applications of alkynyl silanes, aryl silanes, allyl silanes and vinyl silanes, Nazarov cyclization, Synthetic conversion of  $\alpha$ ,  $\beta$ -epoxy silanes, Peterson Olefination, Brook rearrangement and Rubottom oxidation.

UNIT-II

15 Hrs

**Oxidation**

Synthetic applications of the following reagents in the oxidation of functional groups like alkenes, alkynes, alcohols, aldehydes and ketones: 1)  $\text{Pb}(\text{OAc})_4$  2)  $\text{HIO}_4$  3)  $\text{SeO}_2$  4)  $\text{CrO}_3$  (Sodium or potassium dichromate in  $\text{H}_2\text{SO}_4$ , Collins reagent, Jones reagent, Etard reagent,  $\text{CrO}_3$  in acetic anhydride, PCC (Coreys reagent), PDC, Babler oxidation), 4)  $\text{MnO}_2$  5)  $\text{KMnO}_4$  6)  $\text{OsO}_4$  7) Oxidations by using DMSO involving alkoxy sulphonium salts (Kornblum oxidation), DCC- DMSO (Pfitzner-Muffat reagent), Swern oxidation, Corey-Kim oxidation, Albright-Goldman oxidation 8) Oxidations by using IBX, DMP, TPAP, TEMPO, CAN 9) Bayer villager oxidation and Prilezhev epoxidation 10) Oxidation of alkenes using Woodward and Prevost reagents 11) Oxidation by using DDQ 12) Sharpless asymmetric epoxidation and Sharpless asymmetric dihydroxylation 13) Thallium nitrate 14) Oxidative coupling of phenols and alkynes.

UNIT-III

**Reduction**

15 Hrs

- (1) Catalytic reductions: Homogeneous (Wilkinson's Catalytic reduction) and heterogeneous catalytic reductions and their synthetic applications.
- (2) Reductions by using electrophilic nucleophilic metal hydrides:  $\text{LiAlH}_4$  (Various examples of reductions and Cram's rule), related reagents of LAH,  $\text{NaBH}_4$ ,  $\text{NaBH}_3\text{CN}$ , Trialkyl Borohydrides (Super Hydride and Selectride).
- (3) Reductions by using electrophilic metal hydrides:  $\text{BH}_3$ , DIBAL



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- (4) Reductions by dissolving metals: Clemenson reduction, Acyloin condensation, Bouveault-Blanc reduction, Birch reduction (Various examples should be discussed).
- (5) Reductions by using Diimide and Wolf-Kishner Reduction (6) Hydrogenolysis
- (7) Reductions by using tri n-butyl tin hydride.

UNIT-IV

**Retro Synthetic Analysis**

15 Hrs

1. Basic definitions of the following:
  - a) Retro synthetic analysis
  - b) Disconnection
  - c) Target molecule
  - d) Synthons
  - e) Synthetic equivalent
  - f) Functional Group Inter Conversion (FGI)
  - g) Functional Group Addition (FGA)
2. Guidelines for the order of events: One group C-X disconnections One Group C-X disconnections (Carbonyl derivatives, ethers, sulphides and alcohols); Two group C-X disconnections (1,1-difunctionalised, 1,2-difunctionalised and 1,3-difunctionalised compounds), One group C-C disconnections (Alcohols and carbonyl compounds, 1,1-C-C, 1,2-C-C and 1,3-C-C); Synthesis of alkenes (Wittig disconnections and diene synthesis), Two group disconnections (Diels Alder reaction and 1,3-difunctionalised compounds); Linear and convergent synthesis.

Textbooks and Books for Reference:

- 1) Some Modern Methods of Organic Synthesis W. Carothers, Third Edition, Cambridge University Press, Cambridge, 1988.
- 2) Modern Organic Synthesis-an introduction by George S.Zweifel and Michael H. Nantz, W. H. Freeman & company, New York.
- 3) Advanced Organic Synthesis, Part B-Reactions and Synthesis, Francis A. Carey and Richard J. Sudenburg, Fourt edition, Kluwer academic publishers, New York.
- 4) Organic Synthesis, Christine Willis and Martin Willis, Oxford Chemistry primers.
- 5) Principles of Organic Synthesis, ROC Norman and JM Coxon, third edition, CBS, Publisher, Delhi.
- 6) Organic Synthesis, M. B. Smith, McGraw Hill, International Edition.
- 7) Organic Chemistry, Clayden, Greeves and Stewart Warren.
- 8) Guide Book to Organic Synthesis (3<sup>rd</sup> edition), R. Mackie, D. M. Smith and Aitken.
- 9) Organo Boranes and Silanes, Thomson, Oxford Chemistry primers.
- 10) Strategic applications of named reactions in organic synthesis, Laszlo Kurti and Barbara Czako.
- 11) Organic Synthesis: The disconnection approach, S. Warrant John Wiley & sons, New York, 1984.
- 12) Modern Synthetic Reactions, Herbet O. Horase, Second Edition, W.A. Benzamine Inc. Menio Park, California, 1972.



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DEPARTMENT OF CHEMISTRY

**FOURTH SEMESTER**

**Paper – IV- BIO-ORGANIC CHEMISTRY**  
**(Effective from the 2016-17 Admitted Batch)**

UNIT-I 15 Hours

**Biopolymers and Enzymes**

Peptides:  $\alpha$ -Amino acids, their general properties and synthesis, Synthesis of peptides by Merrified solid phase synthesis. Chemistry of oxytocin and dolastain-10  
Enzymes-Oxidoreductases, hydrolases, transferases, synthesis of ATP, Baker's Yeast.  
Enzyme models-NADH models, Bio transformations, Remotefunctionalization

UNIT-II 15 Hours

**Antimalarials & Antibiotics**

**i. Antimalarials**

Chemotherapy, synthesis and activity of antimalarial drugs- quinoline group-quinine, acridine group-quinacrine and guanidine group-paludrine.

**ii. Antibiotics**

General characteristics, structure- activity relationships, synthesis and activity of antibiotics: Pencillin G, Cephalosporin-C and streptomycin.

UNIT-III 15 Hours

**Vitamins and Prostaglandins**

Definition, occurrence, structural formulae, physiological functions and synthesis of Vitamins.

Vitamins: Structure determination and synthesis of Retinol (A), Thiamine (B<sub>1</sub>), Riboflavin (B<sub>2</sub>), Pyridoxine (B<sub>6</sub>) and Biotins (H), Nicotininc acid.

**Prostaglandins**

Occurrence, nomenclature, classification, biogenesis and physiological effects. Synthesis of PGE<sub>2</sub> and PGF<sub>2</sub>

UNIT-IV 15 Hours

**Nucleic Acids:**

Nucleic acids: Basic concepts of the structures of RNA and DNA and their hydrolysis products, nucleotides, nucleosides and heterocyclic bases, Genetic Code, Finger Print test.

Application of recombinant DNA technology in production of pharmaceuticals, diagnosis of diseases, insect control, improved biological detergents, gene therapy-examples.





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Reference Books and Material:

1. Chemical Aspects of Biosynthesis, John Man, Oxford University Press, Oxford, 1996.
2. Chemistry of Natural Products: A Unified Approach, N. R. Krishnaswamy, University Press (India) Ltd., Orient Longman Limited, Hyderabad, 1999.
3. Introduction to Organic Chemistry, A Streitwieser, CH Heathcock and E.M./Kosover IV Edition, McMillan, 1992. (For Merrifield synthesis of peptides and also for other aspects of Unit IV)
4. Bio-organic Chemistry, H.Dugas and C. Penney, springer, New York, 1981.
5. Details of Primary literature: Nomenclature: Structure: Dolastatin-10: JACS, 1987, 109, 6883 (structure), ibdi, 1989, 111, 5463, JCS, Parkin I, 1996, 859 (synthesis).



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**III SEMESTER**  
**Laboratory Course-1**

**100 M**

**Multistep Synthesis of Organic Compounds:**

The experiments should illustrate the use of organic reagents and may involve purification of the products by chromatographic techniques.

1. Beckmann rearrangement: Benzanilide from Benzophenone  
Benzophenone → Benzophenone oxime → Benzanilide
2. Benzilic acid rearrangement: Benzilic acid from benzoin  
Benzoin → Benzil → Benzilic acid
3. P-Bromo Aniline from Aniline :  
Aniline → Acetanilide → P-Bromo Acetanilide → P-Bromo Aniline
4. Symmetrical Tribromo Benzene from aniline:  
Aniline → Tribromoaniline → Tribromobenzene
5. 2,4,6-trimethylquinoline from p-toluidine  
p-toluidine → 4-(p-tolylamino) pent-3-ene-2-one → 2,4,6-trimethylquinoline
6. Flavone from o-hydroxy acetophenone  
o-hydroxy acetophenone → o-benzoyl acetophenone → o-hydroxy- dibenzoylmethane → Flavone
7. 2-phenylindole from phenylhydrazine  
phenylhydrazine → acetophenone phenylhydrazone → 2-phenylindole

**Laboratory Course-2**

**100 M**

**Spectral Identification of Organic Compounds (UV, IR,  $1^{\text{H}}$ - and  $^{13}\text{C}$ - NMR, MASS).**

A minimum of 40 representative examples should be studied

**Books Suggested**

1. Modern Organic Synthesis in the Laboratory *A Collection of Standard Experimental Procedures*, Jie Jack Li, Chris Limberakis, Derek A. Pflum
2. Practical organic chemistry by Mann & Saunders
3. Text book of practical organic chemistry by Vogel
4. Spectrometric Identification of organic compounds, R.M. Silverstein, F.X. Webster and D.J. Kiemle, 7th Ed., (Wiley)



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**IV – SEMESTER**  
**Laboratory Course-1**

**100 M**

**Chromatographic Separation and Isolation & identification of Natural Products**

1. Thin layer chromatography: Determination of purity of a given sample, monitoring the progress of chemical reactions, identification of unknown organic compounds by comparing the R<sub>f</sub> values of known standards.
2. Isolation and identification of Natural Products
  - (a) Isolation of caffeine from tea leaves
  - (b) Isolation of eugenol from cloves
  - (c) Isolation of casein and lactose from milk
  - (d) Isolation of limonene from lemon peel
  - (e) Isolation of piperines from black pepper
  - (f) Isolation of lycopene from tomatoes
  - (g) Isolation of β-carotene from carrots

**Laboratory Course-2**  
**Estimations and Chromatography**

**100 M**

1. Estimation of (a) Glucose (b) Phenol (c) Aniline (d) Acetone (e) Aspirin (f) Ibuprofen (g) Paracetamol
2. Separation by column chromatography: Separation of a mixture of *ortho* and *para* nitroanilines using silicagel as adsorbent and chloroform as the eluent. The column chromatography should be monitored by TLC.

**Books Suggested:**

1. Ikan, R. *Natural Products, A Laboratory Guide*, 2nd ed.; Academic Press: New York, 1991.
2. Adapted from *Introduction to Organic Laboratory Techniques: A Microscale Approach*. Pavia, Lampman, Kriz and Engel. (1999) Saunders College Publishing.
3. Pharmaceutical drug analysis by Ashutoshkar
4. Quantitative analysis of drugs in pharmaceutical formulations by P D Sethi
5. Practical pharmaceutical chemistry part-1 and part-2 by A H Beckett and J B Stenlake
6. Practical organic chemistry by Mann & Saunders
7. Text book of practical organic chemistry including qualitative organic analysis by A.I. Vogel (Longman)



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**THIRD SEMESTER**  
PAPER-I: ADVANCED CHEMICAL KINETICS AND PHYSICAL  
CHEMISTRY OF POLYMERS  
(Effective from the 2016-17 admitted Batch)

UNIT-I

Theories of reaction rates – Potential energy surfaces – Reaction coordinate – theories of unimolecular gas phase reactions – Lindemann hypothesis – Hinshelwood treatment – Reactions in solutions – Kinetic Isotope effect – Linear free energy relationships – Hammett equation – Okamoto–Brown Equation – Taft Equation; Chain Reactions  $H_2-Cl_2$ ,  $H_2-Br_2$  and  $H_2-O_2$  reaction – Explosion limits.

UNIT-II

Complex reactions – Consecutive – Parallel and Opposing reactions – Equilibrium and Steady state technique – Michaelis – Menten Models. Flow and relaxation Technique for fast reactions – NMR methods determining exchange rates.

UNIT-III

Characteristics of macro molecules (addition & condensation of polymerization), degree of polymerization. Shapes of macro – molecules, bulk, solution and emulsion polymerization – Co-Polymerization, block and graft copolymers, Ziegler natta catalysis. The structure and properties of polymers – Crystallinity. Glass-transition temperature, Rheology and solubility of polymers, processing of polymers – Additives.

UNIT-IV

Interaction of polymers and liquids – Flory – Huggins treatment and its limitation, Fractionation, Viscosities of polymer solutions, Synthesis and properties of polyesters, polyamides, polyurethanes, polystyrene and bakelite. Determination of molecular Weights of polymers by osmometry, light scattering, Ultra centrifuge and Viscometry.

Suggested books :

1. Chemical Kinetics by Laidler.
2. Physical Organic Chemistry by Wiberg.
3. Kinetics and Mechanism by Frost and Pearson.
4. Molecular connectivity in Chemistry and Drug Research L.B.Kier and L.H.Hall Academic press, 1976.
5. Chemical Kinetics – The study of Reaction Rates in solution – Kenneth A. CANNORSV – VCH Publishers.
6. An introducer to polymer Chemistry – W.R. Moore.
7. Introduction to polymer Chemistry – R.B. Seymour.
8. Fundamentals of Polymer Science and Engineering – Anil Kumar and S.K. Gupta.



ADIKAVI NANNAYA UNIVERSITY  
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**THIRD SEMESTER**  
PAPER II: QUANTUM CHEMISTRY –II AND CHEMICAL  
APPLICATIONS OF SYMMETRY AND GROUP THEORY  
(Effective from the 2016-17 admitted Batch)

UNIT –I:

Wave mechanics of simple systems –Systems with discontinuity in the Potential field  
–Quantum Mechanical tunneling effect –potential barrier with finite thickness.

Wave mechanics of systems with variable potential energy – Harmonic Oscillator –  
Hermite polynomials –recursion formula –Energy levels of three dimensional harmonic  
oscillator – degeneracy of the energy levels.

UNIT –II:

Hydrogen like atoms –Solutions of the wave equation –solution of  $R(r)$ ,  $\phi(\phi)$  and  $\theta(\theta)$   
equations – Shapes of atomic orbitals – Space quantization of electronic orbitals.

Angular momentum – Commutation relations – Commutation with Hamiltonian-Spin-  
Orbit interaction – Vector model of the atom.

UNIT–III:

Representation – reducible and irreducible representations – Orthogonality theorem and  
its consequences – Constructions of Character table for  $C_{2v}$  and  $C_{3v}$  point groups – Wave  
functions as bases for irreducible representations – Direct Product

Hybridization scheme for  $AB_n$  type of molecules –  $AB_3$ ,  $AB_4$ ,  $AB_5$  and  $AB_6$  under point  
groups  $D_{3h}$ ,  $D_{4h}$ ,  $T_d$ ,  $C_{4v}$  and  $O_h$

Ligand field theory: Splitting of d-orbitals under  $D_{4h}$ ,  $T_d$ ,  $C_{4v}$  and  $O_h$  environments.

Construction of molecular orbital correlation diagram (1) for  $\sigma$  bonds in octahedral  
environment and (2) for  $H_2O$  molecule.

UNIT-IV:

Symmetry selection rules for I.R. and Raman activity – transition moment integral –  
application of direct product.

Determination of symmetries of total degrees of freedom: Calculation of Character per  
un-shifted atom for different symmetry operations and evaluation of  $SF_6$ .

Determination of symmetries of I.R. and Raman active vibrational modes for different  
molecules  $SO_2$ ,  $NO_2$ ,  $CCl_4$ ,  $POCl_3$ ,  $PCl_5$  and  $SF_6$ .

Accidental degeneracy and Fermi Resonance.

Recommended Text Books:

1. Chemical Applications of Group Theory, F.A.Cotton Wiley Eastern Limited, New Delhi.
2. Group Theory and its Applications to Chemistry, K.V.Ramana, Tata McGraw-Hill Publishing Company Limited New Delhi.
3. Introductory Quantum Chemistry, A.K.Chandra, TATA MCGRAW-HILL Publishing Company Ltd., New Delhi.
4. Quantum Chemistry, Iran Levine, Pearson Education.
5. Theoretical Chemistry, S.Glastone.



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**THIRD SEMESTER**  
PAPER-III: STATISTICAL THERMODYNAMICS AND SOLUTION  
EQUILIBRIA OF PROTON LIGAND COMPELXES  
(Effective from the 2016-17 admitted Batch)

UNIT-I:

Statistical mechanics : Ensembles (Canonical and micro canonical ) –Basic definition distribution and microstates ,thermodynamic probability . The classical distribution law . The Maxwell – Boltzmann distribution law ,method of lagrangian multiplies ,indistinguishable particles, quantum statistics – Bose –Einstein and Fermi Dirac Statistics, Conditions for the applicability of Maxwell – Boltzmann statistics, Bose – Einstein statistics and radiation, extreme gas degeneration, degenerate electron gas.

UNIT-II :

Statistical thermodynamics: Partition function. Thermodynamics functions from partition functions for multiple degree of freedom, theories of heat capacities of solids, stastical evaluation of entropy, comparison of statistical values with third law entropies (thermal entropies).

UNIT-III :

Gran analysis of acid base titrations –Determination of Carbonate content and correction factors for  $P^H$  meter dial readings ; Secondary formation function  $nbarh$ ; Calculation of stability constants of proton ligand complexes –successive approximation method –half  $nbarh$  method; Simulation of  $p^H$  metric titration data for proton –ligand systems.

UNIT –IV :

Prediction of proton –ligand formation constants using Molecular mechanics/ Quantum Chemical methods; Effect of solvent on stability – Abraham multi layer model –LD model; Components of expert systems – knowledge base, inference engine and user interface.

Suggested Books:

1. M.T.Beck,Complex Equilibria,1991
2. Alcock,solution Equilibria,1992
3. Richard E. Dickerson,Molecular Thermodynamics
4. S.Glasstone, Theoretical Chemistry
5. S.Glasstone,Thermodynamics for Chemists
6. C.Andrews ,Equilibrium Statistical Mechanics
7. Davies, Thermodynamics
8. Yeremin, Thermodynamics
9. J. Rajaram, and T.C. Kuriacose, Thermodynamics for student of chemistry.



ADIKAVI NANNAYA UNIVERSITY  
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**THIRD SEMESTER**

PAPER –IV : INSTRUMENTATION

**(Effective from the 2016-17 admitted Batch)**

UNIT –I :

Spectrophotometry – deviations from Beer - lamberts law Instrumentation –Errors in Spectrophotometry – photometric titrations composition and stability constants of mononuclear complexes by linear extrapolation methods.Fundamental principles of Fluorescence spectroscopy and basic instrumentation of spectrofluorimeter.

UNIT –II :

Chromatographic methods - Ion exchange chromatography separation of transition metal ion – solvent extraction - partition coefficient – distribution ratio - classification of solvent extraction systems and evaluation of formation constants and applications Gas liquid Chromatography principal - Instrumentation - retention time - retention volume – Elementary principles of HPLC and hyphenated instruments.

UNIT –III :

Techniques and instrumentation of IR , Microwave and Raman. Theory and instrumentation Atomic absorption spectroscopy - Atomic emission spectroscopy with ICP source - Elementary principles of laser mass spectrometry.

UNIT – IV :

Polarography - Introduction - types of currents - qualitative and quantitative aspects of polarography – analytical applications to organic and inorganic compounds - Evaluation of stability constants by deford and hume method – amperometric titrations. Principles of thermo gravimetry - Apparatus and working, Differential methods of analysis - principle factors affecting DTA curve. Application of DTA .

Suggested Books:

1. Quantitative Analysis – R.A.Day and A.L.Underwood
2. Quantitative Inorganic Analysis – A . I . Vogel
3. Spectroscopy S.Walker and Straw Volumes I, II and III
4. Instrumental Methods of Chemical Analysis - Kudesla Snwheny (Pragati Prallesan Meerut) 1988.
5. Instrumental Techniques for Analytical Chemistry-Frank settle (Pearson Eddition )2004.



2015-16

DEPARTMENT OF PHYSICAL AND NUCLEAR CHEMISTRY AND CHEMICAL  
OCEANOGRAPHY  
ANDHRA UNIVERSITY

S.K. Anju Begum

M.Sc. (Final) PHYSICAL CHEMISTRY  
IV SEMESTER

Paper I: ADVANCED CHEMICAL KINETICS AND PHOTO CHEMISTRY

**UNIT - I:**

Correlation analysis - Marcus Theory of electron transfer adiabatic and non adiabatic electron transfer - outer and inner sphere mechanism - effect of solvent on rates - effect of dielectric constants on ion - ion, ion - molecule, molecule - molecule reactions - BET isotherm determination of surface area - semiconductor catalysis - Homogeneous catalysis - acid base and redox catalysis.

**UNIT - II:**

Correlation of rate with  $H_0$ ,  $H_R$ , acidity functions and their use in the illustration of mechanism in acid base catalysis - catalysis by transition metal ions and their complexes - Industrially important processes - substitution reactions in Octahedral complexes.

**UNIT - III:**

Photochemistry : Absorption Excitation - photochemical laws - quantum yield of electronically excited states - measurements of life times - Flash photolysis - Stopped flow Techniques: energy dissipation by radiative and non - radiative processes, absorption spectra - Franck - Condon principles. Photochemical stages - Primary processes and secondary processes - Rate constants and life times of reactive excited states.

**UNIT - IV:**

Properties of excited states : structure, dipole moment acid base strengths - reactivity, kinetics of bimolecular processes - quenching, Stern - Volmer equation. Photo-reduction and oxidation. Cyclo addition reactions, Woodward - Hoffmann's rules.

**Suggested Books**

1. Chemical kinetics by Laidler
2. Physical Organic Chemistry by Wiberg
3. Kinetics and mechanism by Frost and Pearson
4. Techniques in Organic Reaction Mechanism by Zuman and Patel.
5. Chemical kinetics - The study of Reaction Rates in solution - Kenneth A. CONNORS - VCH Publishers.
6. Fundamentals of photochemistry - k.k.Rohatgi - Mukherjee
7. Photochemistry - Cox and Kemp
8. Photochemistry - Calvert by Pitts,

ANDHRA UNIVERSITY  
M.Sc. (Final) PHYSICAL CHEMISTRY  
IV SEMESTER

PAPER II: QUANTUM CHEMISTRY-III, NUMERICAL METHODS FOR CHEMISTS AND  
ADVANCED COMPUTER PROGRAMMING

QUANTUM CHEMISTRY:

**UNIT I:**

Approximation methods. Variation method and its application- Ground state of helium atom- ground state energy of one dimensional harmonic oscillator- Perturbation theory- time dependent perturbation- First and second order approximations- Stark effect- Calculation of first and second order perturbation effects on simple systems. Time dependent perturbations- Interaction of matter with radiation; Zeeman effect- Derivation of Fermi's Golden rule.

**UNIT II:**

Born-Oppenheimer approximation- The LCAO approximation- application to  $H_2^+$  ion- MO theory and its application- Correlation diagrams- Hartee-Fock self consistent field method. Chemical bonding in poly atomic molecules- Hybrid orbitals- Huckel theory of linear conjugated systems and cyclic conjugated molecules- Aromaticity- Calculations of delocalization energy of simple conjugated systems.

**UNIT III:**

**NUMERICAL METHODS:**

Precision and Accuracy, Determinate and indeterminate errors, computational errors truncation and rounding off errors, algorithm errors-absolute and relative errors-Error propagation. Measures of Dispersion – range, arithmetic mean, mean deviation variance and standard deviation – moments – skewness and kurtosis.

Interpolation: interpolation for linear fit, linear interpolation in non-linear fit, polynomial interpolation – Lagrange interpolation formula – Application to complex equilibria.

Numerical techniques of solving ordinary first order differential equations:- Euler's method, Predictor-corrector method, Rungae-Kutta method- application to chemical kinetics.

**UNIT IV:**

Fortan programming: Concepts of algorithms and flow-charts, logical variables and logical expressions, order of evaluation of logical expressions, logical assignment statements, logical if and block if statements, computed GO TO statement, writing a decision, chain of decisions, arrays-one dimensional and two dimensional arrays. DO loop and its application in Input and Output statements. Statement Function, Function and Subroutine sub-programs.

Application to Chemical Problems: : Flowcharts and Programs for

1. Calculation of skewness and kurtosis of replicate measurements.
2. Polynomial interpolation using Lagrange interpolation formula
3. Euler's step by step iteration method for solving ordinary first order differential equation.
4. Calculation of first order rate constant of acid catalyzed hydrolysis of an ester, using a subprogram for the calculation of slope by linear least-squares method.

**RECOMMENDED TEXT BOOKS:**

1. Introductory Quantum Chemistry, A.K.Chandra, TATA McGRAW-HILL Publishing company Ltd., New Delhi.
2. Quantum Chemistry, Iran Levine, Pearson Education.
3. Theoretical Chemistry, S.Glastone
4. Computer programming in Fortan-IV by V.Rajaraman, Prentice-Hall of India Pvt. Ltd., New Delhi.

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IV SEMESTER**

**Paper- III: ADVANCED THERMODYNAMICS AND SOLUTION EQUILIBRIA OF  
METAL-LIGAND COMPLEXES**

**UNIT - I:**

Thermodynamics and phase changes – Free energy and meaning of phase changes, calculation of phase equilibrium curves, Pressure as a measure of escaping tendency, single components phase diagrams, free energy diagrams and the critical point, first and second order transitions, partial molar quantities and their determination, chemical potential and phase rule. Thermodynamics of chemical reactions, Real gases and fugacity and its determination from PVT data.

**UNIT - II:**

Thermodynamics of living systems: Simultaneous coupled reactions, coupled reactions and metabolism free energy utilization, free energy utilization in metabolism, citric acid cycle, Terminal oxidation, Chain aerobic metabolism. Elementary aspects of non-equilibrium thermodynamics conservation of mass and energy – entropy production and flow in open system – Onsager theory – principles of microscopic reversibility.

**UNIT - III:**

Calvin Wilson Titration Techniques for metal ligand complexes – Determination of Stability constants using formation function, hydroxylated complexes stability constant by Martell method – Leden's procedure. Solution of a non – linear function of two variables – A algorithm of MINQUAD programme – criteria of best fit model.

**UNIT - IV:**

Prediction of metal ligand stability constants – Irving and William order. Neural networks – Processing element, Transfer function, Training algorithm – BFGS, MAFQUARDT and back propagation. Multi layer perception and radial basis function NN's. Features of Trajan software – Input Output – Intelligent problem solver.

**Suggested Books**

1. M.T.Beck, complex Equilibria, 1991
2. Alcock, Solution Equilibria, 1992
3. Neural Networks systems Techniques and Applications – Ciornelices T. leondes; Vol.1:Algorithms and Architectures.
4. J.Zupan, Neural Network for Chemists, VCH,1992
5. Richard E.Dickerson , molecular Thermodynamics
6. S.Glasstone, Theroretical Chemistry
7. S.Glasstone, Thermodynamics for chemists
8. C.Andrews, Equilibrium Statistical Mechanics
9. Davies, Thermodynamics
10. Yereimin, thermodynamics
11. J.Rajaram, and T.C.Kuriacose, Thermodynamics for students of chemistry.

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IV SEMESTER

Paper IV: SPECTROSCOPY  
(Common for Physical Chemistry and Marine Chemistry)  
Effective from 2010-11 admitted batch

**UNIT - I:**

Rotational (Microwave) Spectroscopy - The rotational energies of polyatomic molecules - Rotational selection rules for linear molecules - symmetric top - Asymmetric top molecules - degeneracy of rotational energy levels - The Stark effect in molecular rotational spectra - Molecular Rotation - Nuclear spin coupling - Application of Rotation Spectra - Determination of Inter Nuclear distance - Moment of Inertia and Dipole moment.

**UNIT - II:**

Rotation vibration spectra - selection rules and transitions for the rigid rotator - harmonic oscillator model - parallel and perpendicular bands of linear and symmetric top molecules - Raman active fundamental - Criterion for their appearance - Rotational and vibrational Raman; Raman and Infrared studies of  $AB_2$ ,  $AB_3$  type molecules - correlation of infrared and Raman spectra.

**UNIT - III:**

ESR spectroscopy - the resonance condition - anisotropy in g-factor - Theory and applications of ESR method - Crystalline solids - free radicals in solutions - interpretation of ESR spectra of typical radicals and ion like  $Mn^{2+}$ ,  $Cr^{3+}$ ,  $Cu^{2+}$  - Hyperfine interactions in the following systems. P-Benzoquinone - (semi) naphthalene radical anion and anthracene radical anion.

NMR spectroscopy - chemical shifts and shielding - some application of NMR spectra - effect of chemical exchange on spectra - Effect of quadrupole interactions on NMR spectra - an elementary study of isotopes other than proton - Fluorine -19, phosphorous-31, Carbon-13, Boron-11 - NQR spectroscopy - Electric field gradient and quadrupole coupling constant - Splitting in NQR spectra - Applications of NQR spectroscopy

**UNIT - IV:**

Electron Spectroscopy - basic principles of Photo Electron Spectroscopy (PES) - Koopman's theorem and chemical shift. PES of simple molecules. Electron Spectroscopy for Chemical Analysis (ESCA) - Chemical information from ESCA. Principles and applications of Auger Electron Spectroscopy (AES) - comparison between PES, ESCA and AES - X-ray methods - X-ray fluorescence (XRF) - techniques of X-ray absorption and X-ray emission methods and their applications.

**Suggested Books**

1. Spectroscopy S. Walker and straw, volumes I, II and III
2. Molecular Spectroscopy, - Gordon M. barrow
3. Fundamentals of Molecular Spectroscopy - Banwell
4. Spectroscopy - B.K.Sharma - Goe! Publishing House Meerut. 1990.

AC IIIsem - Paper 1 Syllabus.doc

AC IIIsem - Paper 2 Syllabus.doc

AC IIIsem - Paper 3 Syllabus.doc

AC IIIsem - Paper 4 Syllabus.doc

AC IVsem - Paper 1 Syllabus.doc

AC IVsem - Paper 2 Syllabus.doc

AC IVsem - Paper 3 Syllabus.doc

AC IVsem - Paper 4 Syllabus.doc

M.Sc\_Analytical Chemistry Practical\_Syllabus.doc

**Adikavi Nannaya University :: Rajahmundry**  
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**M.Sc. (Final) Chemistry Syllabus for III-Semester**  
**Specialization: Analytical Chemistry**  
**Paper - I: Separation Methods – I**  
(Effective from 2016-17 Admitted batch)

**Unit – I Chromatography - 1**

**Chromatography:** classification of different chromatographic methods, methods of development-Elution development, Gradient elution development, displacement development, and frontal analysis.

Principles of chromatography, different migration, adsorption phenomena, partition, adsorption coefficient, retardation factor, retention time and volume, column capacity, temperature effects, partition isotherm.

Dynamics of chromatography-efficiency of chromatographic column, zone spreading, High Equivalent Theoretical Plate (HETP), Van Deemter equation, resolution, choice of column, length and flow velocity, qualitative and quantitative analysis.

**Unit - II Chromatography – 2**

**Column chromatography (adsorption chromatography):** principles, general aspects, adsorption isotherms, chromatographic media, nature of forces between adsorbent and solutes, eluents (mobile phase), column chromatography without detectors and liquid chromatography with detectors and applications.

**Gel Exclusion chromatography or Gel filtration chromatography:** principles, properties of xerogels, apparatus and detectors, resolution of gel type, applications to organic compounds.

**Capillary Electrophoresis :** Principle, Details of the Instrument, Applications to Inorganic and Organic compounds.

**Unit – III Chromatography – 3**

**Gas chromatography:** Theory, Instrument description of equipment and different parts, columns (packed and capillary columns), detector specifications-thermal conductivity detector, flame ionization detector, electron capture detector, nitrogen-phosphorus detector, photo ionization detector, programmed temperature gas chromatography; applications in the analysis of gases, petroleum products etc., other detectors used their Principles and Applications.

**Inorganic molecular sieves:** structure of zeolites, crystals, types of sieves, application in the separation of gases including hydrocarbons, ion exclusion-principles and applications,

Counter current chromatography-principles and application, Affinity chromatography- principles and applications

### ***GC-MS – Introduction***

Instrumentation – GC – MS interface – Mass spectrometer (MS) Instrument operation, processing GC – MS data – ion chromatogram Library searching – Quantitative measurement – sample preparation Selected ion monitoring – Application of GC-MS for Trace constituents. Drugs analysis, Environmental analysis and others.

## **Unit – IV Chromatography – 4**

***Liquid-liquid partition chromatography:*** principle, supports, partitioning liquids, eluents, reverse phase chromatography, apparatus, applications

***High performance liquid chromatography:*** Theory, Instrument description of the different parts of the equipment, columns, detectors-UV detector, refractometric detector, Fluorescence detector, Diode Array detector, applications in the separation of organic compounds, names of other detectors used their Principles and Applications.

***LC-MS*** – Introduction – Instrumentation – liquid chromatograph – Mass spectrometer Interface – Instrumental details – Processing LC-MS data – ion chromatograms – Library searching – Quantitative measurements. Sample preparation – selected ion monitoring. Application of LC-MS for Drug analysis, Environmental samples and others.

### **Text books:**

1. R.P.W Scott, Techniques and practice of Chromatography, Marel Dekker Inc., New York
2. M.N. Sastri ,Separation methods, Himalaya Publishing Company, Mumbai

### **Reference books:**

1. E. Helfman, Chromatography, Van Nostrand, Reinhold, New York
2. E. Lederer and M. Lederer, Chromatography, Elsevier, Amsterdam.
3. Chemical separation methods, John A Dean, Von Nostrand Reinhold, New York
4. R.P.W Scott, Techniques and practice of Chromatography, Marel Dekker Inc., New York
5. H.M Mc Nair and J. M. Miller, Basic Gas Chromatography, John Wiley, New York
6. W. Jeumings, Analytical Gas chromatography, Academic Press, New York
7. H. Eugelhardt (ed), Practice of HPLC, Springer Verrag, Berrin

**Adikavi Nannaya University :: Rajahmundry**  
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**M.Sc. (Final) Chemistry Syllabus for III-Semester**  
**Specialization: Analytical Chemistry**  
**Paper- II: Quality control and Traditional methods of Analysis-I**  
(Effective from 2016-17 Admitted batch)

**Unit – I: Quality control in Analytical Chemistry**

- (a) **Characteristics of an analysis:** quality of an analytical procedure, limit of detection, sensitivity, safety, cost measurability, selectivity and specificity, quality control-principles of Ruggedness test, control charts, Youden plot, and ranking test.
- (b) **Evaluation and reliability of analytical data:** limitation of analytical methods, accuracy, precision, errors in chemical analysis, classification of errors, minimization of errors, significant figures, computations and propagation of errors.
- (c) **Statistical analysis:** Mean deviation, Standard deviation, coefficient of variance, normal distribution, F test, T test, rejection of results, presentation of data.
- (d) **Quality assurance and management systems:** elements of quality assurance, quality assurance in design, development, production and services, quality and quantity management system, **ISO 9000** and **ISO 14000** series-meaning of quality, quality process model, customer requirement of quality calibration and testing, statistical process control, process control tools, control chart, statistical quality control, acceptance sampling.  
Good laboratory practices (GLP) – need for GLP, GLP implementation and organization, GLP status in India.
- (e) Brief out line of ICH guide lines on drug substances and products.

**Unit – II Decomposition techniques in analysis**

**(a) Inorganic Compounds**

Principle of decomposition and Dissolution. Difference between dissolution / decomposition of Organic and Inorganic substances.

Importance of Decomposition Techniques in Analysis.

Principle of Dissolution of an inorganic substance.

Decomposition of samples with acids – H<sub>2</sub>O, HCl, HF, HNO<sub>3</sub>, H<sub>2</sub>SO<sub>4</sub> and HClO<sub>4</sub>

Decomposition of samples by fusion, Principle and with two examples each

Alkali Fusion--- Na<sub>2</sub>CO<sub>3</sub>, NaOH,

Acidic Fusion--- Sodium Hydro Sulphate, Sodium Pyro Sulphate

Oxidation Fusion---Na<sub>2</sub>O<sub>2</sub>, Sodium Chlorate

Reductive Fusion Na<sub>2</sub>CO<sub>3</sub> + Na<sub>4</sub>BO<sub>4</sub>

What is Sintering process, How is it different from Fusion.

Fusion with alkali carbonates, alkali hydroxides, Sodium Peroxide

Decomposition of samples by sintering with sodium peroxide, sodium carbonate.

Principles of decomposition at high temperatures, high pressures .

Principles of Microwave and ultrasonic decomposition techniques.



### **(b) Organic Compounds**

Principles of solubility of organic compounds, non polar, polar solvents.  
Recrystallisation methods and application of solubility and Recrystallisation.

### **Unit – III Oxidant systems – Principles and applications in analysis**

Analytical chemistry of some selected oxidant systems – formal, standard and normal potentials in various media, species responsible for the oxidation properties, stability of the solutions, standardization, requirement for the selections of the oxidants, selection of suitable indicators for Oxidant systems.

- a) Inorganic Systems Mn (III), Mn (VII), Ce (IV), Cr (VI), V (V), periodate, iodate,
- b) Organic Systems chloramine-T.

### **Unit – IV Organic Functional group analysis**

Classification of functional groups with suitable examples.

Determination of:

- 1) Functional groups imparting acidic nature – thiol, enediol, phenolic hydroxyl.
- 2) Functional groups imparting basic nature – Aliphatic and Aromatic primary, secondary and tertiary amines – hydrazine derivatives.
- 3) Functional groups which impart neither acidic nor basic nature – Aldehydes, Ketones, Nitro, Methoxy, Olifinic.

### **Text books:**

1. Technical methods of analysis – Griffin, Mc Graw Hill Book Co.
2. Chemical Separation and measurements – D.G Peterseti, John M.Haves Sanders Co.
3. Chemical analysis – H.A Laitinan, Mc Graw Hill Book Co.
4. Newer redox titrants – Berka, Zyka and Vulterin, Pergamon Press
5. Volumetric Analysis, Vol III – I.M Kolthoff and R. Belcher, Interscience Public, New York
6. Vogel's Text Book of Inorganic Quantitative Analysis – J. Bassett et al, ELBS
7. Organic functional groups – S. Siggia

### **Reference Books:**

1. D.A Skoog, D.M West and F.J Holler, Analytical Chemistry, An Introduction, Sanders College Publishing, New York
2. K.V.S.G Murali Krishna, An Introduction ISO 9000, ISO 1400 Series, Environmental Management
3. Quality Assurance and Good Laboratory Practices, Prof. Y. Anjaneyulu, In Now Publication, New York
4. Quality Assurance in Analytical Chemistry – G.Kateman and F.W Pijpers, John Wiley and Sons, New York
5. Quantitative Chemical Analysis – I.M Kolthoff, E.B Sandel, E.J Meehan, S. Bruckenstein, Macmillan Company, London
6. Decomposition Techniques in Inorganic Analysis – J.Dolezal, P.Povondra, Z.Sulcek

**Adikavi Nannaya University :: Rajahmundry**  
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**Paper – III: Applied Analysis-I**  
(Effective from 2016-17 Admitted batch)

**Unit – I Analysis of Ores**

- (a) General techniques of analysis applied to complex materials - Scope of metallurgical analysis -  
General methods of dissolution of complex materials - Various chemical methods for the effective separation of the constituents in the complex materials.
- (b) Analysis of ores: Iron ore- Analysis of the Constituents – Moisture , loss of ignition, Total Iron, ferrous Iron ,Ferric Iron, alumina , silica, Titania, Lime, Magnesia, Sulphur, phosphorous, manganese, alkalies, combined water, Carbon in blast furnace, flue dust and sinter.
- (c) Manganese Ore - Analysis of the Constituents – Total Manganese,  $MnO_2$ ,  $SiO_2$ ,  $BaO$ ,  $Fe_2O_3$ ,  $Al_2O_3$ ,  $CaO$ , P and S
- (d) Chromite Ore - Analysis of the Constituents – Chromium,  $SiO_2$ ,  $FeO$ ,  $Al_2O_3$   $CaO$ , &  $MgO$ .
- (e) Phosphate rock Ore - Analysis of the Constituents -  $CaO$ ,  $P_2O_5$ , F,  $SiO_2$ ,  $CO_2$ , S,  $Na_2O$ ,  $Al_2O_3$ ,  $Fe_2O_3$ ,  $MgO$ ,  $K_2O$ ,  $Cl$ ,  $MnO$ . Organic carbon, Moisture, Loss of ignition.
- (f) Aluminium Ore (Bauxite) - Analysis of the Constituents – Silica, Alumina,  $Fe_2O_3$ , Titania,  $MnO$ ,  $P_2O_5$ ,  $CaO$ ,  $MgO$ , vanadium, zirconium, and alkalies.

**Unit – II Analysis of Finished Products – I**

- (a) Analysis of steel for C, Si, S, P, Mn, Ni, Cr; Mg and analysis of blast furnace slag .
- (b) Analysis of refractory materials: fire clay, flour spar, and magnesite
- (c) Analysis of fluxes - limestone and dolomite.

**Unit – III Analysis of Finished Products – II**

- (a) Chemical Analysis of cement-silica,  $NH_4OH$  group, ferric oxide, alumina, lime, magnesia, Sulphide Sulphur ,  $K_2O$ ,  $Na_2O$ , free  $CaO$  in Cement and Clinker,  $SO_3$  and loss on ignition.
- (b) Analysis of oils - saponification number, iodine number, and acid number..
- (c) Analysis of soaps - moisture, volatile matter, total alkali, total fatty matter, free caustic alkali or free fatty acids, sodium silicate , chloride.
- (d) Analysis of paints-vehicle and pigment,  $BaSO_4$ , total lead and lead chromate

## Unit – IV Assessment of water Quality

Sources of water, classification of water for different uses, types of water pollutants and their effects,

Analytical methods for the determination of the following ions in water:

Anions:  $\text{CO}_3^{2-}$ ,  $\text{HCO}_3^-$ ,  $\text{F}^-$ ,  $\text{Cl}^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{PO}_4^{3-}$ ,  $\text{NO}_3^-$ ,  $\text{NO}_2^-$ ,  $\text{CN}^-$ ,  $\text{S}^{2-}$

Cations:  $\text{Fe}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{Cr}^{3+}$ ,  $\text{As}^{5+}$ ,  $\text{Pb}^{2+}$ ,  $\text{Hg}^{2+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Cd}^{2+}$ ,  $\text{Co}^{2+}$

Determination of Dissolved oxygen (D.O), Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD), standards for drinking water.

### Text books

1. Handbook of Analytical Control of Iron and Steel Production, Harrison John, Wiley 1979
2. Standard methods of Chemical Analysis, Welcher
3. Technical Methods of Analysis, Griffin, Mc Graw Hill
4. Commercial Methods of Analysis, Foster Dee Snel and Frank M. Griffin, Mc Graw Hill Book Co.
5. Water Pollution, Lalude, Mc Graw Hill
6. Environmental Chemistry, Anil Kumar De, Wiley Eastern Ltd.
7. Environmental Analysis, S.M. Khopkar (IIT Bombay)

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**Paper – IV: INSTRUMENTAL METHODS OF ANALYSIS - I**

(Effective from 2016-17 Admitted batch)

**Unit – I : Spectroscopic Methods - 1**

- (a) **UV-Visible Spectroscopy:** laws of absorption, deviation from Beer's law, single and double beam spectrophotometers-instrumentation, sources of radiation, detectors, qualitative analysis by absorption measurements, general precautions in colorimetric determinations, determination of certain metal ions by using ligands –  $\text{Fe}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Al}^{3+}$ ,  $\text{NH}_4^+$ ,  $\text{Cr}^{3+}$ ,  $\text{Cr}^{6+}$ ,  $\text{Co}^{3+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Ni}^{2+}$  and anions –  $\text{NO}_2^-$ ,  $\text{PO}_4^{3-}$  using suitable reagents, simultaneous determinations of dichromate and permanganate in a mixture, spectrophotometric titrations, principle of diode array spectrophotometers.
- (b) **Spectrofluorimetry:** Theory of fluorescence, phosphorescence, factors affecting the above, quenching, relation between intensity of fluorescence and concentration, instrumentation, application with reference to  $\text{Al}^{3+}$ , chromium salts, fluorescence, thiamin (B1) and riboflavin (B2) in drug samples.

**Unit – II : Spectroscopic Methods - 2**

- (a) **Infrared spectroscopy:** units of frequency, wavelength and wave number molecular vibrations, factors influencing vibrational frequencies, instrumentation, sampling techniques, detectors, characteristic frequencies of organic molecules, qualitative and quantitative analysis with reference to (petroleum refinery and polymer industry), selected molecules like CO,  $\text{CO}_2$ , non-destructive IR method for the analysis of CO and other organic compounds, principles of Fourier transform IR.
- (b) **Raman Spectroscopy:** Raman effect and spectra, differences between Raman spectra and IR spectra, instrumentation, Raman spectra of CO,  $\text{CO}_2$ ,  $\text{N}_2\text{O}$ ,  $\text{H}_2\text{O}$ .

**Unit – III : Spectroscopic Methods -3**

- (a) **NMR Spectroscopy:** resonance condition, origin of NMR spectra, instrumentation, chemical shift, factors affecting chemical shift, shielding, spin-spin splitting, mechanism for spin-spin coupling, interpretation of NMR spectra of typical organic compounds, factors influencing NMR spectra, fast chemical reactions, magnitude of I, nuclei with quadrupole moments, FT NMR, study of isotopes other than proton- $^{13}\text{C}$ ,  $^{15}\text{N}$ ,  $^{19}\text{F}$ ,  $^{31}\text{P}$ ,  $^{11}\text{B}$ , double resonance, spin tickling, shift reagents, applications.

(b) *ESR Spectroscopy*: principle, g value, hyper fine splitting, qualitative analysis, Krammers degeneracy, fine splitting, instrumentation, introduction to double resonance technique, difference between ESR and NMR spectra, quantitative analysis, application to study of free radicals and other analytical applications.

#### **Unit – IV : Spectroscopic Methods -4**

(a) *Mass Spectroscopy*: Principle, basic instrumentation, energetics of ion formation, types of peaks observed, resolution, qualitative analysis, molecular weight determination, quantitative analysis, advantages

(b) *X-ray Spectroscopy (XRF)*: chemical analysis by X-ray spectrometers, energy dispersive and wavelength dispersive techniques, evaluation methods, instrumentation, matrix effects, applications.

#### **Text Books:**

1. Instrumental methods of analysis – H.H Willard, Meritt Jr. and J.A Dean
2. Principles of instrumental analysis – Skoog and West
3. Vogels Textbook of Quantitative Inorganic analysis – J. Basset, R.C Denney, G.H Jefferey and J.Madhan
4. Instrumental methods of analysis – B.K Sarma, Goel Publishing House, Meerut
5. Instrumental methods of Analysis – Chatwal and Anand
6. Instrumental methods of Analysis – Ewing
7. Handbook of ICP
8. The ICP – Bogdain B.

#### **Reference Books:**

1. Applications of ICP-MS, A.R Date and A.L Glay, London (Eds), Blackie, London
2. A. Moutaser and D.W Golightly (Eds), ICP in Analytical Atomic Spectrometry, VeH Publishers, New York
3. G.I Moore, Introduction to ICP emission Spectrometry in Analytical Spectroscopy, Elsevier, Amsterdam

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**Paper-1: Separation Methods – II**  
(Effective from 2016-17 Admitted batch)

**Unit – I Chromatography - 5**

- (a) **Paper chromatography:** principle, papers as a chromatographic medium, modified papers, solvent systems, mechanism of paper chromatography, experimental technique, different development methods-ascending, descending, horizontal, circular spreading, multiple development, two dimensional development, reverse phase paper chromatographic technique-visualization and evaluation of chromatograms, applications.
- (b) **Thin layer chromatography:** principle, chromatographic media-coating materials, applications, activation of adsorbent, sample development, solvent systems, development of chromatoplate, types of development, visualization methods, documentation, applications in the separation, HPTLC-principle, technique, applications.

**Unit – II Chromatography - 6**

- (a) **Ion Exchange:** principles of ion-exchange systems, synthetic ion-exchange resins, properties of anion and cation exchange resins, ion-exchange mechanism, ion-exchange equilibria, selectivity, ion-exchange capacity, applications of ion-exchangers in different fields.
- (b) **Ion exchange chromatography:** Principle, Equipment, Application Specifically Separations of Lanthanides, Actinides, amino acids.
- (c) **Ion chromatography:** principles of separation, instrumentation, detectors, separation of cations and anions, applications in the analysis of water and air pollutants.

**Unit – III Sampling of Solids, Liquids and Gases**

**Sampling:** Basis of sampling, purpose of sampling, homogeneous and heterogeneous samples, statistical criteria for good sampling, sample size, sampling unit, gross sample, laboratory sample.

Sampling of Solids: Cone and Quartering method, Long pile and alternative shovel method, precautions in preservation of solid samples, sampling of metals and other solids rods, wires, sheets, plates, especially Gold, Silver, Iron and other metals.

Sampling of different types of liquids: different sampling techniques, sampling of drinking water, industrial effluents, precautions in sampling and preservation of collected liquid samples.

Sampling of gases: sampling and Preconcentration by adsorption or absorption method, instantaneous monitoring, sampling in samplers and subsequent monitoring, different types of gas samplers, precautions in preservation of samples, systematic sampling and random sampling.

#### **Unit – IV Importance of Analytical chemistry & Solvent Extraction**

**(a) Importance of Analytical Chemistry to Industrial Research:** Importance of Qualitative and Quantitative analysis in research and development, industries and other branches of science.

Development and validation of an analytical method, units, concentrations, calculations, standards, chemical reactions, expressions of concentrations, importance of separation methods with examples.

**(b) Solvent Extraction:** principles and processes of solvent extraction, Distribution Law and Partition coefficient, nature of partition forces, different types of solvent extraction systems – Batch extraction, Continuous extraction, Counter current extraction, solvent extraction systems, applications in metallurgy, general applications in analysis and pre-concentration, special extraction systems like crown ethers, super fluid and surfactant extractions-examples.

#### **Text books:**

1. R.P.W Scott, Techniques and practice of Chromatography, Marel Dekker Inc., New York
2. Separation methods, M.N Sastri, Himalaya Publishing Company, Mumbai

#### **Reference books:**

1. E. Helfman, Chromatography, Van Nostrand, Reinhold, New York
2. E. Lederer and M. Lederer, Chromatography, Elsevier, Amsterdam.
3. Chemical separation methods, John A Dean, Von Nostrand Reinhold, New York
4. R.P.W Scott, Techniques and practice of Chromatography, Marel Dekker Inc., New York
5. E.Stahl, Thin layer chromatography, Academic Press, New York
6. James, G.Tartor (Ion chromatography)

**Adikavi Nannaya University :: Rajahmundry**  
**Department of Chemistry**  
**M.Sc. (Final) Chemistry Syllabus for IV-Semester**  
**Specialization: Analytical Chemistry**  
**Paper – II : Traditional Methods of Analysis - II**  
(Effective from 2016-17 Admitted batch)

**Unit – I Precipitation methods - 1**

- (a) Crystal habit and super saturation, nucleation and crystal growth, homogeneous and heterogeneous nucleation, solubility and particle size, colloids, completeness of precipitation, effect of excess precipitant, pH, complex formation, temperature, purity of precipitates, aging.
- (b) **Co-precipitation and post precipitation** : theory of adsorption of salts having an ion in common with the main precipitate, co-precipitation in colloidal precipitates, adsorption of solvents, mixed crystal formation by occlusion and entrapment, re-precipitation with examples, Post-precipitation – theory of post-precipitation, examples of post-precipitation, conditions for obtaining pure and quantitative precipitates.
- (c) **Precipitation Titrations**: Principle, Indicators for precipitation titrations, determination of halides.

**Unit – II Precipitation methods - 2**

- (a) **Precipitation from Homogeneous Solution (PFHS)**: theory of PFHS, methods of PFHS – increase in pH, decrease in pH, cation release, anion release, reagent synthesis, change in oxidation state, photochemical reactions, precipitation from mixed solvents. Applications of PFHS methods.
- (b) **Gravimetric determinations**: nature of species, preparation of solutions, limitations, interferences, inorganic precipitants-chloride and sulphate, organic precipitants dimethyl glyoxime (DMG), oxine, benzidine, salicylaldehyde, benzoin oxime, sodium tetraphenyl boron, tetraphenyl arsonium chloride.
- (a) **Electro-gravimetric analysis**: principle, important terms in electrogravimetry, decomposition voltage or decomposition potential, over voltage and their importance, instrumentation, electrolysis at constant current, determination of  $\text{Cu}^{2+}$  by constant current electrolysis, electrolysis at controlled potentials, determination of Cu, Pb, Sn in brass and bronze by controlled potential electrolysis.

**Unit – III Reductant system – Principles and applications in analysis**

Analytical chemistry of some selected reductant systems – formal, standard and normal potentials in various media, stability of the solutions, species responsible for



the reduction properties, standardization, requirement for the selection of the reductants, selection of suitable indicators for various reductant systems,

- (a) Inorganic Systems – Cr (II), V (II), Ti (III), Sn (II), Fe (II) in  $\text{H}_3\text{PO}_4$  and hydrazine,
- (b) Organic Systems – hydroquinone and Ascorbic acid.

#### **Unit – IV Analysis of some selected Drugs:**

Basic considerations of drugs – Classification

Determination of the following Drugs:

- 1) Acetyl salicylic acid ( Antipyretic – Analgesic )
- 2) Testosterone, progesterone and cortisone (Steroids and corticoids)
- 3) Sulphadiazine ( sulphadruugs)
- 4) Phenobarbitone (Barbituric acid derivatives)
- 5) Chloramphenicol, Benzyl penicillin and Tetracycline (Antibiotics)
- 6) Thiamine (B1), Riboflavin (B2) and ascorbic acid (c) [Vitamins]
- 7) Isoniazid ( Antimicrobial agents)
- 8) Methyldopa (Antihypertensive agents)
- 9) Metronidazole (Antiamoebic agents).

#### **Text books:**

- 1. Technical methods of analysis – Griffin, Mc Graw Hill Book Co.
- 2. Chemical Separation and measurements – D.G Peterseti, John M.Haves Sanders Co.
- 3. Chemical analysis – H.A Laitinan, Mc Graw Hill Book Co.
- 4. Newer redox titrants – Berka, Zyka and Vulterin, Pergamon Press
- 5. Volumetric Analysis, Vol III – I.M Kolthoff and R.Belvher, Interscience Public, New York
- 6. Vogel's Text Book of norganic Quantitative Analysis – J.Bassett et al, ELBS
- 7. Pharmaceutical analysis – T. Higuchi, Brochmann hausfen

#### **Reference Books:**

- 1. D.A Skoog, D.M West and F.J Holler, Analytical Chemistry, An Introduction, Sanders College Publishing, New York
- 2. Quantitative Chemical Analysis – I.M Kolthoff, E.B Sandel, E.J Meehan, S. Bruckenstein, Macmillan Company, London

**Adikavi Nannaya University :: Rajahmundry**  
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**Paper – III: Applied Analysis – II**  
(Effective from 2016-17 Admitted batch)

**Unit – I Analysis of raw materials**

- (a) Analysis of non-ferrous alloys:
- (i) Brass – Analysis of the constituents – Cu, Zn, Sn, Pb and Fe.
  - (ii) Bronze - Analysis of the constituents – Cu, Sn, Zn, Pb and Fe.
  - (iii) Solder - Analysis of the constituents – Sn, Pb and Sb.
- (b) Analysis of Ferro alloys :
- (i) Ferro silicon - Analysis of the constituents – Si, C, P, S
  - (ii) Ferro vanadium - Analysis of the constituents – V, C, P, S, Si, Al.
  - (iii) Ferro manganese - Analysis of the constituents – Mn, S, C, P, Si
  - (iv) Silico manganese - Analysis of the constituents – Mn, S, C, P, Si
  - (v) Ferro chromium - Analysis of the constituents – Cr, C, Si.

**Unit – II Analysis of Soil, Fertilizer and Fuel**

- (a) Analysis of soils: sampling, determination of moisture, total N, P, Si, lime, humus nitrogen, alkali salts, soil absorption ratio.
- (b) Analysis of fertilizers: ammonical fertilizers, Phosphate fertilizers, Nitrate fertilizers.
- (c) Analysis of fuels: solid fuels-coal, proximate analysis, ultimate analysis, heating value, grading of coal based on Ultimate Heat Value(UHV).

**Unit – III Assessment of Air Quality**

Composition of pure air, classification of air pollutants, toxic elements present in dust and their sources – collection of air samples.

Sources, effects, control of pollution and chemical analysis for the following.

- (a) Primary pollutants:
- (i) Carbon compounds - Carbon monoxide(CO) and Carbon dioxide(CO<sub>2</sub>).
  - (ii) Sulphur compounds- sulphur dioxide (SO<sub>2</sub>), Sulphur trioxide (SO<sub>3</sub>) and Hydrogen Sulphide (H<sub>2</sub>S).
  - (iii) Nitrogen compounds - nitric oxide (NO), and nitrogen dioxide (NO<sub>2</sub>),
  - (iv) Hydrocarbons - Aliphatic hydrocarbons and polycyclic aromatic hydrocarbons (PAH).
  - (v) Particulate matter - Respirable and Suspended particulate matter, Inorganic and Organic particulates.

- (b) Secondary pollutants - ozone (O<sub>3</sub>), peroxy acetyl nitrate (PAN), peroxy benzyl nitrate (PBN)
- (c) Standards for ambient air quality.

#### **Unit- IV Kinetic Methods of Analysis & Non aqueous Titrimetry**

- (a) Kinetic methods of analysis: introduction, slow reactions, catalyzed reactions, methods of determination of catalyst concentration, extrapolation method for the determination of catalyst, variable time method, fixed time method, examples for the determination of toxic metals and anions using some typical kinetic reactions.
- (b) Non aqueous titrimetry : Classification of solvents and titrations for non aqueous titrimetry- Types of reactions - Indicators .
- (i) Determination of acids
  - (ii) Determination of bases
  - (iii) Karl-Fisher reagent for the determination of moisture content in drugs and other samples.

#### **Text books**

1. Chemical analysis – H.A Laitinan, Mc Graw Hill Book Co
2. Standard methods of Chemical Analysis, Welcher
2. Technical Methods of Analysis, Griffin, Mc Graw Hill
3. Commercial Methods of Analysis, Foster Dee Sneel and Frank M. Griffin, Mc Graw Hill Book Co.
4. Environmental Chemistry, Anil Kumar De, Wiley Eastern Ltd.
5. Environmental Analysis, S.M Khopkar (IIT Bombay)
6. Environmental Air Analysis, Trivedi and Kudesia, Akashdeep Pub.

**Adikavi Nannaya University :: Rajahmundry**  
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**Specialization: Analytical Chemistry**  
**Paper - IV: Instrumental Methods of Analysis -II**  
(Effective from 2016-17 Admitted batch)

**Unit – I: Spectro-analytical Methods of Analysis**

(a) *Flame photometry*: theory, instrumentation, combustion flames, detectors, and analysis of Na, K, Ca, Mg

(b) *Atomic Absorption Spectrometer*: theory, instrumentation, flame and non-flame techniques, resonance line sources, hollow cathode lamp, instrumentation, chemical and spectral interferences, applications with special reference to analysis of trace metals in oils, alloys and toxic metals in drinking water and effluents

(c) *Inductively coupled plasma spectrometer (ICP-AES, ICP-MS)*: principles, instrumentation, plasma, AES detectors, quadrupole mass spectrometers, difference between the two detectors, analysis methods for liquids and solids, applications in the analysis of trace and toxic metals in water, geological and industrial samples.

(d) *Arc and Spark spectrographic Direct analysis of solid for metals.*

**Unit – II Thermal methods of Analysis**

(a) Thermo gravimetry-theory, instrumentation, applications with special reference to  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ ,  $\text{CaC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ ,  $\text{CaCO}_3$ ,  $(\text{COOH})_2 \cdot 2\text{H}_2\text{O}$

(b) Differential thermal analysis-principle, instrumentation, difference between TG and DTA - applications with special reference to the clays and minerals, coals (fuels)

(c) Differential scanning calorimetry-principle, instrumentation, applications to inorganic materials like chlorates and per chlorates, ammonium nitrate, organic compounds and Drugs.

**Unit- III : Electro analytical Methods of Analysis - 1**

(a) *Voltametry and polarographic analysis* : principle of polarography, residual current, migration current, diffusion current, half-wave potential, Ilkovic equation, instrumentation, Dropping mercury electrode (DME), advantages and disadvantages of DME, qualitative and quantitative analysis of inorganic ions-Cu, Bi, Pb, Cd, Zn, AC polarography, pulse polarography

(b) *Anode stripping voltametry*: principle, instrumentation, Hanging mercury drop electrode, application in the analysis of Pb and Cd in environmental samples, principle of cathode stripping voltametry.

- (c) **Coulometric analysis:** principles of coulometric analysis with constant current, coulometric analysis with controlled potential, applications of coulometric methods for the analysis of cations-As (III), Fe (II) and I<sup>-</sup> and S<sup>2-</sup> by using I<sub>2</sub> liberations and Ce<sup>4+</sup> liberation in solutions

#### **Unit – IV Electro Analytical and Radio chemical methods of analysis - 2**

- (a) **Ion Selective Electrodes:** reference electrodes - hydrogen electrode, calomel electrode, silver chloride electrode; indicator electrodes – hydrogen and glass electrodes, theory of membrane potentials and liquid junction potentials, types of ion selective electrodes, basic properties, potentials and construction, calibration of ion selective electrodes, ion selective electrodes with fixed membrane sites, silver, lead, cadmium, sulfide, fluoride, cyanide and glass electrodes, applications in the analysis of air and water pollutants, principles of liquid membrane, gas sensing and enzyme based electrode
- (b) **Radio chemical methods of analysis:** detection and measurement of radioactivity, introduction to radioactive tracers, applications of tracer technique, isotope dilution analysis - applications, activation analysis – application, advantages and disadvantages, radio carbon dating technique

#### **Text Books:**

1. Instrumental methods of analysis – H.H Willard, Meritt Jr. and J.A Dean
2. Principles of instrumental analysis – Skoog and West
1. Vogels Textbook of Quantitative Inorganic analysis – J. Basset, R.C Denney, G.H Jefferey and J.Madhan
2. Instrumental methods of analysis – B.K Sarma, Goel Publishing House, Meerut
3. Instrumental methods of Analysis – Chatwal and Anand
4. Instrumental methods of Analysis – Ewing

#### **Reference Books:**

W.Wendtlandt, Thermal Analysis, John Wiley Sons, New York

**Adikavi Nannaya University :: Rajahmundry**  
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**M.Sc. (Final) Chemistry Syllabus for III-Semester**  
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**ANALYTICAL CHEMISTRY PRACTICAL – I**  
(With effect from 2016-2017 admitted batch)

**Classical Methods of Analysis-1**

1. Water analysis
  - (i) Determination of total hardness ( $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$ ) of water samples
  - (ii) Determination of chloride ( $\text{Cl}^-$ ) present in water samples
  - (iii) Determination of dissolved oxygen (DO) of drinking water and sewage water
  
2. Complexometric titrations
  - (i) Determination of the concentration of calcium in milk powder by complexometric titration (EDTA)
  - (ii) Determination of Calcium and Magnesium in limestone or dolomite samples using EDTA.
  
3. Fertilizer analysis
  - (i) Determination of ammonia from ammonia containing fertilizer
  - (ii) Determination of phosphate from fertilizer
  
4. Analysis of iron ore
  - (i) Complete analysis of iron ore
  - (ii) Determination of percentages of Fe (II) and Fe (III) present in iron ore sample
  
5. Analysis of Coal
  - (i) Determination of moisture content of coal sample
  - (ii) Determination of volatile matter of coal sample
  - (iii) Determination of fixed carbon of coal sample
  - (iv) Determination of ash content of coal sample

## **Instrumental Methods of Analysis-1**

1. pH metry
  - (i) Determination of alkalinity of a coloured effluent using pH metric titration.
  - (ii) Determination of purity of commercial HCl using pH metric titration.
  - (iii) Determination of purity of commercial H<sub>2</sub>SO<sub>4</sub> using pH metric titration.
  
2. Potentiometry
  - (i) Determination of Cr(VI) with Fe(II) using potentiometric end point
  - (ii) Determination of Fe (II) using ceric sulphate by potentiometric end point
  - (iii) Determination of a mixture of Ce(IV) and V(V) with Fe(II) by potentiometric end point
  - (iv) Determination of KSCN with AgNO<sub>3</sub> by potentiometric end point.
  
3. Spectrophotometry
  - (i) Determination of Fe (III) using potassium thiocyanate
  - (ii) Determination of Iron(II) using orthophenanthroline
  - (iii) Determination of phosphate in fertilizer and cola drinks by Molybdenum blue method
  - (iv) Determination of Manganese (II) -periodate method
  
4. Flame photometry
  - (i) Determination of sodium present in bread samples
  - (ii) Determination of sodium and potassium in a given sample of fertilizer
  
5. Thin layer chromatography: Determination of R<sub>f</sub> values and identification of organic compounds in a given mixture by TLC
  - (i) Separation of mixture of benzil and 2-nitrophenol
  - (ii) Mixture of benzophenone and naphthalene
  - (iii) Mixture of 2-nitrophenol and 4-nitrophenol

### References:

1. A Text Book of Quantitative Inorganic Analysis (3<sup>rd</sup> Edition) – A. I. Vogel

**Adikavi Nannaya University :: Rajahmundry**  
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**ANALYTICAL CHEMISTRY PRACTICAL – II**

(With effect from 2016-2017 admitted batch)

**Classical Methods of Analysis-2**

1. Water analysis
  - (i) Determination of alkalinity ( $\text{CO}_3^{2-}$ ,  $\text{HCO}_3^-$ ) of water samples.
  - (ii) Determination of chemical oxygen demand (COD) of drinking water and sewage water
  - (iii) Determination of biological oxygen demand (BOD) of drinking water and sewage water
  
2. Redox titrations
  - (i) Determination of oxalate in kidney stones by permanganometric titration.
  - (ii) Determination of Fe(II) present in an Iron tablet using  $\text{KMnO}_4$
  
3. Fertilizer analysis
  - (i) Determination of nitrate from fertilizer
  - (ii) Determination of sulfur (as sulfate) from sulfur containing fertilizer.
  
4. Analysis of oils and soaps
  - (i) Determination of saponification value, acid value and iodine value of oil sample
  - (ii) Determination of moisture content and total alkali of soaps
  
5. Separation and determination of ions by ion-exchanger resins
  - (i) Determination of  $\text{Na}^+$  by cation exchanger resin
  - (ii) Determination of  $\text{Na}^+$  and  $\text{K}^+$  in a mixture by cation exchanger resin
  - (iii) Determination of  $\text{Cl}^-$  and  $\text{Br}^-$  in a mixture by anion exchanger resin



## Instrumental Methods of Analysis-2

### 1. pH metry

- (i) Determination of purity of commercial  $\text{H}_3\text{PO}_4$  by pH metric titration
- (ii) Determination of  $\text{CH}_3\text{COOH}$  by pH metric titration.
- (iii) Determination of stability constant of copper glycinate

### 2. Potentiometry

- (i) Determination of Fe(II) using Mn(VII) of by potentiometric titration
- (ii) Determination of Fe (II) using V(V) of by potentiometric titration
- (iii) Determination of a mixture of Mn(VII) and V(V) with Fe(II) using potentiometric end point
- (iv) Determination of a mixture of bromide and chloride with  $\text{AgNO}_3$  using potentiometric end point

### 3. Spectrophotometry

- (i) Determination of nitrite in drinking water samples by diazotization method
- (ii) Determination of nitrate -phenoldisulphonic acid method
- (iii) Simultaneous Determination of Cr(VI) and Mn(VII) in a mixture without separation
- (iv) Determination of Cu(II) using EDTA – Photometric titration method.

### 4. Flame photometry

- (i) Determination of Lithium by flame photometry
- (ii) Determination of calcium from milk samples using flame photometry

### 5. Thin layer chromatography

- (i) Separation and identification of the given mixture of colourless compounds (Diphenylamine, Benzophenone and Naphthalene)
- (ii) Separation and identification of the given mixture of coloured compounds (azobenzene, hydroxyazobenzene, p-aminoazobenzene).

### References:

1. A Text Book of Quantitative Inorganic Analysis (3<sup>rd</sup> Edition) – A. I. Vogel



ADIKAVI NANNAYA UNIVERSITY  
FIRST SEMESTER CHEMISTRY SYLLABUS  
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## General Chemistry - I

### UNIT-1

**Basic Quantum Chemistry-I-** Wave equation-interpretation of wave function-properties of wave function-normalization and orthogonalisation, Operators- linear and non-linear- commutators of operators. Postulates of quantum mechanics; setting up of operators to observables; Hermitian operator- Eigen values and Eigen functions of Hermitian operator; Expansion theorems. Eigen functions of commuting operators-significance. Simultaneous measurement of properties and the uncertainty principle.

### UNIT-II

**Basic Quantum Chemistry-II-** Wave mechanics of simple systems with constant potential energy, particle in one-dimensional box- factors influencing color transition- dipole integral, Symmetry arguments in deriving the selection rules, the concept of tunneling- particle in three -dimensional box. Calculations using wave functions of the particle in a box- Orthogonality, measurability of energy, position and momentum, average values and probabilities. Rigid rotor, Wave mechanics of systems with variable potential energy-simple harmonic oscillator- solution of wave equation- selection rules.

### UNIT-III

**Fundamentals of Molecular Spectroscopy-I:** Microwave and IR- Spectroscopy- Rotational spectra of diatomic molecules- Rigid rotor-Selection rules- Calculations of bond length- Isotopic effect, Second order stark effect and its applications. Infrared spectra of diatomic molecules- harmonic and anharmonic oscillators- Selection rules- Overtones- Combination bands- Calculation of force constant, anharmonicity constant and zero point energy. Fermi resonance, simultaneous vibrational-rotational spectra of diatomic molecules.

### UNIT- IV

**Fundamentals of Molecular Spectroscopy-II:** Raman and Electronic Spectra- Classical and quantum mechanical explanations- Rotational Raman and Vibrational Raman spectra. Electronic spectra of diatomic molecules- Vibrational Coarse structure- intensities of spectral lines- Franck-Condon principle- applications, Rotational Fine structure- band head and band shading. Charge transfer spectra

### References/ Text books

1. Fundamentals of Molecular spectroscopy: by C.N. Banwell
2. Molecular spectroscopy: by B.K.Sharma
3. Molecular spectroscopy: by Aruldas
4. Introductory quantum mechanics: by A.K. Chandra
5. Quantum chemistry: by R.K. Prasad



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Paper- II: INORGANIC CHEMISTRY-I

UNIT-1

**Structure & Bonding:** Applications of VSEPR, Valence Bond and Molecular orbital theories in explaining the structures of simple molecules- role of p and d orbitals in pi bonding. Application of MO theory to square planar ( $\text{PtCl}_4^{2-}$ ) and Octahedral complexes ( $\text{CoF}_6^{3-}$ ,  $\text{Co}(\text{NH}_3)_6^{3+}$ ). Walsh diagram for  $\text{H}_2\text{O}$  molecule.

UNIT-II

**Inorganic cage and ring compounds** – preparation, structure and reactions of boranes, carboranes, metallocarboranes, boron–nitrogen ( $\text{H}_3\text{B}_3\text{N}_3\text{H}_3$ ), phosphorus–nitrogen ( $\text{N}_3\text{P}_3\text{Cl}_6$ ) and sulphur-nitrogen ( $\text{S}_4\text{N}_4$ ,  $(\text{SN})_x$ ) cyclic compounds. Electron counting in boranes – Wades rules (Polyhedral skeletal electron pair theory). Isopoly and heteropoly acids.

UNIT-III

**Coordination compounds:** Crystal field theory - crystal field splitting patterns in octahedral, tetrahedral, tetragonal, square planar, square pyramidal and trigonal bipyramidal geometries. Calculation of crystal field stabilization energies. Factors affecting crystal field splitting energies – Spectrochemical series – Jahn – Teller effect, nephelauxetic effect – ligand field theory. Term symbols – Russell – Sanders coupling – derivation of term symbols for various configurations. Spectroscopic ground states.

UNIT- IV

**Electronic spectra of transition metal complexes:** Selection rules, break down of selection rules – Orgel and Tanabe-Sugano diagrams for  $d^1$  –  $d^9$  octahedral and tetrahedral transition metal complexes of 3d series – Calculation of  $Dq$ ,  $B$  and  $\beta$  parameters. Charge transfer spectra. Magnetic properties of transition and inner transition metal complexes – spin and orbital moments – quenching of orbital momentum by crystal fields in complexes.

**Text books:**

1. Advanced Inorganic Chemistry by F.A. Cotton and G. Wilkinson, IV Edition, John Wiley and Sons, New York, 1980.
2. Inorganic Chemistry by J.E. Huheey, III Edition, Harper International Edition, 1983.
3. Theoretical Inorganic Chemistry, II Edition by M.C. Day and J. Selbin, Affiliated East-West press pvt. Ltd., New Delhi.
4. Inorganic Chemistry by Shriver and Atkins, Oxford University Press (1999).



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Paper –III: ORGANIC CHEMISTRY -I

UNIT – I

**Nature of bonding in organic molecules and Aromaticity**

15 Hrs

(A) *Electronic Effects and Reactive intermediates*:-Inductive effect, Mesomeric effect (Resonance), Hyperconjugation, Steric effect, Tautomerism, acidity and basicity of organic molecules Generation, structure, stability and reactivity of carbocations, carbanions, free radicals, carbenes, nitrenes and arynes

(B) *Criteria of Aromaticity*:-The Energy, Structural and Electronic Criteria for Aromaticity, Relationship among the Energetic, Structural, and Electronic Criteria of Aromaticity. Huckle's rule and MO Theory, aromaticity in benzenoid non-benzenoid compounds, Aromaticity in Charged and Fused-Ring Systems, Hetero-aromatic Systems, Annulenes: Cyclobutadiene, Benzene, 1,3,5,7-Cyclooctatetraene, [10] Annulenes- [12], [14], [16] and [18] annulenes, azulenes, fulvenes, fullerenes, ferrocene, anti-aromaticity and homo-aromaticity.

UNIT – II

**Stereo Chemistry & Molecular representation of organic molecules**

20 Hrs

(A) *Molecular Symmetry and Chirality*:-Symmetry elements, Definition and classification of Stereoisomers, Enantiomer, Diastereomer, Invertomer, Homomer, Epimer, Anomer, Configuration and Conformation Configurational nomenclature: D,L and R, S nomenclature, Molecules with a single chiral center: Tetra and Tri coordinate chiral center, Molecules with two or more chiral centers; constitutionally unsymmetrical and symmetrical molecules.

(B) *Geometrical Isomerism and Conformations of Cyclic Systems*:- Cis-trans, E, Z- and Syn & anti nomenclature, Methods of determining configuration of Geometrical isomers using physical, spectral and chemical methods, Stability, Cis-trans inter conversion. Conformations of cyclobutane, cyclopentane, cyclohexane, mono and disubstituted cyclohexanes.

(C) *Prochirality and Prostereoisomerism*:- Homotopic ligands and faces; enantiotopic ligands and faces; diastereotopic ligands and faces; nomenclature of enantiotopic ligands and faces (Pro-R, Pro-S, Re, Si carbonyl compounds and Alkenes)

(D) *Stereoisomerism in molecules without chiral Center* -Axial chirality Allenes, Alkylidene cycloalkanes, spiranes, nomenclature. *Atropisomerism*: Biphenyl derivatives, nomenclature. *Planar chirality*: Ansa compounds, paracyclophanes, trans-cyclooctene and Helicity.

UNIT – III

**Heterocyclic compounds**

15 Hrs

Importance of heterocyclic compounds as drugs. Nomenclature of heterocyclic systems based on ring size, number and nature of hetero atoms. Chemistry of heterocyclic compounds, synthesis and reactivity of the following systems: Quinoline, Isoquinoline, Indole, Pyrazole, Imidazole, Oxazole, Isoxazole, Pyridazine, pyrimidine and Pyrazine.

UNIT - IV

**Chemistry of some typical natural products (Alkaloids and Terpenoids)**

10 Hrs

A study of the following compounds involving their isolation, structure elucidation, synthesis and biogenesis of *Alkaloids*; Atropine, Nicotine, and Quinine.

*Terpenoids*:  $\alpha$ - Terpineol,  $\alpha$ -Pinene and Camphor.



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**Books Suggested:**

1. Advanced Organic Chemistry-Reactions, Mechanism and structure, Jerry March, 6th Ed. (John Wiley & Sons).
2. Organic Chemistry, Paula Yurkanis Bruice, 4th Ed. (Printice Hall)
3. Organic chemistry-Clayden J. (Oxford)
4. Organic Chemsitry, Wade, L.G. Jr. 5th Ed. (Pearson)
5. Advanced Organic Chemistry: Reactions and mechanisms, Miller Bernard & Other, 2nd Ed. (Pearson)
6. Mechanism and Theory in Organic Chemistry, Thomas H. Lowry, Kathleen S. Richardson, Harper & Row, (Publishers, Inc.).
7. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, 6th Ed., (Longman).
8. Reaction Mechanism in Organic Chemistry, P.S. Kalsi, 2nd Ed. (New Age International).
9. Organic Chemistry, R. T. Morrison and R. N. Boyd (Prentice-Hall)
10. Stereochemistry to Organic Compounds, E.L. Eliel (John Wiley).
11. Stereochemistry, P.S. Kalsi, 5th Ed. (New Age International).
12. Organic Chemistry Structure and Reactivity, Ege Seyhan, 3rd Ed. (AITBS)
13. Heterocyclic Chemistry, J.A.Joule, K. Kills and G. F. Smith, Chapman and Hall
14. Heterocyclic Chemistry, T.L.Gilchrist, Longman Scientific Technical
15. Heterocyclic Chemistry, Raj.K. Bansal.
16. An Introduction to the Heterocyclic Compounds, R. M. Acheson, John Wiley.

**REFERENCE BOOKS:**

1. Chemistry of Natural Products, K.W.Bentley
2. Stereochemistry of carbon compounds by E.Eliel, John Wiley & Sons, Inc.
3. Stereochemistry to Organic Compounds, D. Nasipuri, 2nd Ed. (New Age International).
4. Chemistry of Natural products by R.S. Kalsi Kalyani Publishers. 1983.



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Paper – IV: PHYSICAL CHEMISTRY-I

UNIT-I:

**Thermodynamics-I:** Concepts of partial molar properties – partial molar volume and its significance; Determination of partial molar volume: Graphical method, intercept method and apparent molar volume method. Partial molar free energy, chemical potential, Variation of chemical potential with T and P. Gibbs-Duhem equation-derivation and significance. Phase equilibrium- Derivation of phase rule from the concept of chemical potential. *Ideal solutions* - Thermodynamic properties of ideal solutions mixing quantities; Vapour pressure-Raoult's law; Thermodynamic properties of ideally dilute solutions. Vapour pressure- Henry's law.

*Non-ideal systems* -Concept of fugacity, fugacity coefficient. Determination of fugacity; Non ideal solutions. Activities and activity coefficients; Standard-state conventions for non ideal solutions; Determination of activity coefficients from vapour pressure measurements. Activity coefficients of non-volatile solutes using Gibbs-Duhem equation. Chemical equilibrium-effect of temperature on equilibrium constant- Van'tHoff equation

UNIT-II:

**Micelles and Macro molecules:** Surface active agents, classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization- phase separation and mass action models, Solubilization, micro emulsion, reverse micelles.

Polymer- definition, types of polymers, electrically conducting, fire resistant, liquid crystal polymers, kinetics of free radical polymerization. Molecular mass- Number and mass average molecular weight, molecular weight determination-End group analysis, Osmometry, viscometry, ultracentrifugation and light scattering methods.

UNIT-III:

**Chemical Kinetics:** Theories of reaction rates- Collision theory- Limitations, Transition state theory. Effect of ionic strength - Debye Huckel theory-Primary and secondary salt effects; Effect of dielectric constant, effect of substituent, Hammett equation-limitations, Taft equation; Prediction of rate constants- Consecutive reactions, parallel reactions, opposing reactions (Uni molecular steps only, no derivation). Specific and general acid-base catalysis; Skrabal diagram; Fast reactions- different methods of studying fast reactions- flow methods, relaxation methods- temperature jump and pressure jump methods.

UNIT-IV:

**Photochemistry:** Electronic transitions in molecules, Franck-Condon principle. Electronically excited molecules- singlet and triplet states, spin-orbit interaction. Quantum yield and its determination; Actinometry - ferrioxalate and uranyl oxalate actinometers-problems. Derivation of fluorescence and phosphorescence quantum yields. Quenching effect- Stern Volmer equation. Photochemical equilibrium and delayed fluorescence - E type and P type. Photochemical primary processes, types of photochemical reactions-photodissociation, addition and isomerisation reactions with examples.



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**Books:**

1. Physical Chemistry by Peter Atkins and Julio de Paula, Oxford University Press.
2. Physical Chemistry by G.W. Castellon, Narosha Publishing House
3. Physical Chemistry by W.J.Moore, Prentice Hall
4. Thermodynamics for Chemists, Samuel Glasstone
5. Chemical Kinetics by K.J.Laidler, McGraw Hill Pub.
6. Photochemistry, R.P. Kundall and A. Gilbert, Thomson Nelson.
7. Polymer Chemistry by Billmayer
8. Introduction to Polymer Science, V.R. Gowriker, N.V.Viswanadhan and J. Sreedhar., Wiley Easter.
9. Micells, Theoretical and applied aspects, V.Morol, Plenum publishers.



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LABORATORY WORK (6 hrs/week)

**INORGANIC CHEMISTRY - I**

*I. Inorganic Synthesis: Preparation of*

- (i) Tetraamminecopper(II) sulphate
- (ii) Potassium tris-oxalato ferrate(III) trihydrate
- (iii) Tris-thiourea copper(I) sulphate

*II. Semi micro qualitative analysis of six radical mixtures*

(One interfering anion and one less familiar cation for each mixture)

*Anions:*  $\text{CO}_3^{2-}$ ,  $\text{S}^{2-}$ ,  $\text{SO}_3^{2-}$ ,  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{I}^-$ ,  $\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{CH}_3\text{COO}^-$   
 $\text{C}_2\text{O}_4^{2-}$ ,  $\text{C}_4\text{H}_4\text{O}_6^{2-}$ ,  $\text{PO}_4^{3-}$ ,  $\text{CrO}_4^{2-}$ ,  $\text{AsO}_4^{3-}$ ,  $\text{F}^-$ ,  $\text{BO}_3^{3-}$

*Cations :* Ammonium ( $\text{NH}_4^+$ )  
1<sup>st</sup> group: Hg, Ag, Pb, Tl, W  
2<sup>nd</sup> group: Hg, Pb, Bi, Cu, Cd, As, Sb, Sn, Mo  
3<sup>rd</sup> group: Fe, Al, Cr, Ce, Th, Ti, Zr, V, U, Be  
4<sup>th</sup> group: Zn, Mn, Co, Ni  
5<sup>th</sup> group: Ca, Ba, Sr  
6<sup>th</sup> group: Mg, K, Li

**ORGANIC CHEMISTRY - I**

*Preparation, recrystallization, and determination of melting point & yield of the following compounds:*

- (i) Aspirin, (ii) Nerolin, (iii) Chalcone,
- (iv) *p*-Nitro acetanilide, (v) 2,4,6- Tribromoaniline, (vi) *m*-Dinitrobenzene,
- (vii) Phthalimide, (viii) Diels-Alder adduct.

**Books Suggested**

1. Vogel's Text Book of Quantitative Chemical Analysis, J. Mendham, R. C. Denney, J. D. Barnes and M. J. Thomas, 4th & 6th Ed. (Pearson Education Asia).
2. Vogel's Text Book of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, P.W.G. Smith, A.R. Tatchell, 5 Ed. (Longman Scientific & Technical)





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**PHYSICAL CHEMISTRY-I**

1. Determination of critical solution temperature of phenol-water system.
2. Effect of added electrolyte on the CST of phenol-water system.
3. Conductometric titration of Strong acid versus Strong base
4. Dissociation constant of weak acid ( $\text{CH}_3\text{COOH}$ ) by conductometric method.
5. Conductometric titration of Weak acid vs Strong base.
6. Determination of cell constant
7. Adsorption of acetic acid on animal charcoal or silica gel.
8. Acid-catalyzed hydrolysis of methyl acetate
9. Determination of partial molar volume of solute - $\text{H}_2\text{O}$  system by apparent molar volume method.



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SECOND SEMESTER CHEMISTRY SYLLABUS  
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**Paper- I: GENERAL CHEMISTRY-II**

UNIT-1

**Basic Quantum Chemistry-III-** Hydrogen atom- solution of  $R(r)$ ,  $\Phi(\phi)$  and  $\Theta(\theta)$  equations. Probability density in orbitals- shapes of orbitals- Perturbation theory- Time independent perturbation theory(only first order perturbation is to be dealt with)- application to ground state energy of Helium atom- Variation principle- applications- calculation of zero-point energy of harmonic oscillator- many electron atom- Hartee-Fock self-consistent field method(qualitative treatment only)

UNIT-II

**Molecular symmetry and Group Theory in chemistry:** Basic concepts of symmetry and Group theory-Symmetry elements, symmetry operations and point groups- Schoenflies symbols- Classification of molecules into point groups- Axioms of Group theory- Group multiplication tables for  $C_{2v}$  and  $C_{3v}$  point groups- Similarity transformations- and classes- Representations- reducible and irreducible representations, Mullikan symbols, Orthogonality theorem and its implications, Character table and its anatomy.

UNIT-III

**Treatment of analytical data:** Accuracy and precision- Classification of errors- Determination of Indeterminate errors- Minimization of errors- Absolute and Relative errors, propagation of errors-Distribution of Indeterminate errors- Gaussian distribution- Measures of central tendency-Measures of precision- Standard deviation- Standard error of mean- student's t-test- Confidence interval of mean- Testing for significance- Comparison of two means- F-test- Criteria of rejection of an observation- Significant figures and computation rules.

UNIT- IV

**Introduction to computer programming- FORTRAN 77:** Basic structures and functioning of computer with P.C. as an illustrative example- Main memory- Secondary storage memory- input/output devices- computer languages- operating systems- principles of algorithms-and flow charts-constants and variables- Arithmetic expressions- Arithmetic statements- Replacement statement- IF statement- logical IF and BLOCK IF statements- GOTO statements-subscripted variable and DIMENSION statement. DO statement- Rules for DO statement- Functions and subroutines- Development of FORTRAN statements for simple formulae in chemistry such as Vander Waals equation- pH of a solution- First order rate equation- Cell constant-Electrode potential.

Flowcharts and computer programs for

- Program for the calculation of Cell Constant, Specific Conductance and Equivalence.
- Rate Constant of First order reaction or Beer's law by linear least square method.
- Hydrogen ion concentration of a strong acid solution/Quadratic equation.
- Solution for Vander Waals equation or Hydrogen ion concentration of a monoprotic weak acid
- Standard deviation and Variance of univariant data

**References/ Text books:**

- Introductory Quantum chemistry: by A.K. Chandra
- Group theory for Chemistry: by A.K. Bhattacharya
- Introductory Group theory for chemists : by George Davidson
- Vogel's text book of quantitative analysis: byVogel
- Fundamentals of Analytical chemistry: by Skog and West
- Principles of computer programming(FORTRAN 77 IBM PC): by V.Rajaraman
- Basics of computers for chemists: by P.C. Jurs



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**Paper- II: INORGANIC CHEMISTRY-II**

UNIT-I

**Metal cluster compounds** - definition – evidences for existence of M-M bonds - conditions favorable for formation of M-M bonds – preparation, structure and bonding of the following metal cluster compounds.

$\text{Re}_2\text{Cl}_8^{2-}$ ,  $\text{Mo}_2\text{Cl}_8^{4-}$ ,  $\text{Re}_2(\text{RCOO})_4\text{X}_2$ ,  $\text{Mo}_2(\text{RCOO})_4(\text{H}_2\text{O})_2$ ,  $\text{Cr}_2(\text{RCOO})_4(\text{H}_2\text{O})_2$ ,  $\text{Cu}_2(\text{RCOO})_4(\text{H}_2\text{O})_2$ ,  $\text{Cr}_2\text{Cl}_9^{3-}$ ,  $\text{Mo}_2\text{Cl}_9^{3-}$ ,  $\text{W}_2\text{Cl}_9^{3-}$ ,  $\text{Re}_3\text{Cl}_9$ ,  $\text{Re}_3\text{Cl}_{12}^{3-}$ ,  $\text{Mo}_6\text{Cl}_8^{4+}$ ,  $\text{Nb}_6\text{X}_{12}^{2+}$  and  $\text{Ta}_6\text{X}_{12}^{2+}$ .

Polyatomic clusters – Zintl ions, Chevrel phases.

UNIT-II

**Organometallic compounds** - 16 and 18 electron rules. Isoelectronic relationship - Synthesis, structure, bonding and reactions of carbon monoxide, dinitrogen and nitric oxide complexes. Isolobal relationship – H, Cl,  $\text{CH}_3$ ,  $\text{Mn}(\text{CO})_5$ ; S,  $\text{CH}_2$ ,  $\text{Fe}(\text{CO})_4$ ; P, CH,  $\text{Co}(\text{CO})_3$ ; Synthesis, structure, bonding and reactions of metallocenes with special reference to ferrocene.

UNIT-III

**Metal Ligand equilibria in solution:** Step wise and overall formation constants and their interaction– trends in stepwise constants – factors affecting the stability of metal complexes–Pearson's theory of hard and soft acids and bases (HSAB), chelate effect and its thermodynamic origin, determination of stability constants of complexes–spectrophotometric method and pH–metric method. Reactivity of metal complexes–inert and labile complexes. Explanation of lability on the basis of VBT & CFT.

**Bio-Inorganic Chemistry:** Metalloporphyrins with special reference to Haemoglobin & Myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to  $\text{Ca}^{2+}$ . Biological and abiological Nitrogen Fixation.

UNIT- IV

**Inorganic Reaction Mechanisms:** Substitution reactions of metal complexes – D, Id, Ia and A mechanisms – Ligand replacement reactions of metal complexes – Acid hydrolysis – factors affecting acid hydrolysis – Anation and Base hydrolysis of Cobalt(III) complexes. Ligand displacement reactions of square planar complexes of platinum (II). Factors affecting square planar substitution – trans effect (theories).

Electron transfer reactions of complexes – concept of complementary and non-complementary reactions with examples. Inner and outer sphere mechanisms.

**Text books:**

1. Advanced Inorganic Chemistry by F.A. Cotton and R.G. Wilkinson, IV Edition, John, John Wiley and Sons, New York, 1980.
2. Inorganic Chemistry by J.E. Huheey, III edition, Harper International Edition, 1983.
3. Organometallic Chemistry-A unified approach by A. Singh and R.C. Mehrotra, Wiley Eastern Ltd.
4. Inorganic Chemistry by Shriver and Atkins, Oxford University Press (1999)
5. Theoretical Inorganic Chemistry, II Edition by M.C. Day and J. Selbin, Affiliated East-West press Pvt. Ltd., New Delhi.
6. Mechanisms of Inorganic reactions in solution by D.Benson, McGraw Hill, London, 1968.
7. Inorganic chemistry by K.F. Purcell and J.C.Kotz, W.B. Saunders company, New York, 1977.
8. Elements of Bioinorganic Chemistry by G.N. Mukherjee and Arabinda Das, U.N. Dhur & sons Pvt. Ltd, Calcutta.



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**Paper-III: ORGANIC CHEMISTRY-II**

UNIT-I

**Reaction Mechanism**

**15Hrs**

(A) *Aliphatic Nucleophilic Substitution and Nucleophilic Aromatic substitution*: Stereochemistry of  $S_N2$  and  $S_N1$  mechanisms, Neighboring Group Participation (Anchimeric assistance), NGP by O, S, N: Aromatic Nucleophilic substitution:  $S_N2$  (Ar) (Addition – Elimination),  $S_N1$ (Ar) and benzyne mechanisms (Elimination - Addition); evidence for the structure of benzyne. Von Richter Sommelet-Hauser and Smiles rearrangements.

(B) *Elimination Reactions*: Type of elimination reactions, mechanisms, Stereochemistry and Orientation, Hofmann and Saytzeff rules, Syn elimination versus anti-elimination, competition between elimination and substitution, dehydration, dehydrogenation, dehalogenation, decarboxylative eliminations and pyrolytic eliminations

UNIT-II

**Addition Reactions**

**15 Hrs**

(A) *Addition to Carbon – Carbon Multiple Bonds*: Mechanistic and stereo chemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, region and chemo selectivity, orientation and reactivity, Hydrogenation of double and triple bonds, hydrogenation of aromatic rings, Hydroboration.

(B) *Addition to Carbon-Hetero Multiple Bonds*: Steric course of addition reactions to C=O and C=N, Aldol, Cannizzaro, Perkin, Knoevenagel, Claisen-Schmidt, Claisen, Dieckman, Benzoin and Stobbe condensations, Reformatsky reaction, Tollen's reaction, Prins reaction: Wittig, Grignard, Mannich, and Michael reaction, Hydrolysis of Carbon-Nitrogen bond, Isocyanates and isothioyanates.

UNIT-III

**Molecular Rearrangements**

**15 Hrs**

Types of molecular rearrangements, migratory aptitude;

*Rearrangements to electron deficient carbon*: Pinacol-pinacolone, Wagner-Meerwein, Tiffeneau – Demjanov, Dienone – Phenol, Arndt-Eistert synthesis;

*Rearrangements to electron deficient nitrogen*: Beckmann, Hofmann, Curtius, Schmidt and Lossen rearrangements;

*Rearrangements to electron deficient oxygen*: Baeyer-villiger, Hydro peroxide rearrangement and Dakin rearrangements; Neber rearrangement, Benzil-Benzilic acid and Favorskii rearrangements

UNIT-IV

**Spectroscopy and Protecting Groups**

**15 Hrs**

- A. Basic principles and importance of UV, IR, NMR and Mass.
- B. Protection of carbonyl, Hydroxyl, carboxylic and Amine groups



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**Books Suggested:**

1. Advanced Organic Chemistry-Reactions, Mechanism and structure, Jerry March, 6th Ed. (John Wiley & Sons).
2. Modern Organic Reactions, H. O. House (Benjamin)
3. Structure and Mechanism in Organic Chemistry C. K. Ingold (Cornell University Press).
4. Organic Chemistry, Paula Yurkanis Bruice, 4th Ed. (Prentice Hall)
5. Organic chemistry-Clayden J. (Oxford)
6. Organic Chemistry, Wade, L.G. Jr. 5th Ed. (Pearson)
7. Organic Chemistry, Salmons, P.W. & Others, 8th Ed. (John Wiley & Sons)
8. Advanced Organic Chemistry: Reactions and mechanisms, Miller Bernard & Other, 2nd Ed. (Pearson)
9. Mechanism and Theory in Organic Chemistry, Thomas H. Lowry, Kathleen S. Richardson, Harper & Row, (Publishers, Inc.).
10. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, 6th Ed., (Longman).
11. Reaction Mechanism in Organic Chemistry, P.S. Kalsi, 2nd Ed. (New Age International).
12. Stereochemistry to Organic Compounds, E.L. Eliel (John Wiley).
13. Stereochemistry to Organic Compounds, Nasipuri, 2nd Ed. (New Age International).
14. Stereochemistry, P.S. Kalsi, 5th Ed. (New Age International). Organic Chemistry Structure and Reactivity, Ege Seyhan, 3rd Ed. (AITBS)
15. Spectroscopic Methods in Organic Chemistry- Forth Edition, D.H. Williams and I. Fleming Tata - McGraw Hill, New Delhi, 1990.
16. Organic Spectroscopy- Second Edition, W.Kemp, ELBS Macmillan, 1987.
17. Applications of absorption spectroscopy of Organic Compounds J.R.Dyer, Prentice Hall of India, New Delhi, 1984.
18. Spectrometric identification of Organic Compounds-Fourth Edition, R.M. Silverstein: G.C.Vassillr and T.C. Merrill, John Wiley, Singapore, 1981.
19. Introduction to spectroscopy-D.L.Pavia, G.M.Lampman, G.S.Kriz, 3rdEd (Harcourt college publishers).



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**Paper – IV: PHYSICAL CHEMISTRY-II**

UNIT-I:

**Physical methods of molecular structural elucidation:** NMR: Principle and theory, Nature of spinning particle and its interaction with magnetic field. Chemical shift and its origin. Spin-Spin interaction, Application of NMR to structural elucidation- Structure of ethanol, dimethylformamide, styrene and acetophenone.

Electron Spin Resonance: Principle and experimental technique- g-factor, line shapes and line widths- hyperfine interactions- applications of ESR studies.

UNIT -II:

**Thermodynamics-II-** Brief review on entropy; entropy changes accompanying specific process – expansion, phase transition, heating, measurement of entropy. Nernst heat theorem; Third law of thermodynamics- Determination of the absolute entropy- Apparent exceptions to Third law of thermodynamics.

**Statistical Thermodynamics:** Objectives of statistical thermodynamics, Concept of distributions, Types of ensembles. Thermodynamic probability, Most probable distribution Law – Partition Function, (Definition and significance): Molar and molecular partitions-translational, rotational, vibrational and electronic partition functions- Relation between thermodynamic functions (E, H, S, G and  $C_v$ ) and the partition functions

UNIT-III:

**Electrochemistry I:** Electrochemical cell- Galvanic and electrolytic cell. Concentration cell with and without transference, Effect of complexation on redox potential- ferricyanide/ ferrocyanide couple, Iron (III) phenanthroline / Iron (II) phenanthroline couple. Determination of standard potential, solubility product equilibrium constant and activity coefficients from EMF data.

Bjerrum theory of ion association (elementary treatment) Concept of activity and activity coefficients in electrolytic solutions. The mean ionic activity coefficient. Debye-Huckel theory of electrolytic solutions. Debye-Huckel limiting law (derivation not required), Calculation of mean ionic activity coefficient; Limitations of Debye-Huckel theory. Effect of dilution on equivalent conductance of electrolytes - Anomalous behavior of strong electrolytes. Debye Huckel-Onsagar equation – verification and limitations, Fuel Cells.

UNIT-IV:

**Electrochemistry II:** The electrode-electrolyte interface. The electric double layer. The Helmholtz-Perrin parallel-plate model, the Gouy-Chapman diffuse-charge model and the Stern model.

Electrodics: Charge transfer reactions at the electrode-electrolyte interface. Exchange current density and over-potential. Derivation of Butler-Volmer equation. High field approximation, Tafel equation, Low field equilibrium, Nernst equation. Voltametry-Concentration polarization, experimental techniques.



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**Books:**

1. Text book of Physical Chemistry by Samuel Glasstone, McMillan Pub.
2. Physical Chemistry by W.J.Moore, Prentice Hall
3. Physical Chemistry by G.W. Castellon, Narosha Publishing House
4. Physical Chemistry by Peter Atkins and Julio de Paula, Oxford University Press.
5. Modern Electrochemistry, 2A & 2B, JOM Bockris & A.K.N.Reddy, Plenum publishers
6. Introduction to Electrochemistry, S.Glasstone.
7. Fundamentals of Molecular Spectroscopy, Banwell
8. Spectroscopy by Straw & Walker.
9. Statistical thermodynamics , M.C.Gupta
10. Statistical Thermodynamics, M.Dole



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**LABORATORY WORK (6 hrs/ week)**

**INORGANIC CHEMISTRY PRACTICALS –II**

**Quantitative analysis:**

*Volumetric:*

1. Determination of Ferric iron by photochemical reduction
2. Determination of Nickel by EDTA
3. Determination of Calcium and Magnesium in a mixture by EDTA
4. Determination of Ferrocyanide by Ceric sulphate
5. Determination of Copper(II) in presence of iron(III)

*Gravimetric:*

6. Determination of Zinc as Zinc pyrophosphate
7. Determination of Nickel from a mixture of Copper and Nickel.

**ORGANIC CHEMISTRY PRACTICALS –II**

*Systematic qualitative analysis of an organic mixture containing two compounds*

Identification of method of separation and the functional group(s) present in each of them and preparation of one solid derivative for the confirmation of each of the functional group(s).

**PHYSICAL CHEMISTRY PRACTICALS –II**

1. Distribution of iodine between  $\text{CHCl}_3$  and water
2. Distribution of  $\text{I}_2$  between  $\text{CHCl}_3$  and aq. KI solution- calculation of equilibrium constant.
3. Determination of Coordination number of cuprammonium cation.
4. Titration of mixture Strong acid and weak acid versus Strong base by conductometry.
5. Titration of Strong acid Vs Strong Base – pH – metry.
6. Titration of mixture of ( $\text{NaHCO}_3 + \text{Na}_2\text{CO}_3$ ) Vs HCl – pH- metry.
7. Titration of Strong acid Vs Strong Base using Quinhydrone electrode.
8. Titration of  $\text{Fe}^{+2}$  Vs  $\text{K}_2\text{Cr}_2\text{O}_7$  – potentiometry
9. Verification of Beer-Lambert's law by Iron-thiocyanate system –colorimetry.
10. Determination of single electrode potential of  $\text{Cu}^{2+}/\text{Cu}$  and estimate the given unknown concentration.





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**THIRD SEMESTER**

**Paper – I- ORGANIC REACTION MECHANISMS-I and  
PERICYCLIC REACTIONS**

(Effective from the 2016-17 Admitted Batch)

UNIT – I

15 Hrs

**A) Aliphatic Nucleophilic Substitution:**

Neighboring group participation by Bromine, Phenyl group, Non-Classical carbocations, NGP by Pi bond, Sigma bond and Cyclopropyl group,  $S_N$  at Allylic carbon (allylic rearrangements),  $S_N$  at Aliphatic trigonal carbon,  $S_N$  at Vinylic carbon, Ambident nucleophiles, Hydrolysis of esters ( $B_{AC}^2$ ,  $A_{AC}2$ ,  $A_{AC}1$ ,  $A_{AL}1$ ,  $B_{AL}1$ ), Mechanism of estrification of carboxylic acid with an alcohol using DCC, Mayers Synthesis of aldehydes, ketones and carboxylic acids Mitsunobu reaction, Von-Braun reaction

**B) Aliphatic Electrophilic Substitution:**

Mechanisms of  $S_E^2$ ,  $S_E^1$ ,  $S_{Ei}$ , *Hydrogen as electrophile*: Hydrogen exchange; Migration of double bonds, *Halogen electrophiles*. Mechanism of Halogenation of aldehydes and ketones; HVZ reaction; Halogenation of Sulphoxides & Sulphones, *Nitrogen Electrophiles*: Aliphatic diazo coupling, Diazo transfer reaction, Insertion of nitrenes, *Metal Electrophiles*: Metallation with Organometallic Compounds (Orthometallation), *Carbon as Leaving groups*: Decarboxylation of Aliphatic Acids; Dakin – West reaction; Haller–Bauer reaction.

UNIT – II

15 Hrs

**Principles of asymmetric synthesis:**

Introduction and terminology: Topicity in molecules Homotopic, stereoheterotopic (enantiotopic and diastereotopic) groups and faces, symmetry, substitution and addition criteria. Prochirality nomenclature: Pro-R, Pro-S, Re and Si. Stereoselective reactions: Substrate stereoselectivity, product stereoselectivity, enantioselectivity and diastereoselectivity. Conditions for stereoselectivity: Symmetry and transition state criteria, kinetic and thermodynamic control. Methods for inducing enantio and diastereoselectivity. Analytical methods: % Enantiomeric excess, enantiomeric ratio, optical purity, % diastereomeric excess and diastereomeric ratio. Techniques for determination of enantiomeric excess, specific rotation, Chiral NMR; Chiral derivatizing agents, Chiral solvent, Chiral shift reagents and Chiral HPLC.

UNIT – III

15 Hrs

**Pericyclic Reactions-I**

Molecular orbital symmetry, frontier orbitals of ethylene, 1,3 Butadiene, 1,3,5- Hexatriene, allyl system, classification of pericyclic reactions FMO approach, Woodward- Hoffman correlation diagram method and perturbation of molecular (PMO) approach for the explanation of pericyclic reactions under thermal and photochemical conditions.

Electrocyclic Reactions: Conrotatory and disrotatory motions ( $4n$ ) and ( $4n+2$ ), allyl systems  
Cycloadditions: Antarafacial and suprafacial additions, notation. of cycloadditions, ( $4n$ ) and ( $4n+2$ ) systems with a greater emphasis on ( $2+2$ ) and ( $4+4$ ) - cycloadditions, ( $2+2$ ) - additions of ketenes and chelotropic reactions.



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UNIT-IV

15 Hrs

**Pericyclic Reactions-II**

FMO approach and perturbation of molecular (PMO) approach for the explanation of sigma tropic rearrangements under thermal and photochemical conditions. suprafacial and antarafacial shifts of H Sigmatropic shift involving carbon moieties, retention and inversion of configurations, (3, 3) and (5, 5) sigmatropic rearrangements detailed treatment of Claisen and Cope rearrangements, fluxional tautomerism, aza-Cope rearrangement and Barton reaction.

Text Books and Reference Books:

- 1) Advanced Organic Chemistry: Reactions Mechanisms and Structure by Jerry March, Mc.Graw Hill and Kogakush.
- 2) Molecular reactions and Photochemistry by Charles Dupey and O. Chapman, Prentice Hall.
- 3) Pericyclic reactions by S.N. Mukharji, Mcmilan.
- 4) Mechanisms and Theory in Organic Chemistry by T.H. Lowery and K.S. Rich gardson.
- 5) The modern structural theory in Organic Chemistry by L.N.Ferguson, Pretice Hall
- 6) Physical Organic Chemistry by jack Hine, Mc. Graw Hill
- 7) Advanced Organic Synthesis, Part B-Reactions and Synthesis, Francis A. Carey and Richard J. Sudenburg, Fourth edition, Kluwer academic publishers, New York
- 8) Organic Synthesis, Christine Willis and Martin Willis, Oxford Chemistry primers.
- 9) Principles of Organic Synthesis, ROC Norman and JM Coxon, third edition, CBS, Publisher, Delhi.
- 10) Organic Synthesis, M. B. Smith, Mc Graw Hill, International Edition.
- 11) Organic Chemistry, Clayden, Greeves and Stuwart Warren.
- 12) Modern Organic Synthesis-an introduction by George S.Zweifel and Michael H. Nantz, W. H. Freeman & company, New York.
- 13) Pericyclic Reactions — a problem solving approach, Lehr and Merchand.
- 14) Conservation of Orbital Symmetry by Woodward and Hoffmann.



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**THIRD SEMESTER**

**Paper – II- ORGANIC SPECTROSCOPY-I**

**(Effective from the 2016-17 Admitted Batch)**

UNIT-I 15 Hrs

**UV-Visible spectroscopy:**

A) Beer-Lambert's law-Deviations from Beers law-Instrumentation-Mechanics of measurement- Energy transitions-Simple chromophores- Auxochrome, Absorption shifts (Bathochromic, Hypsochromic, Hyper chromic and Hypo chromic shifts) UV absorption of Alkenes-Polyenes unsaturated cyclic systems.

B) UV absorption of carbonyl compounds:  $\alpha,\beta$ -unsaturated carbonyl systems-UV absorption of aromatic systems-solvent effects-geometrical isomerism-acid and base effects-typical examples-calculation of  $\lambda$  max values using Woodward Fieser rules, applications.

UNIT-II 15 Hrs

**Infrared spectroscopy:**

A) Mechanics of measurement-Fundamental modes of vibrations-stretching and bending vibrations-Factors effecting Vibrational frequency-hydrogen bonding.

B) Finger print region and its importance, typical group frequencies for –CH,-OH, N-H, CC,-CO and aromatic systems-Application in structural determination-Examples-simple problems.

UNIT-III 15 Hrs

**Nuclear Magnetic Resonance Spectroscopy ( $^1\text{H}$ NMR):**

A) Introduction: Basic principle of- NMR Nuclear spin- nuclear resonance-saturation-Relaxation-Instrumentation (CW&FT).

B) Shielding and deshielding of magnetic nuclei-chemical shift and its measurements, factors influencing chemical shift – spin-spin interactions- factors influencing –coupling constant J and factors effecting J value.

C)  $^{13}\text{C}$  NMR Spectroscopy: Similarities and Differences between PMR and CMR, general considerations, chemical shift (aliphatic, olefinic, alkyne, aromatic, hetero aromatic and carbonyl carbon), coupling constants, typical examples of CMR spectroscopy-simple systems.

UNIT-IV 15 Hrs

**Mass spectrometry**

A) Introduction: Ion production-E1, C1, ES, MALDI and FAB- determination of Molecular weight and formulae-Behavior of organic compounds in mass spectrometer- factors affecting fragmentation, ion analysis, and ion abundance.

B) Mass spectral fragmentation of organic compounds, Common functional groups, molecular ion peak, meta stable peak, Mc Lafferty rearrangement, Nitrogen rule, High resolution mass spectrometry, Examples of mass spectral fragmentation of organic compounds with respect of their structure determination.



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Suggested Books:

- 1) Spectroscopic Methods in Organic Chemistry- Forth Edition, D.H. Williams and I.Fleming  
Tata McGraw Hill, New Delhi, 1990.
- 2) Organic Spectroscopy- Second Edition, W.Kemp, ELBS Macmillan, 1987.
- 3) Applications of absorption spectroscopy of Organic Compounds J.R.Dyer,  
Prentice Hall of India, New Delhi, 1984.
- 4) Spectrometric identification of Organic Compounds-Fourth Edition, R.M.  
Silverstein: G.C.Vassiellr and T.C. Merrill, Johne Willey, Singapore, 1981.
- 5) Introduction to spectroscopy-D.L.Pavia, G.M.Lampman, G.S.Kriz, 3rdEd  
(Harcourt college publishers).
- 6) Absorption spectroscopy of organic molecules-V.M.Parkih.
- 7) Nuclear Magnetic Resonance-Basic principles-Atta-Ur-Rehman, Springer-Verlag, 1986.



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**THIRD SEMESTER**

**Paper – III- MODERN ORGANIC SYNTHESIS-I**  
**(Effective from the 2016-17 Admitted Batch)**

UNIT-I

**Formation of C-C single bonds** 15 Hrs

Alkylations via enolate, Thermodynamic and kinetic enolate, Asymmetric Aldol reaction: a) Chiral enolate and achiral aldehyde b) Achiral enolate and chiral aldehyde – explanation by Zimmerman Traxler model; Stork enamine reaction and its synthetic applications; Organo sulphur chemistry: Umpolung and its synthetic applications (Corey Seebach Reaction), sulphur ylides: dimethyl sulphonium methylide, dimethyloxosulphonium methylide preparations and their synthetic applications; Organo Palladium Chemistry: Heck Reaction, Stille coupling, Suzuki coupling, Sonogashira coupling, Negishi coupling, Wacker Oxidation; Organo copper chemistry: Gilman's reagent and synthetic applications; Synthetic applications of carbenes and carbenoids; Baylis Hilman reaction.

UNIT-II

**Formation of Carbon-Carbon double bonds** 15 Hrs

Stereochemistry of E1 and E2 reactions (Different examples of acyclic and cyclic molecules, Saytzeff rule, Hofmann rules and Bredt's rule); Pyrolytic Syn eliminations (focus should be given on stereochemistry of syn eliminations of amine oxides, xanthates and esters of acyclic and cyclic molecules); Sulphoxide-Sulphenate rearrangement (Mislow-Evans rearrangement); Wittig reaction, Wadsworth Emmons reaction, Corey-Fuchs reaction, Aza Wittig reaction, Wittig-Horner reaction and stereo chemistry of Wittig reaction; Shapiro reaction, Eschen-Moser Tanabe fragmentation, Claisen rearrangement of allyl vinyl ethers, Julia Lythgoe olefination, Mc Murray coupling, Peterson Olefination, Tebbs reagent and its application, Metathesis: Grubbs 1st and 2nd generation catalyst, Olefin cross coupling (OCM), ring closing (RCM) and ring opening (ROM) metathesis, applications, olefination by Nysted reagent.

UNIT-III

**Reactions of unactivated C-H bonds and organoboranes** 15 Hrs

The Hoffmann Loeffler- Freytag reaction, the Barton reaction and Photolysis of organic hypothalites;

Organoboranes: Preparation of Organoboranes



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viz hydroboration with  $\text{BH}_3\text{-THF}$ , dicyclohexyl borane, disiamyl borane, theryl borane, 9-BBN mono isopinacamplyl borane ( $\text{IPC}_2\text{BH}_2$ ) and diisopinacamplyl borane ( $\text{IPC}_2\text{BH}$ ) functional group transformations of Organo boranes-Oxidation, protonolysis and isomerisation. Formation of carbon-carbon-bonds viz organo boranes carbonylation and cyanidation, reactions of alkenyl boranes and trialkyl alkynyl borates.

UNIT-IV

**Protecting groups and simple applications of microwave and ultrasound assisted reactions** 15 Hrs

(A) Protecting Groups

- 1) Protection of **alcohols** as **ethers** [methyl ether ( $\text{RO-Me}$ ), Tertiary butyl ether ( $\text{ROCM}_3$ ), Benzyl ethers ( $\text{RO-Bn}$ ), *p*-methoxybenzylethers ( $\text{RO-PMB}$ )], as **Silyl ethers** [Trimethyl silylether ( $\text{R-OTMS}$ ), tri ethyl silyl ethers ( $\text{RO-TEs}$ ), *t*-butyldimethylsilyl ether ( $\text{R-OTBDMS}$  in the presence of imidazole), tri isopropylsilyl ether ( $\text{RO-TIPS}$ ), *t*-butyl diphenylsilyl ether ( $\text{RO-TBDPS}$ )], as **acetals** [tetrahydropyranyl ethers ( $\text{RO-THP}$ ), methoxymethyl ethers ( $\text{RO-CH}_2\text{-OCH}_3 = \text{RO-MOM}$ ) and **ester formation** (carboxylic acid ester and *p*-toluene sulphonate esters).
- 2) Protection of 1,2-diols by acetal, ketal and carbonate formation.
- 3) Protection of amines by acetylation, benzoylation, benzoyloxy carbonyl, Fmoc and triphenyl methyl groups.
- 4) Protection of carbonyl by acetal, ketal and thio acetal (Umpolung) groups.
- 5) Protection of carboxylic acids by esters and ortho ester formation.

(B)

Synthetic applications of PTC and crown ethers

1. Microwave Technology: Microwave equipment, activation-benefits, limitations, microwave effects. Microwave assisted reactions in organic solvents-Esterification reactions, Fries rearrangement, Orthoester Claisen rearrangement, Diels- Alder reaction, decarboxylation.
2. Ultrasound assisted reactions: introduction, substitution reactions, addition, oxidation, reduction reactions.
3. Click chemistry: criterion for click reaction, Sharpless azides cycloadditions



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Textbooks and Books for Reference:

- 1) Some Modern Methods of Organic Synthesis W. Carruthers, Third & Fourth Edition, Cambridge University Press, Cambridge, 1988.
- 2) Modern Organic Synthesis-an introduction by George S.Zweifel and Michael H. Nantz, W. H. Freeman & company, New York.
- 3) Advanced Organic Synthesis, Part B-Reactions and Synthesis, Francis A. Carey and Richard J. Sudenburg, Fourth edition, Kluwer academic publishers, New York
- 4) Organic Synthesis, Christine Willis and Martin Willis, Oxford Chemistry primers.
- 5) Principles of Organic Synthesis, ROC Norman and JM Coxon, third edition, CBS, Publisher, Delhi.
- 6) Organic Synthesis, M. B. Smith, McGraw Hill, International Edition.
- 7) Organic Chemistry, Clayden, Greeves and Stuart Warren.
- 8) Guide Book to Organic Synthesis (3<sup>rd</sup> edition), R. Mackie, D. M. Smith and Aitken.
- 9) Organo Boranes and Silanes, Thomson, Oxford Chemistry primers.
- 10) Strategic applications of named reactions in organic synthesis, Laszlo Kurti and Barbara Czako.
- 11) Modern Synthetic Reactions, Herbet O. House, Second Edition, W.A. Benzamine Inc. Menio Park, California, 1972.
- 12) Organic Synthesis viz Boranes, Herbet C. Brown Gray, W. Kramer Alan B. Levy and M. Mark Midland John Wiely &. Sons, New York, 1975.
- 13) Organic Synthesis: Special Techniques, V. K. Ahluwalia and Renu Agarwal.
- 14) Organic Synthesis, Jagadamba Singh and Dr. A. Yadav, Pragati Edition.



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**THIRD SEMESTER**

**Paper – IV- : CHEMISTRY OF NATURAL PRODUCTS**

**(Effective from the 2016-17 Admitted Batch)**

**UNIT–I: Alkaloids** 15 Hrs

Introduction, isolation, general methods of structure elucidation and physiological action, degradation, classification based on nitrogen heterocyclic ring, structure, stereochemistry, synthesis and biosynthesis of morphine, strychnine, vincristine, colchicine, camptothecin and reserpine.

**UNIT–II: Terpenoids** 15 Hrs

Occurrence, isolation, general methods of structure determination, isoprene rule. Structure determination, stereochemistry, biosynthesis and synthesis of Farnesol, Zingiberene, Forskolin, Taxol, Azadirachtin and  $\beta$ -amyrin.

**UNIT–III: Steroids** 15 Hrs

Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and its stereochemistry. Isolation, structure determination and synthesis of cholesterol (total synthesis not expected), androsterone, testosterone, estrone and progesterone, Biosynthesis of steroids.

**UNIT–IV: Flavonoids and Isoflavonoids** 15 Hrs

Occurrence, nomenclature and general methods of structure determination, Isolation, structure elucidation and synthesis of Kaempferol, Quercetin, Cyanidin, Genestein, Butein and Daidzein. Biosynthesis of flavonoids and Isoflavonoids: Acetate Pathway and Shikimic acid Pathway.

Books Suggested:

1. Natural Products: Chemistry and Biological Significance, J. Mann, R.S.Davidson, J. B. Hobbs, D. V. Banthrope and J. B. Hatrbnome, Longman, Essex.
2. Organic Chemistry, Vol. 2, I. L. Finar, ELBS.
3. Chemistry of Organic Natural Products, O. P. Agrawal, Vols. 1 &2, Goel Pubs.
4. Natural Products Chemistry K. B. G. torsell, John Wiley, 1983
5. New Trends in Natural Products Chemistry, Atta-ur-Rahman and M.I.Choudhary, Harwood Academic Publisher.
6. Chemistry of Natural products P. S. Kalsi, Kalyani Publishers
7. Biosynthesis of steroids, terpenes and acetogenins, J. H. Richards & J. R. Hendrieson
8. The biosynthesis of secondary metabolites, R. D. Herbert, Chapman & Hall
9. The Biosynthesis of Secondary Metabolite, R. D. Herbert, Second edn, Chapman and Hall 1984
10. Chemical aspects of Biosynthesis, John Mann, Oxford University Press, Oxford, 1996.





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FOURTH SEMESTER

Paper – I- ORGANIC REACTION MECHANISMS-II and  
ORGANIC PHOTO CHEMISTRY

(Effective from the 2016-17 Admitted Batch)

UNIT – I 15 Hrs

A) **Free Radical Reactions:**

Free radical substitution mechanisms; Mechanism at an aromatic substrate; Neighboring group assistance in free radical reactions; Reactivity for aliphatic substrates; Reactivity in aromatic substrates; Reactivity at bridge head; Reactivity in the attacking radical; Effect of solvent on reactivity, Allylic halogenations using NBS (Wohl – Ziegler bromination); Hydroxylation at aromatic carbon by Fentons reagent; Oxidation of aldehydes to carboxylic acids; Formation of cyclic ethers using Leadtetraacetate; Formation of hydroperoxides (autooxidation); Coupling of alkynes (Eglinton reaction and Glacer reaction); Arylation of Aromatic compounds by diazonium salts(Gomberg – Bachman reaction); Mechanisms of Sandmeyer reaction, Kolbes reaction, Hunsdiecker reaction, Reed reaction; free radical rearrangements.

B) **Quantitative relationships between Molecular structure and Chemical reactivity:**

Hammett and Taft Equations

C) **Rearrangements:** Wagner – Meerwein Rearrangement, Demjanov Rearrangement, Wittig Rearrangement and Stevens Rearrangement

Unit – II: 15 Hrs

**Methodologies in asymmetric synthesis**

Strategies in Asymmetric Synthesis: 1. Chiral substrate controlled, 2. Chiral auxiliary controlled, 3. Chiral reagent controlled and 4. Chiral catalyst controlled.

1. **Chiral Substrate controlled asymmetric synthesis:** Nucleophilic additions to chiral carbonyl compounds. 1, 2- asymmetric induction, Cram's rule and Felkin-Anh model.

2. **Chiral auxiliary controlled asymmetric synthesis:**  $\alpha$ -Alkylation of chiral enolates, azaenolates, imines and hydrazones. 1, 4-Asymmetric induction and Prelog's rule. Use of chiral auxiliaries in Diels-Alder reaction.

3. **Chiral reagent controlled asymmetric synthesis:** Asymmetric reductions using BINAL-H. Asymmetric hydroboration using IPC2 BH and IPCBH2.

4. **Chiral catalyst controlled asymmetric synthesis:** Sharpless and Jacobsen asymmetric epoxidations. Sharpless asymmetric dihydroxylation. Asymmetric hydrogenations using chiral Wilkinson biphosphine and Noyori catalysis. Enzyme mediated enantioselective synthesis

5. **Asymmetric aldol reaction:** Diastereoselectivity aldol reaction (chiral enolate & achiral aldehydes and achiral enolate & chiral aldehydes) its explanation by Zimmerman-Traxel model.

UNIT – III 15 Hrs

**Photo Chemistry-I**

Photochemical energy, Frank Condon Principle, Types of Electronic Excitation and Molecular orbital view of excitation, Jablonski Diagram, singlet and triplet states, dissipation of photochemical energy, photosensitization, quenching, quantum efficiency and quantum yield, Determination of Quantum yield

Photo Chemistry of Carbonyl Compounds: Norrish Type I reaction (alpha cleavage reaction), Norrish Type – II reaction, Paterno- Buchi reaction, Photo reduction & photo enolisation; photochemical Oxidations [Backstrom mechanism], Photo oxidation of alkenes with singlet oxygen.



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Unit – IV

**Photochemistry-II**

Di – Pi methane Rearrangement, Aza di – Pi methane rearrangement; Photochemistry of Benzene and substituted benzene, 1, 2 , 1,3 ,& 1, 4-additions; Photo Fries rearrangement of Phenolic acetates and Anilides; Photochemistry of unsaturated systems, Cis- Trans Isomerisation of alkenes (Direct and sensitized) (Photoisomerisation of Stilbene), Photochemistry of Butadiene; Dimerisations of alkenes, Intramolecular dimerisation.

Photochemical rearrangement of Cyclohexadienenones; Photochemistry of alpha, beta Unsaturated ketones (dimerisations and addition across the double bond); Photochemical rearrangement reactions of Cyclohexenone, Photorearrangements of Beta, gamma unsaturated systems (Mechanism of 1,2 & 1,3 – acyl shifts); Photochemistry of Nitrite esters (Barton reaction); Photochemistry of alpha diazoketones; Photo Aromatic Substitutions; Photochemistry of Pyridinium ylides.

Text Books and Reference Books:

- 1) Advanced Organic Chemistry: Reactions Mechanisms and Structure by Jerry March, Mc.Graw Hill and Kogakush.
- 2) Molecular reactions and Photochemistry by Charles Dupey and O. Chapman, Prentice Hall.
- 3) Mechanisms and Theory in Organic Chemistry by T.H. Lowery and K.S. Richardson.
- 4) The modern structural theory in Organic Chemistry by L.N.Ferguson, Prentice Hall
- 5) Physical Organic Chemistry by Jack Hine, Mc. Graw Hill
- 6) Advanced Organic Synthesis, Part B-Reactions and Synthesis, Francis A. Carey and Richard J. Sudenburg, Fourth edition, Kluwer academic publishers, New York
- 7) Organic Synthesis, Christine Willis and Martin Willis, Oxford Chemistry primers.
- 8) Principles of Organic Synthesis, R.C. Norman and J.M. Coxon, third edition, CBS, Publisher, Delhi.
- 9) Organic Synthesis, M. B. Smith, Mc Graw Hill, International Edition.
- 10) Organic Chemistry, Clayden, Greeves and Stuart Warren.
- 11) Modern Organic Synthesis-an introduction by George S.Zweifel and Michael H. Nantz, W. H. Freeman & company, New York.
- 12) Organic Photochemistry by D Coyle
- 13) Molecular Photochemistry by Gilbert & Baggo
- 14) Organic Photochemistry by Turro
- 15) Photochemistry by C W J Wells



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**FOURTH SEMESTER**

**Paper – II- ORGANIC SPECTROSCOPY-II**

**(Effective from the 2016-17 Admitted Batch)**

UNIT-I:

A) Optical Rotatory Dispersion: Theory of Optical Rotatory Dispersion-Cotton effect –CD curves-types of ORD and CD curves–similarities and difference between ORD and CD curves

B) The octant rule-application in structural studies- $\alpha$ - halo keto rule.

UNIT-II

A) Improving the PMR spectrum: Chemical and Magnetic Equivalence. Chemical exchange, First and Non-First Order Spectra and analysis of AB, AMX and ABX systems.

B) Simplification of complex spectra-: Nuclear Magnetic double resonance, Lanthanide shift reagents, solvent effects, Fourier transforms technique, Nuclear Overhauser Effect (NOE), Deuterium Exchange, spectra at higherfields. Hindered Rotations and Rate processes. Resonance of other nuclei- $^{19}\text{F}$  and  $^{31}\text{P}$

C) 2D NMR spectroscopy: Definitions and importance of COSY, DEPT, HOMCOR, HETCOR, INADEQUATE, INDOR INEPT, NOESY, HOM2DJ, HET2DJ and DQFCOSY.

UNIT-III

Solution of structural problems by joint application of UV, IR, NMR ( $^1\text{H}$ & $^{13}\text{C}$ ) and mass spectrometry.

UNIT-IV

A) Separation Techniques: Solvent extraction chromatography-paper-thin layer partition-column chromatography, Electrophoresis.

B) Instrumentation – Gas Chromatography, High performance Liquid Chromatography, X – Ray diffraction (XRD)

**Suggested Books:**

- 1) Spectroscopic Methods in Organic Chemistry- Forth Edition, D.H. Williams and I. Fleming  
Tata - McGraw Hill, New Delhi, 1990.
- 2) Organic Spectroscopy- Second Edition, W.Kemp, ELBS Macmillan, 1987.
- 3) Spectrometric identification of Organic Compounds-Fourth Edition, R.M. Silverstein: G.C.Vassillr and T.C. Merill, John Willey, Singapore, 1981.
- 4) Introduction to spectroscopy-D.L.Pavia, G.M.Lampman, G.S.Kriz, 3rdEd  
(Harcourt college publishers).
- 5) "Applications of Optical rotation and Circular Dichroism", G.C. Barret, in  
"Elucidation of Organic structures by Physical and Chemical Methods"  
Part I (Eds) K.W. Bentley and G.W.Rirty John Wiley, 1972, Chapter VIII  
(only those aspects mentioned in the syllabus).
- 6) Instrumental methods of chemical analysis by H.Kaur, Pragati Prakasan,meerut.
- 7) Separation Techniques by M.N.Sastri, Himalaya publishing House (HPH), Mumbai.



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**FOURTH SEMESTER**

**Paper – III- MODERN ORGANIC SYNTHESIS-II**  
**(Effective from the 2016-17 Admitted Batch)**

UNIT-I

**Organo Silanes**

15 Hrs

Synthetic applications of trimethylsilyl chloride dimethyl-*t*-butylsilyl chloride, trimethylsilyl cyanide, trimethylsilyl iodide and trimethylsilyl triflate, synthetic applications of  $\alpha$ -silyl carbanion and  $\beta$ -silyl carbonium ions. Synthetic applications of silyl enol ethers, Preparation and synthetic applications of alkynyl silanes, aryl silanes, allyl silanes and vinyl silanes, Nazarov cyclization, Synthetic conversion of  $\alpha$ ,  $\beta$ -epoxy silanes, Peterson Olefination, Brook rearrangement and Rubottom oxidation.

UNIT-II

15 Hrs

**Oxidation**

Synthetic applications of the following reagents in the oxidation of functional groups like alkenes, alkynes, alcohols, aldehydes and ketones: 1)  $\text{Pb}(\text{OAc})_4$  2)  $\text{HIO}_4$  3)  $\text{SeO}_2$  4)  $\text{CrO}_3$  (Sodium or potassium dichromate in  $\text{H}_2\text{SO}_4$ , Collins reagent, Jones reagent, Etard reagent,  $\text{CrO}_3$  in acetic anhydride, PCC (Coreys reagent), PDC, Babler oxidation), 4)  $\text{MnO}_2$  5)  $\text{KMnO}_4$  6)  $\text{OsO}_4$  7) Oxidations by using DMSO involving alkoxy sulphonium salts (Kornblum oxidation), DCC- DMSO (Pfitzner-Muffat reagent), Swern oxidation, Corey-Kim oxidation, Albright-Goldman oxidation 8) Oxidations by using IBX, DMP, TPAP, TEMPO, CAN 9) Bayer villager oxidation and Prilezhev epoxidation 10) Oxidation of alkenes using Woodward and Prevost reagents 11) Oxidation by using DDQ 12) Sharpless asymmetric epoxidation and Sharpless asymmetric dihydroxylation 13) Thallium nitrate 14) Oxidative coupling of phenols and alkynes.

UNIT-III

**Reduction**

15 Hrs

- (1) Catalytic reductions: Homogeneous (Wilkinson's Catalytic reduction) and heterogeneous catalytic reductions and their synthetic applications.
- (2) Reductions by using electrophilic nucleophilic metal hydrides:  $\text{LiAlH}_4$  (Various examples of reductions and Cram's rule), related reagents of LAH,  $\text{NaBH}_4$ ,  $\text{NaBH}_3\text{CN}$ , Trialkyl Borohydrides (Super Hydride and Selectride).
- (3) Reductions by using electrophilic metal hydrides:  $\text{BH}_3$ , DIBAL



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- (4) Reductions by dissolving metals: Clemenson reduction, Acyloin condensation, Bouveault-Blanc reduction, Birch reduction (Various examples should be discussed).
- (5) Reductions by using Diimide and Wolf-Kishner Reduction (6) Hydrogenolysis
- (7) Reductions by using tri n-butyl tin hydride.

UNIT-IV

**Retro Synthetic Analysis**

15 Hrs

1. Basic definitions of the following:
  - a) Retro synthetic analysis
  - b) Disconnection
  - c) Target molecule
  - d) Synthone
  - e) Synthetic equivalent
  - f) Functional Group Inter Conversion (FGI)
  - g) Functional Group Addition (FGA)
2. Guidelines for the order of events: One group C-X disconnections One Group C-X disconnections (Carbonyl derivatives, ethers, sulphides and alcohols); Two group C-X disconnections (1,1-difunctionalised, 1,2-difunctionalised and 1,3-difunctionalised compounds), One group C-C disconnections (Alcohols and carbonyl compounds, 1,1-C-C, 1,2-C-C and 1,3-C-C); Synthesis of alkenes (Wittig disconnections and diene synthesis), Two group disconnections (Diels Alder reaction and 1,3-difunctionalised compounds); Linear and convergent synthesis.

Textbooks and Books for Reference:

- 1) Some Modern Methods of Organic Synthesis W. Carothers, Third Edition, Cambridge University Press, Cambridge, 1988.
- 2) Modern Organic Synthesis-an introduction by George S.Zweifel and Michael H. Nantz, W. H. Freeman & company, New York.
- 3) Advanced Organic Synthesis, Part B-Reactions and Synthesis, Francis A. Carey and Richard J. Sudenburg, Fourt edition, Kluwer academic publishers, New York.
- 4) Organic Synthesis, Christine Willis and Martin Willis, Oxford Chemistry primers.
- 5) Principles of Organic Synthesis, ROC Norman and JM Coxon, third edition, CBS, Publisher, Delhi.
- 6) Organic Synthesis, M. B. Smith, McGraw Hill, International Edition.
- 7) Organic Chemistry, Clayden, Greeves and Stewart Warren.
- 8) Guide Book to Organic Synthesis (3<sup>rd</sup> edition), R. Mackie, D. M. Smith and Aitken.
- 9) Organo Boranes and Silanes, Thomson, Oxford Chemistry primers.
- 10) Strategic applications of named reactions in organic synthesis, Laszlo Kurti and Barbara Czako.
- 11) Organic Synthesis: The disconnection approach, S. Warrant John Wiley & sons, New York, 1984.
- 12) Modern Synthetic Reactions, Herbet O. Horase, Second Edition, W.A. Benzamine Inc. Menio Park, California, 1972.



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**FOURTH SEMESTER**

**Paper – IV- BIO-ORGANIC CHEMISTRY**  
**(Effective from the 2016-17 Admitted Batch)**

UNIT-I 15 Hours

**Biopolymers and Enzymes**

Peptides:  $\alpha$ -Amino acids, their general properties and synthesis, Synthesis of peptides by Merrified solid phase synthesis. Chemistry of oxytocin and dolastain-10  
Enzymes-Oxidoreductases, hydrolases, transferases, synthesis of ATP, Baker's Yeast.  
Enzyme models-NADH models, Bio transformations, Remotefunctionalization

UNIT-II 15 Hours

**Antimalarials & Antibiotics**

**i. Antimalarials**

Chemotherapy, synthesis and activity of antimalarial drugs- quinoline group-quinine, acridine group-quinacrine and guanidine group-paludrine.

**ii. Antibiotics**

General characteristics, structure- activity relationships, synthesis and activity of antibiotics: Pencillin G, Cephalosporin-C and streptomycin.

UNIT-III 15 Hours

**Vitamins and Prostaglandins**

Definition, occurrence, structural formulae, physiological functions and synthesis of Vitamins.

Vitamins: Structure determination and synthesis of Retinol (A), Thiamine (B<sub>1</sub>), Riboflavin (B<sub>2</sub>), Pyridoxine (B<sub>6</sub>) and Biotins (H), Nicotininc acid.

**Prostaglandins**

Occurrence, nomenclature, classification, biogenesis and physiological effects. Synthesis of PGE<sub>2</sub> and PGF<sub>2</sub>

UNIT-IV 15 Hours

**Nucleic Acids:**

Nucleic acids: Basic concepts of the structures of RNA and DNA and their hydrolysis products, nucleotides, nucleosides and heterocyclic bases, Genetic Code, Finger Print test.

Application of recombinant DNA technology in production of pharmaceuticals, diagnosis of diseases, insect control, improved biological detergents, gene therapy-examples.



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Reference Books and Material:

1. Chemical Aspects of Biosynthesis, John Man, Oxford University Press, Oxford, 1996.
2. Chemistry of Natural Products: A Unified Approach, N. R. Krishnaswamy, University Press (India) Ltd., Orient Longman Limited, Hyderabad, 1999.
3. Introduction to Organic Chemistry, A Streitwieser, CH Heathcock and E.M./Kosover IV Edition, McMillan, 1992. (For Merrifield synthesis of peptides and also for other aspects of Unit IV)
4. Bio-organic Chemistry, H.Dugas and C. Penney, springer, New York, 1981.
5. Details of Primary literature: Nomenclature: Structure: Dolastatin-10: JACS, 1987, 109, 6883 (structure), ibdi, 1989, 111, 5463, JCS, Parkin I, 1996, 859 (synthesis).



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**III SEMESTER**  
**Laboratory Course-1**

**100 M**

**Multistep Synthesis of Organic Compounds:**

The experiments should illustrate the use of organic reagents and may involve purification of the products by chromatographic techniques.

1. Beckmann rearrangement: Benzanilide from Benzophenone  
Benzophenone → Benzophenone oxime → Benzanilide
2. Benzilic acid rearrangement: Benzilic acid from benzoin  
Benzoin → Benzil → Benzilic acid
3. P-Bromo Aniline from Aniline :  
Aniline → Acetanilide → P-Bromo Acetanilide → P-Bromo Aniline
4. Symmetrical Tribromo Benzene from aniline:  
Aniline → Tribromoaniline → Tribromobenzene
5. 2,4,6-trimethylquinoline from p-toluidine  
p-toluidine → 4-(p-tolylamino) pent-3-ene-2-one → 2,4,6-trimethylquinoline
6. Flavone from o-hydroxy acetophenone  
o-hydroxy acetophenone → o-benzoyl acetophenone → o-hydroxy- dibenzoylmethane → Flavone
7. 2-phenylindole from phenylhydrazine  
phenylhydrazine → acetophenone phenylhydrazone → 2-phenylindole

**Laboratory Course-2**

**100 M**

**Spectral Identification of Organic Compounds (UV, IR,  $^1\text{H}$ - and  $^{13}\text{C}$ - NMR, MASS).**

A minimum of 40 representative examples should be studied

**Books Suggested**

1. Modern Organic Synthesis in the Laboratory *A Collection of Standard Experimental Procedures*, Jie Jack Li, Chris Limberakis, Derek A. Pflum
2. Practical organic chemistry by Mann & Saunders
3. Text book of practical organic chemistry by Vogel
4. Spectrometric Identification of organic compounds, R.M. Silverstein, F.X. Webster and D.J. Kiemle, 7th Ed., (Wiley)





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**IV – SEMESTER**  
**Laboratory Course-1**

**100 M**

**Chromatographic Separation and Isolation & identification of Natural Products**

1. Thin layer chromatography: Determination of purity of a given sample, monitoring the progress of chemical reactions, identification of unknown organic compounds by comparing the R<sub>f</sub> values of known standards.
2. Isolation and identification of Natural Products
  - (a) Isolation of caffeine from tea leaves
  - (b) Isolation of eugenol from cloves
  - (c) Isolation of casein and lactose from milk
  - (d) Isolation of limonene from lemon peel
  - (e) Isolation of piperines from black pepper
  - (f) Isolation of lycopene from tomatoes
  - (g) Isolation of β-carotene from carrots

**Laboratory Course-2**  
**Estimations and Chromatography**

**100 M**

1. Estimation of (a) Glucose (b) Phenol (c) Aniline (d) Acetone (e) Aspirin (f) Ibuprofen (g) Paracetamol
2. Separation by column chromatography: Separation of a mixture of *ortho* and *para* nitroanilines using silicagel as adsorbent and chloroform as the eluent. The column chromatography should be monitored by TLC.

**Books Suggested:**

1. Ikan, R. *Natural Products, A Laboratory Guide*, 2nd ed.; Academic Press: New York, 1991.
2. Adapted from *Introduction to Organic Laboratory Techniques: A Microscale Approach*. Pavia, Lampman, Kriz and Engel. (1999) Saunders College Publishing.
3. Pharmaceutical drug analysis by Ashutoshkar
4. Quantitative analysis of drugs in pharmaceutical formulations by P D Sethi
5. Practical pharmaceutical chemistry part-1 and part-2 by A H Beckett and J B Stenlake
6. Practical organic chemistry by Mann & Saunders
7. Text book of practical organic chemistry including qualitative organic analysis by A.I. Vogel (Longman)



ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY  
**THIRD SEMESTER**  
PAPER-I: ADVANCED CHEMICAL KINETICS AND PHYSICAL  
CHEMISTRY OF POLYMERS  
(Effective from the 2016-17 admitted Batch)

UNIT-I

Theories of reaction rates – Potential energy surfaces – Reaction coordinate – theories of unimolecular gas phase reactions – Lindemann hypothesis – Hinshelwood treatment – Reactions in solutions – Kinetic Isotope effect – Linear free energy relationships – Hammett equation – Okamoto–Brown Equation – Taft Equation; Chain Reactions  $H_2-Cl_2, H_2-Br_2$  and  $H_2-O_2$  reaction – Explosion limits.

UNIT-II

Complex reactions – Consecutive – Parallel and Opposing reactions – Equilibrium and Steady state technique – Michaelis – Menten Models. Flow and relaxation Technique for fast reactions – NMR methods determining exchange rates.

UNIT-III

Characteristics of macro molecules (addition & condensation of polymerization), degree of polymerization. Shapes of macro – molecules, bulk, solution and emulsion polymerization – Co-Polymerization, block and graft copolymers, Ziegler natta catalysis. The structure and properties of polymers – Crystallinity. Glass-transition temperature, Rheology and solubility of polymers, processing of polymers – Additives.

UNIT-IV

Interaction of polymers and liquids – Flory – Huggins treatment and its limitation, Fractionation, Viscosities of polymer solutions, Synthesis and properties of polyesters, polyamides, polyurethanes, polystyrene and bakelite. Determination of molecular Weights of polymers by osmometry, light scattering, Ultra centrifuge and Viscometry.

Suggested books :

1. Chemical Kinetics by Laidler.
2. Physical Organic Chemistry by Wiberg.
3. Kinetics and Mechanism by Frost and Pearson.
4. Molecular connectivity in Chemistry and Drug Research L.B.Kier and L.H.Hall Academic press, 1976.
5. Chemical Kinetics – The study of Reaction Rates in solution – Kenneth A. CANNORSV – VCH Publishers.
6. An introducer to polymer Chemistry – W.R. Moore.
7. Introduction to polymer Chemistry – R.B. Seymour.
8. Fundamentals of Polymer Science and Engineering – Anil Kumar and S.K. Gupta.



ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY  
**THIRD SEMESTER**  
PAPER II: QUANTUM CHEMISTRY –II AND CHEMICAL  
APPLICATIONS OF SYMMETRY AND GROUP THEORY  
(Effective from the 2016-17 admitted Batch)

UNIT –I:

Wave mechanics of simple systems –Systems with discontinuity in the Potential field  
–Quantum Mechanical tunneling effect –potential barrier with finite thickness.

Wave mechanics of systems with variable potential energy – Harmonic Oscillator –  
Hermite polynomials –recursion formula –Energy levels of three dimensional harmonic  
oscillator – degeneracy of the energy levels.

UNIT –II:

Hydrogen like atoms –Solutions of the wave equation –solution of  $R(r)$ ,  $\phi(\phi)$  and  $\theta(\theta)$   
equations – Shapes of atomic orbitals – Space quantization of electronic orbitals.

Angular momentum – Commutation relations – Commutation with Hamiltonian-Spin-  
Orbit interaction – Vector model of the atom.

UNIT–III:

Representation – reducible and irreducible representations – Orthogonality theorem and  
its consequences – Constructions of Character table for  $C_{2v}$  and  $C_{3v}$  point groups – Wave  
functions as bases for irreducible representations – Direct Product

Hybridization scheme for  $AB_n$  type of molecules –  $AB_3$ ,  $AB_4$ ,  $AB_5$  and  $AB_6$  under point  
groups  $D_{3h}$ ,  $D_{4h}$ ,  $T_d$ ,  $C_{4v}$  and  $O_h$

Ligand field theory: Splitting of d-orbitals under  $D_{4h}$ ,  $T_d$ ,  $C_{4v}$  and  $O_h$  environments.

Construction of molecular orbital correlation diagram (1) for  $\sigma$  bonds in octahedral  
environment and (2) for  $H_2O$  molecule.

UNIT-IV:

Symmetry selection rules for I.R. and Raman activity – transition moment integral –  
application of direct product.

Determination of symmetries of total degrees of freedom: Calculation of Character per  
un-shifted atom for different symmetry operations and evaluation of  $SF_6$ .

Determination of symmetries of I.R. and Raman active vibrational modes for different  
molecules  $SO_2$ ,  $NO_2$ ,  $CCl_4$ ,  $POCl_3$ ,  $PCl_5$  and  $SF_6$ .

Accidental degeneracy and Fermi Resonance.

Recommended Text Books:

1. Chemical Applications of Group Theory, F.A.Cotton Wiley Eastern Limited, New Delhi.
2. Group Theory and its Applications to Chemistry, K.V.Ramana, Tata McGraw-Hill Publishing Company Limited New Delhi.
3. Introductory Quantum Chemistry, A.K.Chandra, TATA MCGRAW-HILL Publishing Company Ltd., New Delhi.
4. Quantum Chemistry, Iran Levine, Pearson Education.
5. Theoretical Chemistry, S.Glastone.



ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY  
**THIRD SEMESTER**  
PAPER-III: STATISTICAL THERMODYNAMICS AND SOLUTION  
EQUILIBRIA OF PROTON LIGAND COMPELXES  
(Effective from the 2016-17 admitted Batch)

UNIT-I:

Statistical mechanics : Ensembles (Canonical and micro canonical ) –Basic definition distribution and microstates ,thermodynamic probability . The classical distribution law . The Maxwell – Boltzmann distribution law ,method of lagrangian multiplies ,indistinguishable particles, quantum statistics – Bose –Einstein and Fermi Dirac Statistics, Conditions for the applicability of Maxwell – Boltzmann statistics, Bose – Einstein statistics and radiation, extreme gas degeneration, degenerate electron gas.

UNIT-II :

Statistical thermodynamics: Partition function. Thermodynamics functions from partition functions for multiple degree of freedom, theories of heat capacities of solids, stastical evaluation of entropy, comparison of statistical values with third law entropies (thermal entropies).

UNIT-III :

Gran analysis of acid base titrations –Determination of Carbonate content and correction factors for  $P^H$  meter dial readings ; Secondary formation function  $nbarh$ ; Calculation of stability constants of proton ligand complexes –successive approximation method –half  $nbarh$  method; Simulation of  $p^H$  metric titration data for proton –ligand systems.

UNIT –IV :

Prediction of proton –ligand formation constants using Molecular mechanics/ Quantum Chemical methods; Effect of solvent on stability – Abraham multi layer model –LD model; Components of expert systems – knowledge base, inference engine and user interface.

Suggested Books:

1. M.T.Beck,Complex Equilibria,1991
2. Alcock,solution Equilibria,1992
3. Richard E. Dickerson,Molecular Thermodynamics
4. S.Glasstone, Theoretical Chemistry
5. S.Glasstone,Thermodynamics for Chemists
6. C.Andrews ,Equilibrium Statistical Mechanics
7. Davies, Thermodynamics
8. Yeremin, Thermodynamics
9. J. Rajaram, and T.C. Kuriacose, Thermodynamics for student of chemistry.



ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY  
**THIRD SEMESTER**

PAPER –IV : INSTRUMENTATION

**(Effective from the 2016-17 admitted Batch)**

UNIT –I :

Spectrophotometry – deviations from Beer - lamberts law Instrumentation –Errors in Spectrophotometry – photometric titrations composition and stability constants of mononuclear complexes by linear extrapolation methods.Fundamental principles of Fluorescence spectroscopy and basic instrumentation of spectrofluorimeter.

UNIT –II :

Chromatographic methods - Ion exchange chromatography separation of transition metal ion – solvent extraction - partition coefficient – distribution ratio - classification of solvent extraction systems and evaluation of formation constants and applications Gas liquid Chromatography principal - Instrumentation - retention time - retention volume – Elementary principles of HPLC and hyphenated instruments.

UNIT –III :

Techniques and instrumentation of IR , Microwave and Raman. Theory and instrumentation Atomic absorption spectroscopy - Atomic emission spectroscopy with ICP source - Elementary principles of laser mass spectrometry.

UNIT – IV :

Polarography - Introduction - types of currents - qualitative and quantitative aspects of polarography – analytical applications to organic and inorganic compounds - Evaluation of stability constants by deford and hume method – amperometric titrations. Principles of thermo gravimetry - Apparatus and working, Differential methods of analysis - principle factors affecting DTA curve. Application of DTA .

Suggested Books:

1. Quantitative Analysis – R.A.Day and A.L.Underwood
2. Quantitative Inorganic Analysis – A . I . Vogel
3. Spectroscopy S.Walker and Straw Volumes I, II and III
4. Instrumental Methods of Chemical Analysis - Kudesla Snwheny (Pragati Prallesan Meerut) 1988.
5. Instrumental Techniques for Analytical Chemistry-Frank settle (Pearson Eddition )2004.

2015-16

DEPARTMENT OF PHYSICAL AND NUCLEAR CHEMISTRY AND CHEMICAL  
OCEANOGRAPHY  
ANDHRA UNIVERSITY

S.K. Anju Begum

M.Sc. (Final) PHYSICAL CHEMISTRY  
IV SEMESTER

**Paper I: ADVANCED CHEMICAL KINETICS AND PHOTO CHEMISTRY**

**UNIT - I:**

Correlation analysis - Marcus Theory of electron transfer adiabatic and non adiabatic electron transfer - outer and inner sphere mechanism - effect of solvent on rates - effect of dielectric constants on ion - ion, ion - molecule, molecule - molecule reactions - BET isotherm determination of surface area - semiconductor catalysis - Homogeneous catalysis - acid base and redox catalysis.

**UNIT - II:**

Correlation of rate with  $H_0$ ,  $H_R$ , acidity functions and their use in the illustration of mechanism in acid base catalysis - catalysis by transition metal ions and their complexes - Industrially important processes - substitution reactions in Octahedral complexes.

**UNIT - III:**

Photochemistry : Absorption Excitation - photochemical laws - quantum yield of electronically excited states - measurements of life times - Flash photolysis - Stopped flow Techniques: energy dissipation by radiative and non - radiative processes, absorption spectra - Franck - Condon principles. Photochemical stages - Primary processes and secondary processes - Rate constants and life times of reactive excited states.

**UNIT - IV:**

Properties of excited states : structure, dipole moment acid base strengths - reactivity, kinetics of bimolecular processes - quenching, Stern - Volmer equation. Photo-reduction and oxidation. Cyclo addition reactions, Woodward - Hoffmann's rules.

**Suggested Books**

1. Chemical kinetics by Laidler
2. Physical Organic Chemistry by Wiberg
3. Kinetics and mechanism by Frost and Pearson
4. Techniques in Organic Reaction Mechanism by Zuman and Patel.
5. Chemical kinetics - The study of Reaction Rates in solution - Kenneth A. CONNORS - VCH Publishers.
6. Fundamentals of photochemistry - k.k.Rohatgi - Mukherjee
7. Photochemistry - Cox and Kemp
8. Photochemistry - Calvert by Pitts,

ANDHRA UNIVERSITY  
M.Sc. (Final) PHYSICAL CHEMISTRY  
IV SEMESTER

PAPER II: QUANTUM CHEMISTRY-III, NUMERICAL METHODS FOR CHEMISTS AND  
ADVANCED COMPUTER PROGRAMMING

QUANTUM CHEMISTRY:

**UNIT I:**

Approximation methods. Variation method and its application- Ground state of helium atom- ground state energy of one dimensional harmonic oscillator- Perturbation theory- time dependent perturbation- First and second order approximations- Stark effect- Calculation of first and second order perturbation effects on simple systems. Time dependent perturbations- Interaction of matter with radiation; Zeeman effect- Derivation of Fermi's Golden rule.

**UNIT II:**

Born-Oppenheimer approximation- The LCAO approximation- application to  $H_2^+$  ion- MO theory and its application- Correlation diagrams- Hartee-Fock self consistent field method. Chemical bonding in poly atomic molecules- Hybrid orbitals- Huckel theory of linear conjugated systems and cyclic conjugated molecules- Aromaticity- Calculations of delocalization energy of simple conjugated systems.

**UNIT III:**

**NUMERICAL METHODS:**

Precision and Accuracy, Determinate and indeterminate errors, computational errors truncation and rounding off errors, algorithm errors-absolute and relative errors-Error propagation. Measures of Dispersion – range, arithmetic mean, mean deviation variance and standard deviation – moments – skewness and kurtosis.

Interpolation: interpolation for linear fit, linear interpolation in non-linear fit, polynomial interpolation – Lagrange interpolation formula – Application to complex equilibria.

Numerical techniques of solving ordinary first order differential equations:- Euler's method, Predictor-corrector method, Rungae-Kutta method- application to chemical kinetics.

**UNIT IV:**

Fortan programming: Concepts of algorithms and flow-charts, logical variables and logical expressions, order of evaluation of logical expressions, logical assignment statements, logical if and block if statements, computed GO TO statement, writing a decision, chain of decisions, arrays-one dimensional and two dimensional arrays. DO loop and its application in Input and Output statements. Statement Function, Function and Subroutine sub-programs.

Application to Chemical Problems: : Flowcharts and Programs for

1. Calculation of skewness and kurtosis of replicate measurements.
2. Polynomial interpolation using Lagrange interpolation formula
3. Euler's step by step iteration method for solving ordinary first order differential equation.
4. Calculation of first order rate constant of acid catalyzed hydrolysis of an ester, using a subprogram for the calculation of slope by linear least-squares method.

**RECOMMENDED TEXT BOOKS:**

1. Introductory Quantum Chemistry, A.K.Chandra, TATA McGRAW-HILL Publishing company Ltd., New Delhi.
2. Quantum Chemistry, Iran Levine, Pearson Education.
3. Theoretical Chemistry, S.Glastone
4. Computer programming in Fortan-IV by V.Rajaraman, Prentice-Hall of India Pvt. Ltd., New Delhi.



**DEPARTMENT OF PHYSICAL AND NUCLEAR CHEMISTRY AND CHEMICAL  
OCEANOGRAPHY  
ANDHRA UNIVERSITY  
M.Sc. (Final) PHYSICAL CHEMISTRY  
IV SEMESTER**

**Paper- III: ADVANCED THERMODYNAMICS AND SOLUTION EQUILIBRIA OF  
METAL-LIGAND COMPLEXES**

**UNIT - I:**

Thermodynamics and phase changes – Free energy and meaning of phase changes, calculation of phase equilibrium curves, Pressure as a measure of escaping tendency, single components phase diagrams, free energy diagrams and the critical point, first and second order transitions, partial molar quantities and their determination, chemical potential and phase rule. Thermodynamics of chemical reactions, Real gases and fugacity and its determination from PVT data.

**UNIT - II:**

Thermodynamics of living systems: Simultaneous coupled reactions, coupled reactions and metabolism free energy utilization, free energy utilization in metabolism, citric acid cycle, Terminal oxidation, Chain aerobic metabolism. Elementary aspects of non-equilibrium thermodynamics conservation of mass and energy – entropy production and flow in open system – Onsager theory – principles of microscopic reversibility.

**UNIT - III:**

Calvin Wilson Titration Techniques for metal ligand complexes – Determination of Stability constants using formation function, hydroxylated complexes stability constant by Martell method – Leden's procedure. Solution of a non – linear function of two variables – A Algorithm of MINQUAD programme – criteria of best fit model.

**UNIT - IV:**

Prediction of metal ligand stability constants – Irving and William order. Neural networks – Processing element, Transfer function, Training algorithm – BFGS, MAFQUARDT and back propagation. Multi layer perception and radial basis function NN's. Features of Trajan software – Input Output – Intelligent problem solver.

**Suggested Books**

1. M.T.Beck, complex Equilibria, 1991
2. Alcock, Solution Equilibria, 1992
3. Neural Networks systems Techniques and Applications – Ciornelices T. leondes; Vol.1:Algorithms and Architectures.
4. J.Zupan, Neural Network for Chemists, VCH,1992
5. Richard E.Dickerson , molecular Thermodynamics
6. S.Glasstone, Theroretical Chemistry
7. S.Glasstone, Thermodynamics for chemists
8. C.Andrews, Equilibrium Statistical Mechanics
9. Davies, Thermodynamics
10. Yereimin, thermodynamics
11. J.Rajaram, and T.C.Kuriacose, Thermodynamics for students of chemistry.

ANDHRA UNIVERSITY  
DEPARTMENT OF PHYSICAL AND NUCLEAR CHEMISTRY AND CHEMICAL  
OCEANOGRAPHY  
M.Sc. (Final) PHYSICAL CHEMISTRY  
IV SEMESTER

Paper IV: SPECTROSCOPY  
(Common for Physical Chemistry and Marine Chemistry)  
Effective from 2010-11 admitted batch

**UNIT - I:**

Rotational (Microwave) Spectroscopy - The rotational energies of polyatomic molecules - Rotational selection rules for linear molecules - symmetric top - Asymmetric top molecules - degeneracy of rotational energy levels - The Stark effect in molecular rotational spectra - Molecular Rotation - Nuclear spin coupling - Application of Rotation Spectra - Determination of Inter Nuclear distance - Moment of Inertia and Dipole moment.

**UNIT - II:**

Rotation vibration spectra - selection rules and transitions for the rigid rotator - harmonic oscillator model - parallel and perpendicular bands of linear and symmetric top molecules - Raman active fundamental - Criterion for their appearance - Rotational and vibrational Raman; Raman and Infrared studies of  $AB_2$ ,  $AB_3$  type molecules - correlation of infrared and Raman spectra.

**UNIT - III:**

ESR spectroscopy - the resonance condition - anisotropy in g-factor - Theory and applications of ESR method - Crystalline solids - free radicals in solutions - interpretation of ESR spectra of typical radicals and ion like  $Mn^{2+}$ ,  $Cr^{3+}$ ,  $Cu^{2+}$  - Hyperfine interactions in the following systems. P-Benzoquinone - (semi) naphthalene radical anion and anthracene radical anion.

NMR spectroscopy - chemical shifts and shielding - some application of NMR spectra - effect of chemical exchange on spectra - Effect of quadrupole interactions on NMR spectra - an elementary study of isotopes other than proton - Fluorine -19, phosphorous-31, Carbon-13, Boron-11 - NQR spectroscopy - Electric field gradient and quadrupole coupling constant - Splitting in NQR spectra - Applications of NQR spectroscopy

**UNIT - IV:**

Electron Spectroscopy - basic principles of Photo Electron Spectroscopy (PES) - Koopman's theorem and chemical shift. PES of simple molecules. Electron Spectroscopy for Chemical Analysis (ESCA) - Chemical information from ESCA. Principles and applications of Auger Electron Spectroscopy (AES) - comparison between PES, ESCA and AES - X-ray methods - X-ray fluorescence (XRF) - techniques of X-ray absorption and X-ray emission methods and their applications.

**Suggested Books**

1. Spectroscopy S. Walker and straw, volumes I, II and III
2. Molecular Spectroscopy, - Gordon M. barrow
3. Fundamentals of Molecular Spectroscopy - Banwell
4. Spectroscopy - B.K.Sharma - Goe! Publishing House Meerut. 1990.

AC IIIsem - Paper 1 Syllabus.doc

AC IIIsem - Paper 2 Syllabus.doc

AC IIIsem - Paper 3 Syllabus.doc

AC IIIsem - Paper 4 Syllabus.doc

AC IVsem - Paper 1 Syllabus.doc

AC IVsem - Paper 2 Syllabus.doc

AC IVsem - Paper 3 Syllabus.doc

AC IVsem - Paper 4 Syllabus.doc

M.Sc\_Analytical Chemistry Practical\_Syllabus.doc

**Adikavi Nannaya University :: Rajahmundry**  
**Department of Chemistry**  
**M.Sc. (Final) Chemistry Syllabus for III-Semester**  
**Specialization: Analytical Chemistry**  
**Paper - I: Separation Methods – I**  
(Effective from 2016-17 Admitted batch)

**Unit – I Chromatography - 1**

**Chromatography:** classification of different chromatographic methods, methods of development-Elution development, Gradient elution development, displacement development, and frontal analysis.

Principles of chromatography, different migration, adsorption phenomena, partition, adsorption coefficient, retardation factor, retention time and volume, column capacity, temperature effects, partition isotherm.

Dynamics of chromatography-efficiency of chromatographic column, zone spreading, High Equivalent Theoretical Plate (HETP), Van Deemter equation, resolution, choice of column, length and flow velocity, qualitative and quantitative analysis.

**Unit - II Chromatography – 2**

**Column chromatography (adsorption chromatography):** principles, general aspects, adsorption isotherms, chromatographic media, nature of forces between adsorbent and solutes, eluents (mobile phase), column chromatography without detectors and liquid chromatography with detectors and applications.

**Gel Exclusion chromatography or Gel filtration chromatography:** principles, properties of xerogels, apparatus and detectors, resolution of gel type, applications to organic compounds.

**Capillary Electrophoresis :** Principle, Details of the Instrument, Applications to Inorganic and Organic compounds.

**Unit – III Chromatography – 3**

**Gas chromatography:** Theory, Instrument description of equipment and different parts, columns (packed and capillary columns), detector specifications-thermal conductivity detector, flame ionization detector, electron capture detector, nitrogen-phosphorus detector, photo ionization detector, programmed temperature gas chromatography; applications in the analysis of gases, petroleum products etc., other detectors used their Principles and Applications.

**Inorganic molecular sieves:** structure of zeolites, crystals, types of sieves, application in the separation of gases including hydrocarbons, ion exclusion-principles and applications,

Counter current chromatography-principles and application, Affinity chromatography- principles and applications

### ***GC-MS – Introduction***

Instrumentation – GC – MS interface – Mass spectrometer (MS) Instrument operation, processing GC – MS data – ion chromatogram Library searching – Quantitative measurement – sample preparation Selected ion monitoring – Application of GC-MS for Trace constituents. Drugs analysis, Environmental analysis and others.

## **Unit – IV Chromatography – 4**

***Liquid-liquid partition chromatography:*** principle, supports, partitioning liquids, eluents, reverse phase chromatography, apparatus, applications

***High performance liquid chromatography:*** Theory, Instrument description of the different parts of the equipment, columns, detectors-UV detector, refractometric detector, Fluorescence detector, Diode Array detector, applications in the separation of organic compounds, names of other detectors used their Principles and Applications.

***LC-MS*** – Introduction – Instrumentation – liquid chromatograph – Mass spectrometer Interface – Instrumental details – Processing LC-MS data – ion chromatograms – Library searching – Quantitative measurements. Sample preparation – selected ion monitoring. Application of LC-MS for Drug analysis, Environmental samples and others.

### **Text books:**

1. R.P.W Scott, Techniques and practice of Chromatography, Marel Dekker Inc., New York
2. M.N. Sastri ,Separation methods, Himalaya Publishing Company, Mumbai

### **Reference books:**

1. E. Helfman, Chromatography, Van Nostrand, Reinhold, New York
2. E. Lederer and M. Lederer, Chromatography, Elsevier, Amsterdam.
3. Chemical separation methods, John A Dean, Von Nostrand Reinhold, New York
4. R.P.W Scott, Techniques and practice of Chromatography, Marel Dekker Inc., New York
5. H.M Mc Nair and J. M. Miller, Basic Gas Chromatography, John Wiley, New York
6. W. Jeumings, Analytical Gas chromatography, Academic Press, New York
7. H. Eugelhardt (ed), Practice of HPLC, Springer Verrag, Berrin

**Adikavi Nannaya University :: Rajahmundry**  
**Department of Chemistry**  
**M.Sc. (Final) Chemistry Syllabus for III-Semester**  
**Specialization: Analytical Chemistry**  
**Paper- II: Quality control and Traditional methods of Analysis-I**  
(Effective from 2016-17 Admitted batch)

**Unit – I: Quality control in Analytical Chemistry**

- (a) **Characteristics of an analysis:** quality of an analytical procedure, limit of detection, sensitivity, safety, cost measurability, selectivity and specificity, quality control-principles of Ruggedness test, control charts, Youden plot, and ranking test.
- (b) **Evaluation and reliability of analytical data:** limitation of analytical methods, accuracy, precision, errors in chemical analysis, classification of errors, minimization of errors, significant figures, computations and propagation of errors.
- (c) **Statistical analysis:** Mean deviation, Standard deviation, coefficient of variance, normal distribution, F test, T test, rejection of results, presentation of data.
- (d) **Quality assurance and management systems:** elements of quality assurance, quality assurance in design, development, production and services, quality and quantity management system, **ISO 9000** and **ISO 14000** series-meaning of quality, quality process model, customer requirement of quality calibration and testing, statistical process control, process control tools, control chart, statistical quality control, acceptance sampling.  
Good laboratory practices (GLP) – need for GLP, GLP implementation and organization, GLP status in India.
- (e) Brief out line of ICH guide lines on drug substances and products.

**Unit – II Decomposition techniques in analysis**

**(a) Inorganic Compounds**

Principle of decomposition and Dissolution. Difference between dissolution / decomposition of Organic and Inorganic substances.

Importance of Decomposition Techniques in Analysis.

Principle of Dissolution of an inorganic substance.

Decomposition of samples with acids – H<sub>2</sub>O, HCl, HF, HNO<sub>3</sub>, H<sub>2</sub>SO<sub>4</sub> and HClO<sub>4</sub>

Decomposition of samples by fusion, Principle and with two examples each

Alkali Fusion--- Na<sub>2</sub>CO<sub>3</sub>, NaOH,

Acidic Fusion--- Sodium Hydro Sulphate, Sodium Pyro Sulphate

Oxidation Fusion---Na<sub>2</sub>O<sub>2</sub>, Sodium Chlorate

Reductive Fusion Na<sub>2</sub>CO<sub>3</sub> + Na<sub>4</sub>BO<sub>4</sub>

What is Sintering process, How is it different from Fusion.

Fusion with alkali carbonates, alkali hydroxides, Sodium Peroxide

Decomposition of samples by sintering with sodium peroxide, sodium carbonate.

Principles of decomposition at high temperatures, high pressures .

Principles of Microwave and ultrasonic decomposition techniques.

### **(b) Organic Compounds**

Principles of solubility of organic compounds, non polar, polar solvents.  
Recrystallisation methods and application of solubility and Recrystallisation.

### **Unit – III Oxidant systems – Principles and applications in analysis**

Analytical chemistry of some selected oxidant systems – formal, standard and normal potentials in various media, species responsible for the oxidation properties, stability of the solutions, standardization, requirement for the selections of the oxidants, selection of suitable indicators for Oxidant systems.

- a) Inorganic Systems Mn (III), Mn (VII), Ce (IV), Cr (VI), V (V), periodate, iodate,
- b) Organic Systems chloramine-T.

### **Unit – IV Organic Functional group analysis**

Classification of functional groups with suitable examples.

Determination of:

- 1) Functional groups imparting acidic nature – thiol, enediol, phenolic hydroxyl.
- 2) Functional groups imparting basic nature – Aliphatic and Aromatic primary, secondary and tertiary amines – hydrazine derivatives.
- 3) Functional groups which impart neither acidic nor basic nature – Aldehydes, Ketones, Nitro, Methoxy, Olifinic.

### **Text books:**

1. Technical methods of analysis – Griffin, Mc Graw Hill Book Co.
2. Chemical Separation and measurements – D.G Peterseti, John M.Haves Sanders Co.
3. Chemical analysis – H.A Laitinan, Mc Graw Hill Book Co.
4. Newer redox titrants – Berka, Zyka and Vulterin, Pergamon Press
5. Volumetric Analysis, Vol III – I.M Kolthoff and R. Belcher, Interscience Public, New York
6. Vogel's Text Book of Inorganic Quantitative Analysis – J. Bassett et al, ELBS
7. Organic functional groups – S. Siggia

### **Reference Books:**

1. D.A Skoog, D.M West and F.J Holler, Analytical Chemistry, An Introduction, Sanders College Publishing, New York
2. K.V.S.G Murali Krishna, An Introduction ISO 9000, ISO 1400 Series, Environmental Management
3. Quality Assurance and Good Laboratory Practices, Prof. Y. Anjaneyulu, In Now Publication, New York
4. Quality Assurance in Analytical Chemistry – G.Kateman and F.W Pijpers, John Wiley and Sons, New York
5. Quantitative Chemical Analysis – I.M Kolthoff, E.B Sandel, E.J Meehan, S. Bruckenstein, Macmillan Company, London
6. Decomposition Techniques in Inorganic Analysis – J.Dolezal, P.Povondra, Z.Sulcek

**Adikavi Nannaya University :: Rajahmundry**  
**Department of Chemistry**  
**M.Sc. (Final) Chemistry Syllabus for III-Semester**  
**Specialization: Analytical Chemistry**  
**Paper – III: Applied Analysis-I**  
(Effective from 2016-17 Admitted batch)

**Unit – I Analysis of Ores**

- (a) General techniques of analysis applied to complex materials - Scope of metallurgical analysis -  
General methods of dissolution of complex materials - Various chemical methods for the effective separation of the constituents in the complex materials.
- (b) Analysis of ores: Iron ore- Analysis of the Constituents – Moisture , loss of ignition, Total Iron, ferrous Iron ,Ferric Iron, alumina , silica, Titania, Lime, Magnesia, Sulphur, phosphorous, manganese, alkalies, combined water, Carbon in blast furnace, flue dust and sinter.
- (c) Manganese Ore - Analysis of the Constituents – Total Manganese,  $MnO_2$ ,  $SiO_2$ ,  $BaO$ ,  $Fe_2O_3$ ,  $Al_2O_3$ ,  $CaO$ , P and S
- (d) Chromite Ore - Analysis of the Constituents – Chromium,  $SiO_2$ ,  $FeO$ ,  $Al_2O_3$   $CaO$ , &  $MgO$ .
- (e) Phosphate rock Ore - Analysis of the Constituents -  $CaO$ ,  $P_2O_5$ , F,  $SiO_2$ ,  $CO_2$ , S,  $Na_2O$ ,  $Al_2O_3$ ,  $Fe_2O_3$ ,  $MgO$ ,  $K_2O$ ,  $Cl$ ,  $MnO$ . Organic carbon, Moisture, Loss of ignition.
- (f) Aluminium Ore (Bauxite) - Analysis of the Constituents – Silica, Alumina,  $Fe_2O_3$ , Titania,  $MnO$ ,  $P_2O_5$ ,  $CaO$ ,  $MgO$ , vanadium, zirconium, and alkalies.

**Unit – II Analysis of Finished Products – I**

- (a) Analysis of steel for C, Si, S, P, Mn, Ni, Cr; Mg and analysis of blast furnace slag .
- (b) Analysis of refractory materials: fire clay, flour spar, and magnesite
- (c) Analysis of fluxes - limestone and dolomite.

**Unit – III Analysis of Finished Products – II**

- (a) Chemical Analysis of cement-silica,  $NH_4OH$  group, ferric oxide, alumina, lime, magnesia, Sulphide Sulphur ,  $K_2O$ ,  $Na_2O$ , free  $CaO$  in Cement and Clinker,  $SO_3$  and loss on ignition.
- (b) Analysis of oils - saponification number, iodine number, and acid number..
- (c) Analysis of soaps - moisture, volatile matter, total alkali, total fatty matter, free caustic alkali or free fatty acids, sodium silicate , chloride.
- (d) Analysis of paints-vehicle and pigment,  $BaSO_4$ , total lead and lead chromate



## Unit – IV Assessment of water Quality

Sources of water, classification of water for different uses, types of water pollutants and their effects,

Analytical methods for the determination of the following ions in water:

Anions:  $\text{CO}_3^{2-}$ ,  $\text{HCO}_3^-$ ,  $\text{F}^-$ ,  $\text{Cl}^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{PO}_4^{3-}$ ,  $\text{NO}_3^-$ ,  $\text{NO}_2^-$ ,  $\text{CN}^-$ ,  $\text{S}^{2-}$

Cations:  $\text{Fe}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{Cr}^{3+}$ ,  $\text{As}^{5+}$ ,  $\text{Pb}^{2+}$ ,  $\text{Hg}^{2+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Cd}^{2+}$ ,  $\text{Co}^{2+}$

Determination of Dissolved oxygen (D.O), Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD), standards for drinking water.

### Text books

1. Handbook of Analytical Control of Iron and Steel Production, Harrison John, Wiley 1979
2. Standard methods of Chemical Analysis, Welcher
3. Technical Methods of Analysis, Griffin, Mc Graw Hill
4. Commercial Methods of Analysis, Foster Dee Snel and Frank M. Griffin, Mc Graw Hill Book Co.
5. Water Pollution, Lalude, Mc Graw Hill
6. Environmental Chemistry, Anil Kumar De, Wiley Eastern Ltd.
7. Environmental Analysis, S.M. Khopkar (IIT Bombay)

**Adikavi Nannaya University :: Rajahmundry**  
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**Specialization: Analytical Chemistry**  
**Paper – IV: INSTRUMENTAL METHODS OF ANALYSIS - I**

(Effective from 2016-17 Admitted batch)

**Unit – I : Spectroscopic Methods - 1**

- (a) **UV-Visible Spectroscopy:** laws of absorption, deviation from Beer's law, single and double beam spectrophotometers-instrumentation, sources of radiation, detectors, qualitative analysis by absorption measurements, general precautions in colorimetric determinations, determination of certain metal ions by using ligands –  $\text{Fe}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Al}^{3+}$ ,  $\text{NH}_4^+$ ,  $\text{Cr}^{3+}$ ,  $\text{Cr}^{6+}$ ,  $\text{Co}^{3+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Ni}^{2+}$  and anions –  $\text{NO}_2^-$ ,  $\text{PO}_4^{3-}$  using suitable reagents, simultaneous determinations of dichromate and permanganate in a mixture, spectrophotometric titrations, principle of diode array spectrophotometers.
- (b) **Spectrofluorimetry:** Theory of fluorescence, phosphorescence, factors affecting the above, quenching, relation between intensity of fluorescence and concentration, instrumentation, application with reference to  $\text{Al}^{3+}$ , chromium salts, fluorescence, thiamin (B1) and riboflavin (B2) in drug samples.

**Unit – II : Spectroscopic Methods - 2**

- (a) **Infrared spectroscopy:** units of frequency, wavelength and wave number molecular vibrations, factors influencing vibrational frequencies, instrumentation, sampling techniques, detectors, characteristic frequencies of organic molecules, qualitative and quantitative analysis with reference to (petroleum refinery and polymer industry), selected molecules like CO, CO<sub>2</sub>, non-destructive IR method for the analysis of CO and other organic compounds, principles of Fourier transform IR.
- (b) **Raman Spectroscopy:** Raman effect and spectra, differences between Raman spectra and IR spectra, instrumentation, Raman spectra of CO, CO<sub>2</sub>, N<sub>2</sub>O, H<sub>2</sub>O.

**Unit – III : Spectroscopic Methods -3**

- (a) **NMR Spectroscopy:** resonance condition, origin of NMR spectra, instrumentation, chemical shift, factors affecting chemical shift, shielding, spin-spin splitting, mechanism for spin-spin coupling, interpretation of NMR spectra of typical organic compounds, factors influencing NMR spectra, fast chemical reactions, magnitude of I, nuclei with quadrupole moments, FT NMR, study of isotopes other than proton-<sup>13</sup>C, <sup>15</sup>N, <sup>19</sup>F, <sup>31</sup>P, <sup>11</sup>B, double resonance, spin tickling, shift reagents, applications.

(b) *ESR Spectroscopy*: principle, g value, hyper fine splitting, qualitative analysis, Krammers degeneracy, fine splitting, instrumentation, introduction to double resonance technique, difference between ESR and NMR spectra, quantitative analysis, application to study of free radicals and other analytical applications.

#### **Unit – IV : Spectroscopic Methods -4**

(a) *Mass Spectroscopy*: Principle, basic instrumentation, energetics of ion formation, types of peaks observed, resolution, qualitative analysis, molecular weight determination, quantitative analysis, advantages

(b) *X-ray Spectroscopy (XRF)*: chemical analysis by X-ray spectrometers, energy dispersive and wavelength dispersive techniques, evaluation methods, instrumentation, matrix effects, applications.

#### **Text Books:**

1. Instrumental methods of analysis – H.H Willard, Meritt Jr. and J.A Dean
2. Principles of instrumental analysis – Skoog and West
3. Vogels Textbook of Quantitative Inorganic analysis – J. Basset, R.C Denney, G.H Jefferey and J.Madhan
4. Instrumental methods of analysis – B.K Sarma, Goel Publishing House, Meerut
5. Instrumental methods of Analysis – Chatwal and Anand
6. Instrumental methods of Analysis – Ewing
7. Handbook of ICP
8. The ICP – Bogdain B.

#### **Reference Books:**

1. Applications of ICP-MS, A.R Date and A.L Glay, London (Eds), Blackie, London
2. A. Moutaser and D.W Golightly (Eds), ICP in Analytical Atomic Spectrometry, VeH Publishers, New York
3. G.I Moore, Introduction to ICP emission Spectrometry in Analytical Spectroscopy, Elsevier, Amsterdam

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**Specialization: Analytical Chemistry**  
**Paper-1: Separation Methods – II**  
(Effective from 2016-17 Admitted batch)

**Unit – I Chromatography - 5**

- (a) **Paper chromatography:** principle, papers as a chromatographic medium, modified papers, solvent systems, mechanism of paper chromatography, experimental technique, different development methods-ascending, descending, horizontal, circular spreading, multiple development, two dimensional development, reverse phase paper chromatographic technique-visualization and evaluation of chromatograms, applications.
- (b) **Thin layer chromatography:** principle, chromatographic media-coating materials, applications, activation of adsorbent, sample development, solvent systems, development of chromatoplate, types of development, visualization methods, documentation, applications in the separation, HPTLC-principle, technique, applications.

**Unit – II Chromatography - 6**

- (a) **Ion Exchange:** principles of ion-exchange systems, synthetic ion-exchange resins, properties of anion and cation exchange resins, ion-exchange mechanism, ion-exchange equilibria, selectivity, ion-exchange capacity, applications of ion-exchangers in different fields.
- (b) **Ion exchange chromatography:** Principle, Equipment, Application Specifically Separations of Lanthanides, Actinides, amino acids.
- (c) **Ion chromatography:** principles of separation, instrumentation, detectors, separation of cations and anions, applications in the analysis of water and air pollutants.

**Unit – III Sampling of Solids, Liquids and Gases**

**Sampling:** Basis of sampling, purpose of sampling, homogeneous and heterogeneous samples, statistical criteria for good sampling, sample size, sampling unit, gross sample, laboratory sample.

Sampling of Solids: Cone and Quartering method, Long pile and alternative shovel method, precautions in preservation of solid samples, sampling of metals and other solids rods, wires, sheets, plates, especially Gold, Silver, Iron and other metals.

Sampling of different types of liquids: different sampling techniques, sampling of drinking water, industrial effluents, precautions in sampling and preservation of collected liquid samples.

Sampling of gases: sampling and Preconcentration by adsorption or absorption method, instantaneous monitoring, sampling in samplers and subsequent monitoring, different types of gas samplers, precautions in preservation of samples, systematic sampling and random sampling.

#### **Unit – IV Importance of Analytical chemistry & Solvent Extraction**

**(a) Importance of Analytical Chemistry to Industrial Research:** Importance of Qualitative and Quantitative analysis in research and development, industries and other branches of science.

Development and validation of an analytical method, units, concentrations, calculations, standards, chemical reactions, expressions of concentrations, importance of separation methods with examples.

**(b) Solvent Extraction:** principles and processes of solvent extraction, Distribution Law and Partition coefficient, nature of partition forces, different types of solvent extraction systems – Batch extraction, Continuous extraction, Counter current extraction, solvent extraction systems, applications in metallurgy, general applications in analysis and pre-concentration, special extraction systems like crown ethers, super fluid and surfactant extractions-examples.

#### **Text books:**

1. R.P.W Scott, Techniques and practice of Chromatography, Marel Dekker Inc., New York
2. Separation methods, M.N Sastri, Himalaya Publishing Company, Mumbai

#### **Reference books:**

1. E. Helfman, Chromatography, Van Nostrand, Reinhold, New York
2. E. Lederer and M. Lederer, Chromatography, Elsevier, Amsterdam.
3. Chemical separation methods, John A Dean, Von Nostrand Reinhold, New York
4. R.P.W Scott, Techniques and practice of Chromatography, Marel Dekker Inc., New York
5. E.Stahl, Thin layer chromatography, Academic Press, New York
6. James, G.Tartor (Ion chromatography)

**Adikavi Nannaya University :: Rajahmundry**  
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**Specialization: Analytical Chemistry**  
**Paper – II : Traditional Methods of Analysis - II**  
(Effective from 2016-17 Admitted batch)

**Unit – I Precipitation methods - 1**

- (a) Crystal habit and super saturation, nucleation and crystal growth, homogeneous and heterogeneous nucleation, solubility and particle size, colloids, completeness of precipitation, effect of excess precipitant, pH, complex formation, temperature, purity of precipitates, aging.
- (b) **Co-precipitation and post precipitation** : theory of adsorption of salts having an ion in common with the main precipitate, co-precipitation in colloidal precipitates, adsorption of solvents, mixed crystal formation by occlusion and entrapment, re-precipitation with examples, Post-precipitation – theory of post-precipitation, examples of post-precipitation, conditions for obtaining pure and quantitative precipitates.
- (c) **Precipitation Titrations**: Principle, Indicators for precipitation titrations, determination of halides.

**Unit – II Precipitation methods - 2**

- (a) **Precipitation from Homogeneous Solution (PFHS)**: theory of PFHS, methods of PFHS – increase in pH, decrease in pH, cation release, anion release, reagent synthesis, change in oxidation state, photochemical reactions, precipitation from mixed solvents. Applications of PFHS methods.
- (b) **Gravimetric determinations**: nature of species, preparation of solutions, limitations, interferences, inorganic precipitants-chloride and sulphate, organic precipitants dimethyl glyoxime (DMG), oxine, benzidine, salicylaldehyde, benzoin oxime, sodium tetraphenyl boron, tetraphenyl arsonium chloride.
- (a) **Electro-gravimetric analysis**: principle, important terms in electrogravimetry, decomposition voltage or decomposition potential, over voltage and their importance, instrumentation, electrolysis at constant current, determination of  $\text{Cu}^{2+}$  by constant current electrolysis, electrolysis at controlled potentials, determination of Cu, Pb, Sn in brass and bronze by controlled potential electrolysis.

**Unit – III Reductant system – Principles and applications in analysis**

Analytical chemistry of some selected reductant systems – formal, standard and normal potentials in various media, stability of the solutions, species responsible for

the reduction properties, standardization, requirement for the selection of the reductants, selection of suitable indicators for various reductant systems,

- (a) Inorganic Systems – Cr (II), V (II), Ti (III), Sn (II), Fe (II) in  $H_3PO_4$  and hydrazine,
- (b) Organic Systems – hydroquinone and Ascorbic acid.

#### **Unit – IV Analysis of some selected Drugs:**

Basic considerations of drugs – Classification

Determination of the following Drugs:

- 1) Acetyl salicylic acid ( Antipyretic – Analgesic )
- 2) Testosterone, progesterone and cortisone (Steroids and corticoids)
- 3) Sulphadiazine ( sulphadruugs)
- 4) Phenobarbitone (Barbituric acid derivatives)
- 5) Chloramphenicol, Benzyl penicillin and Tetracycline (Antibiotics)
- 6) Thiamine (B1), Riboflavin (B2) and ascorbic acid (c) [Vitamins]
- 7) Isoniazid ( Antimicrobial agents)
- 8) Methyldopa (Antihypertensive agents)
- 9) Metronidazole (Antiamoebic agents).

#### **Text books:**

1. Technical methods of analysis – Griffin, Mc Graw Hill Book Co.
2. Chemical Separation and measurements – D.G Peterseti, John M.Haves Sanders Co.
3. Chemical analysis – H.A Laitinan, Mc Graw Hill Book Co.
4. Newer redox titrants – Berka, Zyka and Vulterin, Pergamon Press
5. Volumetric Analysis, Vol III – I.M Kolthoff and R.Belvher, Interscience Public, New York
6. Vogel's Text Book of norganic Quantitative Analysis – J.Bassett et al, ELBS
7. Pharmaceutical analysis – T. Higuchi, Brochmann hausfen

#### **Reference Books:**

1. D.A Skoog, D.M West and F.J Holler, Analytical Chemistry, An Introduction, Sanders College Publishing, New York
2. Quantitative Chemical Analysis – I.M Kolthoff, E.B Sandel, E.J Meehan, S. Bruckenstein, Macmillan Company, London

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**Paper – III: Applied Analysis – II**  
(Effective from 2016-17 Admitted batch)

**Unit – I Analysis of raw materials**

- (a) Analysis of non-ferrous alloys:
- (i) Brass – Analysis of the constituents – Cu, Zn, Sn, Pb and Fe.
  - (ii) Bronze - Analysis of the constituents – Cu, Sn, Zn, Pb and Fe.
  - (iii) Solder - Analysis of the constituents – Sn, Pb and Sb.
- (b) Analysis of Ferro alloys :
- (i) Ferro silicon - Analysis of the constituents – Si, C, P, S
  - (ii) Ferro vanadium - Analysis of the constituents – V, C, P, S, Si, Al.
  - (iii) Ferro manganese - Analysis of the constituents – Mn, S, C, P, Si
  - (iv) Silico manganese - Analysis of the constituents – Mn, S, C, P, Si
  - (v) Ferro chromium - Analysis of the constituents – Cr, C, Si.

**Unit – II Analysis of Soil, Fertilizer and Fuel**

- (a) Analysis of soils: sampling, determination of moisture, total N, P, Si, lime, humus nitrogen, alkali salts, soil absorption ratio.
- (b) Analysis of fertilizers: ammonical fertilizers, Phosphate fertilizers, Nitrate fertilizers.
- (c) Analysis of fuels: solid fuels-coal, proximate analysis, ultimate analysis, heating value, grading of coal based on Ultimate Heat Value(UHV).

**Unit – III Assessment of Air Quality**

Composition of pure air, classification of air pollutants, toxic elements present in dust and their sources – collection of air samples.

Sources, effects, control of pollution and chemical analysis for the following.

- (a) Primary pollutants:
- (i) Carbon compounds - Carbon monoxide(CO) and Carbon dioxide(CO<sub>2</sub>).
  - (ii) Sulphur compounds- sulphur dioxide (SO<sub>2</sub>), Sulphur trioxide (SO<sub>3</sub>) and Hydrogen Sulphide (H<sub>2</sub>S).
  - (iii) Nitrogen compounds - nitric oxide (NO), and nitrogen dioxide (NO<sub>2</sub>),
  - (iv) Hydrocarbons - Aliphatic hydrocarbons and polycyclic aromatic hydrocarbons (PAH).
  - (v) Particulate matter - Respirable and Suspended particulate matter, Inorganic and Organic particulates.



- (b) Secondary pollutants - ozone ( $O_3$ ), peroxy acetyl nitrate (PAN), peroxy benzyl nitrate (PBN)
- (c) Standards for ambient air quality.

#### **Unit- IV Kinetic Methods of Analysis & Non aqueous Titrimetry**

- (a) Kinetic methods of analysis: introduction, slow reactions, catalyzed reactions, methods of determination of catalyst concentration, extrapolation method for the determination of catalyst, variable time method, fixed time method, examples for the determination of toxic metals and anions using some typical kinetic reactions.
- (b) Non aqueous titrimetry : Classification of solvents and titrations for non aqueous titrimetry- Types of reactions - Indicators .
- (i) Determination of acids
  - (ii) Determination of bases
  - (iii) Karl-Fisher reagent for the determination of moisture content in drugs and other samples.

#### **Text books**

1. Chemical analysis – H.A Laitinan, Mc Graw Hill Book Co
2. Standard methods of Chemical Analysis, Welcher
2. Technical Methods of Analysis, Griffin, Mc Graw Hill
3. Commercial Methods of Analysis, Foster Dee Sneel and Frank M. Griffin, Mc Graw Hill Book Co.
4. Environmental Chemistry, Anil Kumar De, Wiley Eastern Ltd.
5. Environmental Analysis, S.M Khopkar (IIT Bombay)
6. Environmental Air Analysis, Trivedi and Kudesia, Akashdeep Pub.

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**Specialization: Analytical Chemistry**  
**Paper - IV: Instrumental Methods of Analysis -II**  
(Effective from 2016-17 Admitted batch)

**Unit – I: Spectro-analytical Methods of Analysis**

(a) *Flame photometry*: theory, instrumentation, combustion flames, detectors, and analysis of Na, K, Ca, Mg

(b) *Atomic Absorption Spectrometer*: theory, instrumentation, flame and non-flame techniques, resonance line sources, hollow cathode lamp, instrumentation, chemical and spectral interferences, applications with special reference to analysis of trace metals in oils, alloys and toxic metals in drinking water and effluents

(c) *Inductively coupled plasma spectrometer (ICP-AES, ICP-MS)*: principles, instrumentation, plasma, AES detectors, quadrupole mass spectrometers, difference between the two detectors, analysis methods for liquids and solids, applications in the analysis of trace and toxic metals in water, geological and industrial samples.

(d) *Arc and Spark spectrographic Direct analysis of solid for metals.*

**Unit – II Thermal methods of Analysis**

(a) Thermo gravimetry-theory, instrumentation, applications with special reference to  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ ,  $\text{CaC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ ,  $\text{CaCO}_3$ ,  $(\text{COOH})_2 \cdot 2\text{H}_2\text{O}$

(b) Differential thermal analysis-principle, instrumentation, difference between TG and DTA - applications with special reference to the clays and minerals, coals (fuels)

(c) Differential scanning calorimetry-principle, instrumentation, applications to inorganic materials like chlorates and per chlorates, ammonium nitrate, organic compounds and Drugs.

**Unit- III : Electro analytical Methods of Analysis - 1**

(a) *Voltametry and polarographic analysis* : principle of polarography, residual current, migration current, diffusion current, half-wave potential, Ilkovic equation, instrumentation, Dropping mercury electrode (DME), advantages and disadvantages of DME, qualitative and quantitative analysis of inorganic ions-Cu, Bi, Pb, Cd, Zn, AC polarography, pulse polarography

(b) *Anode stripping voltametry*: principle, instrumentation, Hanging mercury drop electrode, application in the analysis of Pb and Cd in environmental samples, principle of cathode stripping voltametry.

- (c) **Coulometric analysis:** principles of coulometric analysis with constant current, coulometric analysis with controlled potential, applications of coulometric methods for the analysis of cations-As (III), Fe (II) and I<sup>-</sup> and S<sup>2-</sup> by using I<sub>2</sub> liberations and Ce<sup>4+</sup> liberation in solutions

#### **Unit – IV Electro Analytical and Radio chemical methods of analysis - 2**

- (a) **Ion Selective Electrodes:** reference electrodes - hydrogen electrode, calomel electrode, silver chloride electrode; indicator electrodes – hydrogen and glass electrodes, theory of membrane potentials and liquid junction potentials, types of ion selective electrodes, basic properties, potentials and construction, calibration of ion selective electrodes, ion selective electrodes with fixed membrane sites, silver, lead, cadmium, sulfide, fluoride, cyanide and glass electrodes, applications in the analysis of air and water pollutants, principles of liquid membrane, gas sensing and enzyme based electrode
- (b) **Radio chemical methods of analysis:** detection and measurement of radioactivity, introduction to radioactive tracers, applications of tracer technique, isotope dilution analysis - applications, activation analysis – application, advantages and disadvantages, radio carbon dating technique

#### **Text Books:**

1. Instrumental methods of analysis – H.H Willard, Meritt Jr. and J.A Dean
2. Principles of instrumental analysis – Skoog and West
1. Vogels Textbook of Quantitative Inorganic analysis – J. Basset, R.C Denney, G.H Jefferey and J.Madhan
2. Instrumental methods of analysis – B.K Sarma, Goel Publishing House, Meerut
3. Instrumental methods of Analysis – Chatwal and Anand
4. Instrumental methods of Analysis – Ewing

#### **Reference Books:**

W.Wendtlandt, Thermal Analysis, John Wiley Sons, New York

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**ANALYTICAL CHEMISTRY PRACTICAL – I**  
(With effect from 2016-2017 admitted batch)

**Classical Methods of Analysis-1**

1. Water analysis
  - (i) Determination of total hardness ( $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$ ) of water samples
  - (ii) Determination of chloride ( $\text{Cl}^-$ ) present in water samples
  - (iii) Determination of dissolved oxygen (DO) of drinking water and sewage water
  
2. Complexometric titrations
  - (i) Determination of the concentration of calcium in milk powder by complexometric titration (EDTA)
  - (ii) Determination of Calcium and Magnesium in limestone or dolomite samples using EDTA.
  
3. Fertilizer analysis
  - (i) Determination of ammonia from ammonia containing fertilizer
  - (ii) Determination of phosphate from fertilizer
  
4. Analysis of iron ore
  - (i) Complete analysis of iron ore
  - (ii) Determination of percentages of Fe (II) and Fe (III) present in iron ore sample
  
5. Analysis of Coal
  - (i) Determination of moisture content of coal sample
  - (ii) Determination of volatile matter of coal sample
  - (iii) Determination of fixed carbon of coal sample
  - (iv) Determination of ash content of coal sample

## **Instrumental Methods of Analysis-1**

1. pH metry
  - (i) Determination of alkalinity of a coloured effluent using pH metric titration.
  - (ii) Determination of purity of commercial HCl using pH metric titration.
  - (iii) Determination of purity of commercial H<sub>2</sub>SO<sub>4</sub> using pH metric titration.
  
2. Potentiometry
  - (i) Determination of Cr(VI) with Fe(II) using potentiometric end point
  - (ii) Determination of Fe (II) using ceric sulphate by potentiometric end point
  - (iii) Determination of a mixture of Ce(IV) and V(V) with Fe(II) by potentiometric end point
  - (iv) Determination of KSCN with AgNO<sub>3</sub> by potentiometric end point.
  
3. Spectrophotometry
  - (i) Determination of Fe (III) using potassium thiocyanate
  - (ii) Determination of Iron(II) using orthophenanthroline
  - (iii) Determination of phosphate in fertilizer and cola drinks by Molybdenum blue method
  - (iv) Determination of Manganese (II) -periodate method
  
4. Flame photometry
  - (i) Determination of sodium present in bread samples
  - (ii) Determination of sodium and potassium in a given sample of fertilizer
  
5. Thin layer chromatography: Determination of R<sub>f</sub> values and identification of organic compounds in a given mixture by TLC
  - (i) Separation of mixture of benzil and 2-nitrophenol
  - (ii) Mixture of benzophenone and naphthalene
  - (iii) Mixture of 2-nitrophenol and 4-nitrophenol

### References:

1. A Text Book of Quantitative Inorganic Analysis (3<sup>rd</sup> Edition) – A. I. Vogel

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**ANALYTICAL CHEMISTRY PRACTICAL – II**

(With effect from 2016-2017 admitted batch)

**Classical Methods of Analysis-2**

1. Water analysis
  - (i) Determination of alkalinity ( $\text{CO}_3^{2-}$ ,  $\text{HCO}_3^-$ ) of water samples.
  - (ii) Determination of chemical oxygen demand (COD) of drinking water and sewage water
  - (iii) Determination of biological oxygen demand (BOD) of drinking water and sewage water
  
2. Redox titrations
  - (i) Determination of oxalate in kidney stones by permanganometric titration.
  - (ii) Determination of Fe(II) present in an Iron tablet using  $\text{KMnO}_4$
  
3. Fertilizer analysis
  - (i) Determination of nitrate from fertilizer
  - (ii) Determination of sulfur (as sulfate) from sulfur containing fertilizer.
  
4. Analysis of oils and soaps
  - (i) Determination of saponification value, acid value and iodine value of oil sample
  - (ii) Determination of moisture content and total alkali of soaps
  
5. Separation and determination of ions by ion-exchanger resins
  - (i) Determination of  $\text{Na}^+$  by cation exchanger resin
  - (ii) Determination of  $\text{Na}^+$  and  $\text{K}^+$  in a mixture by cation exchanger resin
  - (iii) Determination of  $\text{Cl}^-$  and  $\text{Br}^-$  in a mixture by anion exchanger resin

## Instrumental Methods of Analysis-2

### 1. pH metry

- (i) Determination of purity of commercial  $\text{H}_3\text{PO}_4$  by pH metric titration
- (ii) Determination of  $\text{CH}_3\text{COOH}$  by pH metric titration.
- (iii) Determination of stability constant of copper glycinate

### 2. Potentiometry

- (i) Determination of Fe(II) using Mn(VII) of by potentiometric titration
- (ii) Determination of Fe (II) using V(V) of by potentiometric titration
- (iii) Determination of a mixture of Mn(VII) and V(V) with Fe(II) using potentiometric end point
- (iv) Determination of a mixture of bromide and chloride with  $\text{AgNO}_3$  using potentiometric end point

### 3. Spectrophotometry

- (i) Determination of nitrite in drinking water samples by diazotization method
- (ii) Determination of nitrate -phenoldisulphonic acid method
- (iii) Simultaneous Determination of Cr(VI) and Mn(VII) in a mixture without separation
- (iv) Determination of Cu(II) using EDTA – Photometric titration method.

### 4. Flame photometry

- (i) Determination of Lithium by flame photometry
- (ii) Determination of calcium from milk samples using flame photometry

### 5. Thin layer chromatography

- (i) Separation and identification of the given mixture of colourless compounds (Diphenylamine, Benzophenone and Naphthalene)
- (ii) Separation and identification of the given mixture of coloured compounds (azobenzene, hydroxyazobenzene, p-aminoazobenzene).

### References:

1. A Text Book of Quantitative Inorganic Analysis (3<sup>rd</sup> Edition) – A. I. Vogel



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FIRST SEMESTER CHEMISTRY SYLLABUS  
(Common for M.Sc Analytical, Physical & Organic Chemistry )  
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## General Chemistry - I

### UNIT-1

**Basic Quantum Chemistry-I-** Wave equation-interpretation of wave function-properties of wave function-normalization and orthogonalisation, Operators- linear and non-linear- commutators of operators. Postulates of quantum mechanics; setting up of operators to observables; Hermitian operator- Eigen values and Eigen functions of Hermitian operator; Expansion theorems. Eigen functions of commuting operators-significance. Simultaneous measurement of properties and the uncertainty principle.

### UNIT-II

**Basic Quantum Chemistry-II-** Wave mechanics of simple systems with constant potential energy, particle in one-dimensional box- factors influencing color transition- dipole integral, Symmetry arguments in deriving the selection rules, the concept of tunneling- particle in three -dimensional box. Calculations using wave functions of the particle in a box- Orthogonality, measurability of energy, position and momentum, average values and probabilities. Rigid rotor, Wave mechanics of systems with variable potential energy-simple harmonic oscillator- solution of wave equation- selection rules.

### UNIT-III

**Fundamentals of Molecular Spectroscopy-I:** Microwave and IR- Spectroscopy- Rotational spectra of diatomic molecules- Rigid rotor-Selection rules- Calculations of bond length- Isotopic effect, Second order stark effect and its applications. Infrared spectra of diatomic molecules- harmonic and anharmonic oscillators- Selection rules- Overtones- Combination bands- Calculation of force constant, anharmonicity constant and zero point energy. Fermi resonance, simultaneous vibrational-rotational spectra of diatomic molecules.

### UNIT- IV

**Fundamentals of Molecular Spectroscopy-II:** Raman and Electronic Spectra- Classical and quantum mechanical explanations- Rotational Raman and Vibrational Raman spectra. Electronic spectra of diatomic molecules- Vibrational Coarse structure- intensities of spectral lines- Franck-Condon principle- applications, Rotational Fine structure- band head and band shading. Charge transfer spectra

### References/ Text books

1. Fundamentals of Molecular spectroscopy: by C.N. Banwell
2. Molecular spectroscopy: by B.K.Sharma
3. Molecular spectroscopy: by Aruldas
4. Introductory quantum mechanics: by A.K. Chandra
5. Quantum chemistry: by R.K. Prasad





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Paper- II: INORGANIC CHEMISTRY-I

UNIT-1

**Structure & Bonding:** Applications of VSEPR, Valence Bond and Molecular orbital theories in explaining the structures of simple molecules- role of p and d orbitals in pi bonding. Application of MO theory to square planar ( $\text{PtCl}_4^{2-}$ ) and Octahedral complexes ( $\text{CoF}_6^{3-}$ ,  $\text{Co}(\text{NH}_3)_6^{3+}$ ). Walsh diagram for  $\text{H}_2\text{O}$  molecule.

UNIT-II

**Inorganic cage and ring compounds** – preparation, structure and reactions of boranes, carboranes, metallocarboranes, boron–nitrogen ( $\text{H}_3\text{B}_3\text{N}_3\text{H}_3$ ), phosphorus–nitrogen ( $\text{N}_3\text{P}_3\text{Cl}_6$ ) and sulphur-nitrogen ( $\text{S}_4\text{N}_4$ ,  $(\text{SN})_x$ ) cyclic compounds. Electron counting in boranes – Wades rules (Polyhedral skeletal electron pair theory). Isopoly and heteropoly acids.

UNIT-III

**Coordination compounds:** Crystal field theory - crystal field splitting patterns in octahedral, tetrahedral, tetragonal, square planar, square pyramidal and trigonal bipyramidal geometries. Calculation of crystal field stabilization energies. Factors affecting crystal field splitting energies – Spectrochemical series – Jahn – Teller effect, nephelauxetic effect – ligand field theory. Term symbols – Russell – Sanders coupling – derivation of term symbols for various configurations. Spectroscopic ground states.

UNIT- IV

**Electronic spectra of transition metal complexes:** Selection rules, break down of selection rules – Orgel and Tanabe-Sugano diagrams for  $d^1$  –  $d^9$  octahedral and tetrahedral transition metal complexes of 3d series – Calculation of  $Dq$ ,  $B$  and  $\beta$  parameters. Charge transfer spectra. Magnetic properties of transition and inner transition metal complexes – spin and orbital moments – quenching of orbital momentum by crystal fields in complexes.

**Text books:**

1. Advanced Inorganic Chemistry by F.A. Cotton and G. Wilkinson, IV Edition, John Wiley and Sons, New York, 1980.
2. Inorganic Chemistry by J.E. Huheey, III Edition, Harper International Edition, 1983.
3. Theoretical Inorganic Chemistry, II Edition by M.C. Day and J. Selbin, Affiliated East-West press pvt. Ltd., New Delhi.
4. Inorganic Chemistry by Shriver and Atkins, Oxford University Press (1999).



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Paper –III: ORGANIC CHEMISTRY -I

UNIT – I

**Nature of bonding in organic molecules and Aromaticity**

15 Hrs

(A) *Electronic Effects and Reactive intermediates*:-Inductive effect, Mesomeric effect (Resonance), Hyperconjugation, Steric effect, Tautomerism, acidity and basicity of organic molecules Generation, structure, stability and reactivity of carbocations, carbanions, free radicals, carbenes, nitrenes and arynes

(B) *Criteria of Aromaticity*:-The Energy, Structural and Electronic Criteria for Aromaticity, Relationship among the Energetic, Structural, and Electronic Criteria of Aromaticity. Huckle's rule and MO Theory, aromaticity in benzenoid non-benzenoid compounds, Aromaticity in Charged and Fused-Ring Systems, Hetero-aromatic Systems, Annulenes: Cyclobutadiene, Benzene, 1,3,5,7-Cyclooctatetraene, [10] Annulenes- [12], [14], [16] and [18] annulenes, azulenes, fulvenes, fullerenes, ferrocene, anti-aromaticity and homo-aromaticity.

UNIT – II

**Stereo Chemistry & Molecular representation of organic molecules**

20 Hrs

(A) *Molecular Symmetry and Chirality*:-Symmetry elements, Definition and classification of Stereoisomers, Enantiomer, Diastereomer, Invertomer, Homomer, Epimer, Anomer, Configuration and Conformation Configurational nomenclature: D,L and R, S nomenclature, Molecules with a single chiral center: Tetra and Tri coordinate chiral center, Molecules with two or more chiral centers; constitutionally unsymmetrical and symmetrical molecules.

(B) *Geometrical Isomerism and Conformations of Cyclic Systems*:- Cis-trans, E, Z- and Syn & anti nomenclature, Methods of determining configuration of Geometrical isomers using physical, spectral and chemical methods, Stability, Cis-trans inter conversion. Conformations of cyclobutane, cyclopentane, cyclohexane, mono and disubstituted cyclohexanes.

(C) *Prochirality and Prostereoisomerism*:- Homotopic ligands and faces; enantiotopic ligands and faces; diastereotopic ligands and faces; nomenclature of enantiotopic ligands and faces (Pro-R, Pro-S, Re, Si carbonyl compounds and Alkenes)

(D) *Stereoisomerism in molecules without chiral Center* -Axial chirality Allenes, Alkylidene cycloalkanes, spiranes, nomenclature. *Atropisomerism*: Biphenyl derivatives, nomenclature. *Planar chirality*: Ansa compounds, paracyclophanes, trans-cyclooctene and Helicity.

UNIT – III

**Heterocyclic compounds**

15 Hrs

Importance of heterocyclic compounds as drugs. Nomenclature of heterocyclic systems based on ring size, number and nature of hetero atoms. Chemistry of heterocyclic compounds, synthesis and reactivity of the following systems: Quinoline, Isoquinoline, Indole, Pyrazole, Imidazole, Oxazole, Isoxazole, Pyridazine, pyrimidine and Pyrazine.

UNIT - IV

**Chemistry of some typical natural products (Alkaloids and Terpenoids)**

10 Hrs

A study of the following compounds involving their isolation, structure elucidation, synthesis and biogenesis of *Alkaloids*; Atropine, Nicotine, and Quinine.

*Terpenoids*:  $\alpha$ - Terpineol,  $\alpha$ -Pinene and Camphor.



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**Books Suggested:**

1. Advanced Organic Chemistry-Reactions, Mechanism and structure, Jerry March, 6th Ed. (John Wiley & Sons).
2. Organic Chemistry, Paula Yurkanis Bruice, 4th Ed. (Printice Hall)
3. Organic chemistry-Clayden J. (Oxford)
4. Organic Chemsitry, Wade, L.G. Jr. 5th Ed. (Pearson)
5. Advanced Organic Chemistry: Reactions and mechanisms, Miller Bernard & Other, 2nd Ed. (Pearson)
6. Mechanism and Theory in Organic Chemistry, Thomas H. Lowry, Kathleen S. Richardson, Harper & Row, (Publishers, Inc.).
7. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, 6th Ed., (Longman).
8. Reaction Mechanism in Organic Chemistry, P.S. Kalsi, 2nd Ed. (New Age International).
9. Organic Chemistry, R. T. Morrison and R. N. Boyd (Prentice-Hall)
10. Stereochemistry to Organic Compounds, E.L. Eliel (John Wiley).
11. Stereochemistry, P.S. Kalsi, 5th Ed. (New Age International).
12. Organic Chemistry Structure and Reactivity, Ege Seyhan, 3rd Ed. (AITBS)
13. Heterocyclic Chemistry, J.A.Joule, K. Kills and G. F. Smith, Chapman and Hall
14. Heterocyclic Chemistry, T.L.Gilchrist, Longman Scientific Technical
15. Heterocyclic Chemistry, Raj.K. Bansal.
16. An Introduction to the Heterocyclic Compounds, R. M. Acheson, John Wiley.

**REFERENCE BOOKS:**

1. Chemistry of Natural Products, K.W.Bentley
2. Stereochemistry of carbon compounds by E.Eliel, John Wiley & Sons, Inc.
3. Stereochemistry to Organic Compounds, D. Nasipuri, 2nd Ed. (New Age International).
4. Chemistry of Natural products by R.S. Kalsi Kalyani Publishers. 1983.



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Paper – IV: PHYSICAL CHEMISTRY-I

UNIT-I:

**Thermodynamics-I:** Concepts of partial molar properties – partial molar volume and its significance; Determination of partial molar volume: Graphical method, intercept method and apparent molar volume method. Partial molar free energy, chemical potential, Variation of chemical potential with T and P. Gibbs-Duhem equation-derivation and significance. Phase equilibrium- Derivation of phase rule from the concept of chemical potential. *Ideal solutions* - Thermodynamic properties of ideal solutions mixing quantities; Vapour pressure-Raoult's law; Thermodynamic properties of ideally dilute solutions. Vapour pressure- Henry's law.

*Non-ideal systems* -Concept of fugacity, fugacity coefficient. Determination of fugacity; Non ideal solutions. Activities and activity coefficients; Standard-state conventions for non ideal solutions; Determination of activity coefficients from vapour pressure measurements. Activity coefficients of non-volatile solutes using Gibbs-Duhem equation. Chemical equilibrium-effect of temperature on equilibrium constant- Van'tHoff equation

UNIT-II:

**Micelles and Macro molecules:** Surface active agents, classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization- phase separation and mass action models, Solubilization, micro emulsion, reverse micelles.

Polymer- definition, types of polymers, electrically conducting, fire resistant, liquid crystal polymers, kinetics of free radical polymerization. Molecular mass- Number and mass average molecular weight, molecular weight determination-End group analysis, Osmometry, viscometry, ultracentrifugation and light scattering methods.

UNIT-III:

**Chemical Kinetics:** Theories of reaction rates- Collision theory- Limitations, Transition state theory. Effect of ionic strength - Debye Huckel theory-Primary and secondary salt effects; Effect of dielectric constant, effect of substituent, Hammett equation-limitations, Taft equation; Prediction of rate constants- Consecutive reactions, parallel reactions, opposing reactions (Uni molecular steps only, no derivation). Specific and general acid-base catalysis; Skrabal diagram; Fast reactions- different methods of studying fast reactions- flow methods, relaxation methods- temperature jump and pressure jump methods.

UNIT-IV:

**Photochemistry:** Electronic transitions in molecules, Franck-Condon principle. Electronically excited molecules- singlet and triplet states, spin-orbit interaction. Quantum yield and its determination; Actinometry - ferrioxalate and uranyl oxalate actinometers-problems. Derivation of fluorescence and phosphorescence quantum yields. Quenching effect- Stern Volmer equation. Photochemical equilibrium and delayed fluorescence - E type and P type. Photochemical primary processes, types of photochemical reactions-photodissociation, addition and isomerisation reactions with examples.



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**Books:**

1. Physical Chemistry by Peter Atkins and Julio de Paula, Oxford University Press.
2. Physical Chemistry by G.W. Castellon, Narosha Publishing House
3. Physical Chemistry by W.J.Moore, Prentice Hall
4. Thermodynamics for Chemists, Samuel Glasstone
5. Chemical Kinetics by K.J.Laidler, McGraw Hill Pub.
6. Photochemistry, R.P. Kundall and A. Gilbert, Thomson Nelson.
7. Polymer Chemistry by Billmayer
8. Introduction to Polymer Science, V.R. Gowriker, N.V.Viswanadhan and J. Sreedhar., Wiley Easter.
9. Micells, Theoretical and applied aspects, V.Morol, Plenum publishers.



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LABORATORY WORK (6 hrs/week)

**INORGANIC CHEMISTRY - I**

*I. Inorganic Synthesis: Preparation of*

- (i) Tetraamminecopper(II) sulphate
- (ii) Potassium tris-oxalato ferrate(III) trihydrate
- (iii) Tris-thiourea copper(I) sulphate

*II. Semi micro qualitative analysis of six radical mixtures*

(One interfering anion and one less familiar cation for each mixture)

*Anions:*  $\text{CO}_3^{2-}$ ,  $\text{S}^{2-}$ ,  $\text{SO}_3^{2-}$ ,  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{I}^-$ ,  $\text{NO}_3^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{CH}_3\text{COO}^-$   
 $\text{C}_2\text{O}_4^{2-}$ ,  $\text{C}_4\text{H}_4\text{O}_6^{2-}$ ,  $\text{PO}_4^{3-}$ ,  $\text{CrO}_4^{2-}$ ,  $\text{AsO}_4^{3-}$ ,  $\text{F}^-$ ,  $\text{BO}_3^{3-}$

*Cations :* Ammonium ( $\text{NH}_4^+$ )  
1<sup>st</sup> group: Hg, Ag, Pb, Tl, W  
2<sup>nd</sup> group: Hg, Pb, Bi, Cu, Cd, As, Sb, Sn, Mo  
3<sup>rd</sup> group: Fe, Al, Cr, Ce, Th, Ti, Zr, V, U, Be  
4<sup>th</sup> group: Zn, Mn, Co, Ni  
5<sup>th</sup> group: Ca, Ba, Sr  
6<sup>th</sup> group: Mg, K, Li

**ORGANIC CHEMISTRY - I**

*Preparation, recrystallization, and determination of melting point & yield of the following compounds:*

- (i) Aspirin, (ii) Nerolin, (iii) Chalcone,
- (iv) *p*-Nitro acetanilide, (v) 2,4,6- Tribromoaniline, (vi) *m*-Dinitrobenzene,
- (vii) Phthalimide, (viii) Diels-Alder adduct.

**Books Suggested**

1. Vogel's Text Book of Quantitative Chemical Analysis, J. Mendham, R. C. Denney, J. D. Barnes and M. J. Thomas, 4th & 6th Ed. (Pearson Education Asia).
2. Vogel's Text Book of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, P.W.G. Smith, A.R. Tatchell, 5 Ed. (Longman Scientific & Technical)



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**PHYSICAL CHEMISTRY-I**

1. Determination of critical solution temperature of phenol-water system.
2. Effect of added electrolyte on the CST of phenol-water system.
3. Conductometric titration of Strong acid versus Strong base
4. Dissociation constant of weak acid ( $\text{CH}_3\text{COOH}$ ) by conductometric method.
5. Conductometric titration of Weak acid vs Strong base.
6. Determination of cell constant
7. Adsorption of acetic acid on animal charcoal or silica gel.
8. Acid-catalyzed hydrolysis of methyl acetate
9. Determination of partial molar volume of solute - $\text{H}_2\text{O}$  system by apparent molar volume method.



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**Paper- I: GENERAL CHEMISTRY-II**

UNIT-1

**Basic Quantum Chemistry-III-** Hydrogen atom- solution of  $R(r)$ ,  $\Phi(\phi)$  and  $\Theta(\theta)$  equations. Probability density in orbitals- shapes of orbitals- Perturbation theory- Time independent perturbation theory(only first order perturbation is to be dealt with)- application to ground state energy of Helium atom- Variation principle- applications- calculation of zero-point energy of harmonic oscillator- many electron atom- Hartee-Fock self-consistent field method(qualitative treatment only)

UNIT-II

**Molecular symmetry and Group Theory in chemistry:** Basic concepts of symmetry and Group theory-Symmetry elements, symmetry operations and point groups- Schoenflies symbols- Classification of molecules into point groups- Axioms of Group theory- Group multiplication tables for  $C_{2v}$  and  $C_{3v}$  point groups- Similarity transformations- and classes- Representations- reducible and irreducible representations, Mullikan symbols, Orthogonality theorem and its implications, Character table and its anatomy.

UNIT-III

**Treatment of analytical data:** Accuracy and precision- Classification of errors- Determination of Indeterminate errors- Minimization of errors- Absolute and Relative errors, propagation of errors-Distribution of Indeterminate errors- Gaussian distribution- Measures of central tendency-Measures of precision- Standard deviation- Standard error of mean- student's t-test- Confidence interval of mean- Testing for significance- Comparison of two means- F-test- Criteria of rejection of an observation- Significant figures and computation rules.

UNIT- IV

**Introduction to computer programming- FORTRAN 77:** Basic structures and functioning of computer with P.C. as an illustrative example- Main memory- Secondary storage memory- input/output devices- computer languages- operating systems- principles of algorithms-and flow charts-constants and variables- Arithmetic expressions- Arithmetic statements- Replacement statement- IF statement- logical IF and BLOCK IF statements- GOTO statements-subscripted variable and DIMENSION statement. DO statement- Rules for DO statement- Functions and subroutines- Development of FORTRAN statements for simple formulae in chemistry such as Vander Waals equation- pH of a solution- First order rate equation- Cell constant-Electrode potential.

Flowcharts and computer programs for

- Program for the calculation of Cell Constant, Specific Conductance and Equivalence.
- Rate Constant of First order reaction or Beer's law by linear least square method.
- Hydrogen ion concentration of a strong acid solution/Quadratic equation.
- Solution for Vander Waals equation or Hydrogen ion concentration of a monoprotic weak acid
- Standard deviation and Variance of univariant data

**References/ Text books:**

- Introductory Quantum chemistry: by A.K. Chandra
- Group theory for Chemistry: by A.K. Bhattacharya
- Introductory Group theory for chemists : by George Davidson
- Vogel's text book of quantitative analysis: byVogel
- Fundamentals of Analytical chemistry: by Skog and West
- Principles of computer programming(FORTRAN 77 IBM PC): by V.Rajaraman
- Basics of computers for chemists: by P.C. Jurs





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**Paper- II: INORGANIC CHEMISTRY-II**

UNIT-I

**Metal cluster compounds** - definition – evidences for existence of M-M bonds - conditions favorable for formation of M-M bonds – preparation, structure and bonding of the following metal cluster compounds.

$\text{Re}_2\text{Cl}_8^{2-}$ ,  $\text{Mo}_2\text{Cl}_8^{4-}$ ,  $\text{Re}_2(\text{RCOO})_4\text{X}_2$ ,  $\text{Mo}_2(\text{RCOO})_4(\text{H}_2\text{O})_2$ ,  $\text{Cr}_2(\text{RCOO})_4(\text{H}_2\text{O})_2$ ,  $\text{Cu}_2(\text{RCOO})_4(\text{H}_2\text{O})_2$ ,  $\text{Cr}_2\text{Cl}_9^{3-}$ ,  $\text{Mo}_2\text{Cl}_9^{3-}$ ,  $\text{W}_2\text{Cl}_9^{3-}$ ,  $\text{Re}_3\text{Cl}_9$ ,  $\text{Re}_3\text{Cl}_{12}^{3-}$ ,  $\text{Mo}_6\text{Cl}_8^{4+}$ ,  $\text{Nb}_6\text{X}_{12}^{2+}$  and  $\text{Ta}_6\text{X}_{12}^{2+}$ .

Polyatomic clusters – Zintl ions, Chevrel phases.

UNIT-II

**Organometallic compounds** - 16 and 18 electron rules. Isoelectronic relationship - Synthesis, structure, bonding and reactions of carbon monoxide, dinitrogen and nitric oxide complexes. Isolobal relationship – H, Cl,  $\text{CH}_3$ ,  $\text{Mn}(\text{CO})_5$ ; S,  $\text{CH}_2$ ,  $\text{Fe}(\text{CO})_4$ ; P, CH,  $\text{Co}(\text{CO})_3$ ; Synthesis, structure, bonding and reactions of metallocenes with special reference to ferrocene.

UNIT-III

**Metal Ligand equilibria in solution:** Step wise and overall formation constants and their interaction– trends in stepwise constants – factors affecting the stability of metal complexes–Pearson's theory of hard and soft acids and bases (HSAB), chelate effect and its thermodynamic origin, determination of stability constants of complexes–spectrophotometric method and pH–metric method. Reactivity of metal complexes–inert and labile complexes. Explanation of lability on the basis of VBT & CFT.

**Bio-Inorganic Chemistry:** Metalloporphyrins with special reference to Haemoglobin & Myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to  $\text{Ca}^{2+}$ . Biological and abiological Nitrogen Fixation.

UNIT- IV

**Inorganic Reaction Mechanisms:** Substitution reactions of metal complexes – D, Id, Ia and A mechanisms – Ligand replacement reactions of metal complexes – Acid hydrolysis – factors affecting acid hydrolysis – Anation and Base hydrolysis of Cobalt(III) complexes. Ligand displacement reactions of square planar complexes of platinum (II). Factors affecting square planar substitution – trans effect (theories).

Electron transfer reactions of complexes – concept of complementary and non-complementary reactions with examples. Inner and outer sphere mechanisms.

**Text books:**

1. Advanced Inorganic Chemistry by F.A. Cotton and R.G. Wilkinson, IV Edition, John, John Wiley and Sons, New York, 1980.
2. Inorganic Chemistry by J.E. Huheey, III edition, Harper International Edition, 1983.
3. Organometallic Chemistry-A unified approach by A. Singh and R.C. Mehrotra, Wiley Eastern Ltd.
4. Inorganic Chemistry by Shriver and Atkins, Oxford University Press (1999)
5. Theoretical Inorganic Chemistry, II Edition by M.C. Day and J. Selbin, Affiliated East-West press Pvt. Ltd., New Delhi.
6. Mechanisms of Inorganic reactions in solution by D.Benson, McGraw Hill, London, 1968.
7. Inorganic chemistry by K.F. Purcell and J.C.Kotz, W.B. Saunders company, New York, 1977.
8. Elements of Bioinorganic Chemistry by G.N. Mukherjee and Arabinda Das, U.N. Dhur & sons Pvt. Ltd, Calcutta.



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**Paper-III: ORGANIC CHEMISTRY-II**

UNIT-I

**Reaction Mechanism**

**15Hrs**

(A) *Aliphatic Nucleophilic Substitution and Nucleophilic Aromatic substitution*: Stereochemistry of  $S_N^2$  and  $S_N1$  mechanisms, Neighboring Group Participation (Anchimeric assistance), NGP by O, S, N: Aromatic Nucleophilic substitution:  $S_N2$  (Ar) (Addition – Elimination),  $S_N1$ (Ar) and benzyne mechanisms (Elimination - Addition); evidence for the structure of benzyne. Von Richter Sommelet-Hauser and Smiles rearrangements.

(B) *Elimination Reactions*: Type of elimination reactions, mechanisms, Stereochemistry and Orientation, Hofmann and Saytzeff rules, Syn elimination versus anti-elimination, competition between elimination and substitution, dehydration, dehydrogenation, dehalogenation, decarboxylative eliminations and pyrolytic eliminations

UNIT-II

**Addition Reactions**

**15 Hrs**

(A) *Addition to Carbon – Carbon Multiple Bonds*: Mechanistic and stereo chemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, region and chemo selectivity, orientation and reactivity, Hydrogenation of double and triple bonds, hydrogenation of aromatic rings, Hydroboration.

(B) *Addition to Carbon-Hetero Multiple Bonds*: Steric course of addition reactions to C=O and C=N, Aldol, Cannizzaro, Perkin, Knoevenagel, Claisen-Schmidt, Claisen, Dieckman, Benzoin and Stobbe condensations, Reformatsky reaction, Tollen's reaction, Prins reaction: Wittig, Grignard, Mannich, and Michael reaction, Hydrolysis of Carbon-Nitrogen bond, Isocyanates and isothioyanates.

UNIT-III

**Molecular Rearrangements**

**15 Hrs**

Types of molecular rearrangements, migratory aptitude;

*Rearrangements to electron deficient carbon*: Pinacol-pinacolone, Wagner-Meerwein, Tiffeneau – Demjanov, Dienone – Phenol, Arndt-Eistert synthesis;

*Rearrangements to electron deficient nitrogen*: Beckmann, Hofmann, Curtius, Schmidt and Lossen rearrangements;

*Rearrangements to electron deficient oxygen*: Baeyer-villiger, Hydro peroxide rearrangement and Dakin rearrangements; Neber rearrangement, Benzil-Benzilic acid and Favorskii rearrangements

UNIT-IV

**Spectroscopy and Protecting Groups**

**15 Hrs**

- A. Basic principles and importance of UV, IR, NMR and Mass.
- B. Protection of carbonyl, Hydroxyl, carboxylic and Amine groups



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**Books Suggested:**

1. Advanced Organic Chemistry-Reactions, Mechanism and structure, Jerry March, 6th Ed. (John Wiley & Sons).
2. Modern Organic Reactions, H. O. House (Benjamin)
3. Structure and Mechanism in Organic Chemistry C. K. Ingold (Cornell University Press).
4. Organic Chemistry, Paula Yurkanis Bruice, 4th Ed. (Prentice Hall)
5. Organic chemistry-Clayden J. (Oxford)
6. Organic Chemistry, Wade, L.G. Jr. 5th Ed. (Pearson)
7. Organic Chemistry, Salmons, P.W. & Others, 8th Ed. (John Wiley & Sons)
8. Advanced Organic Chemistry: Reactions and mechanisms, Miller Bernard & Other, 2nd Ed. (Pearson)
9. Mechanism and Theory in Organic Chemistry, Thomas H. Lowry, Kathleen S. Richardson, Harper & Row, (Publishers, Inc.).
10. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, 6th Ed., (Longman).
11. Reaction Mechanism in Organic Chemistry, P.S. Kalsi, 2nd Ed. (New Age International).
12. Stereochemistry to Organic Compounds, E.L. Eliel (John Wiley).
13. Stereochemistry to Organic Compounds, Nasipuri, 2nd Ed. (New Age International).
14. Stereochemistry, P.S. Kalsi, 5th Ed. (New Age International). Organic Chemistry Structure and Reactivity, Ege Seyhan, 3rd Ed. (AITBS)
15. Spectroscopic Methods in Organic Chemistry- Forth Edition, D.H. Williams and I. Fleming Tata - McGraw Hill, New Delhi, 1990.
16. Organic Spectroscopy- Second Edition, W.Kemp, ELBS Macmillan, 1987.
17. Applications of absorption spectroscopy of Organic Compounds J.R.Dyer, Prentice Hall of India, New Delhi, 1984.
18. Spectrometric identification of Organic Compounds-Fourth Edition, R.M. Silverstein: G.C.Vassillr and T.C. Merrill, John Wiley, Singapore, 1981.
19. Introduction to spectroscopy-D.L.Pavia, G.M.Lampman, G.S.Kriz, 3rdEd (Harcourt college publishers).



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**Paper – IV: PHYSICAL CHEMISTRY-II**

UNIT-I:

**Physical methods of molecular structural elucidation:** NMR: Principle and theory, Nature of spinning particle and its interaction with magnetic field. Chemical shift and its origin. Spin-Spin interaction, Application of NMR to structural elucidation- Structure of ethanol, dimethylformamide, styrene and acetophenone.

Electron Spin Resonance: Principle and experimental technique- g-factor, line shapes and line widths- hyperfine interactions- applications of ESR studies.

UNIT -II:

**Thermodynamics-II-** Brief review on entropy; entropy changes accompanying specific process – expansion, phase transition, heating, measurement of entropy. Nernst heat theorem; Third law of thermodynamics- Determination of the absolute entropy- Apparent exceptions to Third law of thermodynamics.

**Statistical Thermodynamics:** Objectives of statistical thermodynamics, Concept of distributions, Types of ensembles. Thermodynamic probability, Most probable distribution Law – Partition Function, (Definition and significance): Molar and molecular partitions-translational, rotational, vibrational and electronic partition functions- Relation between thermodynamic functions (E, H, S, G and  $C_v$ ) and the partition functions

UNIT-III:

**Electrochemistry I:** Electrochemical cell- Galvanic and electrolytic cell. Concentration cell with and without transference, Effect of complexation on redox potential- ferricyanide/ ferrocyanide couple, Iron (III) phenanthroline / Iron (II) phenanthroline couple. Determination of standard potential, solubility product equilibrium constant and activity coefficients from EMF data.

Bjerrum theory of ion association (elementary treatment) Concept of activity and activity coefficients in electrolytic solutions. The mean ionic activity coefficient. Debye-Huckel theory of electrolytic solutions. Debye-Huckel limiting law (derivation not required), Calculation of mean ionic activity coefficient; Limitations of Debye-Huckel theory. Effect of dilution on equivalent conductance of electrolytes - Anomalous behavior of strong electrolytes. Debye Huckel-Onsagar equation – verification and limitations, Fuel Cells.

UNIT-IV:

**Electrochemistry II:** The electrode-electrolyte interface. The electric double layer. The Helmholtz-Perrin parallel-plate model, the Gouy-Chapman diffuse-charge model and the Stern model.

Electrodics: Charge transfer reactions at the electrode-electrolyte interface. Exchange current density and over-potential. Derivation of Butler-Volmer equation. High field approximation, Tafel equation, Low field equilibrium, Nernst equation. Voltametry-Concentration polarization, experimental techniques.



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**Books:**

1. Text book of Physical Chemistry by Samuel Glasstone, McMillan Pub.
2. Physical Chemistry by W.J.Moore, Prentice Hall
3. Physical Chemistry by G.W. Castellon, Narosha Publishing House
4. Physical Chemistry by Peter Atkins and Julio de Paula, Oxford University Press.
5. Modern Electrochemistry, 2A & 2B, JOM Bockris & A.K.N.Reddy, Plenum publishers
6. Introduction to Electrochemistry, S.Glasstone.
7. Fundamentals of Molecular Spectroscopy, Banwell
8. Spectroscopy by Straw & Walker.
9. Statistical thermodynamics , M.C.Gupta
10. Statistical Thermodynamics, M.Dole



ADIKAVI NANNAYA UNIVERSITY  
SECOND SEMESTER CHEMISTRY SYLLABUS  
(Common for M.Sc Analytical, Physical & Organic Chemistry )  
(With effect from 2016-17 admitted batch)

**LABORATORY WORK (6 hrs/ week)**

**INORGANIC CHEMISTRY PRACTICALS –II**

**Quantitative analysis:**

*Volumetric:*

1. Determination of Ferric iron by photochemical reduction
2. Determination of Nickel by EDTA
3. Determination of Calcium and Magnesium in a mixture by EDTA
4. Determination of Ferrocyanide by Ceric sulphate
5. Determination of Copper(II) in presence of iron(III)

*Gravimetric:*

6. Determination of Zinc as Zinc pyrophosphate
7. Determination of Nickel from a mixture of Copper and Nickel.

**ORGANIC CHEMISTRY PRACTICALS –II**

*Systematic qualitative analysis of an organic mixture containing two compounds*

Identification of method of separation and the functional group(s) present in each of them and preparation of one solid derivative for the confirmation of each of the functional group(s).

**PHYSICAL CHEMISTRY PRACTICALS –II**

1. Distribution of iodine between  $\text{CHCl}_3$  and water
2. Distribution of  $\text{I}_2$  between  $\text{CHCl}_3$  and aq. KI solution- calculation of equilibrium constant.
3. Determination of Coordination number of cuprammonium cation.
4. Titration of mixture Strong acid and weak acid versus Strong base by conductometry.
5. Titration of Strong acid Vs Strong Base – pH – metry.
6. Titration of mixture of ( $\text{NaHCO}_3 + \text{Na}_2\text{CO}_3$ ) Vs HCl – pH- metry.
7. Titration of Strong acid Vs Strong Base using Quinhydrone electrode.
8. Titration of  $\text{Fe}^{+2}$  Vs  $\text{K}_2\text{Cr}_2\text{O}_7$  – potentiometry
9. Verification of Beer-Lambert's law by Iron-thiocyanate system –colorimetry.
10. Determination of single electrode potential of  $\text{Cu}^{2+}/\text{Cu}$  and estimate the given unknown concentration.



ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY

**THIRD SEMESTER**

**Paper – I- ORGANIC REACTION MECHANISMS-I and  
PERICYCLIC REACTIONS**

(Effective from the 2016-17 Admitted Batch)

UNIT – I

15 Hrs

**A) Aliphatic Nucleophilic Substitution:**

Neighboring group participation by Bromine, Phenyl group, Non-Classical carbocations, NGP by Pi bond, Sigma bond and Cyclopropyl group,  $S_N$  at Allylic carbon (allylic rearrangements),  $S_N$  at Aliphatic trigonal carbon,  $S_N$  at Vinylic carbon, Ambident nucleophiles, Hydrolysis of esters ( $B_{AC}^2$ ,  $A_{AC}2$ ,  $A_{AC}1$ ,  $A_{AL}1$ ,  $B_{AL}1$ ), Mechanism of estrification of carboxylic acid with an alcohol using DCC, Mayers Synthesis of aldehydes, ketones and carboxylic acids Mitsunobu reaction, Von-Braun reaction

**B) Aliphatic Electrophilic Substitution:**

Mechanisms of  $S_E^2$ ,  $S_E^1$ ,  $S_{Ei}$ , *Hydrogen as electrophile*: Hydrogen exchange; Migration of double bonds, *Halogen electrophiles*. Mechanism of Halogenation of aldehydes and ketones; HVZ reaction; Halogenation of Sulphoxides & Sulphones, *Nitrogen Electrophiles*: Aliphatic diazo coupling, Diazo transfer reaction, Insertion of nitrenes, *Metal Electrophiles*: Metallation with Organometallic Compounds (Orthometallation), *Carbon as Leaving groups*: Decarboxylation of Aliphatic Acids; Dakin – West reaction; Haller–Bauer reaction.

UNIT – II

15 Hrs

**Principles of asymmetric synthesis:**

Introduction and terminology: Topicity in molecules Homotopic, stereoheterotopic (enantiotopic and diastereotopic) groups and faces, symmetry, substitution and addition criteria. Prochirality nomenclature: Pro-R, Pro-S, Re and Si. Stereoselective reactions: Substrate stereoselectivity, product stereoselectivity, enantioselectivity and diastereoselectivity. Conditions for stereoselectivity: Symmetry and transition state criteria, kinetic and thermodynamic control. Methods for inducing enantio and diastereoselectivity. Analytical methods: % Enantiomeric excess, enantiomeric ratio, optical purity, % diastereomeric excess and diastereomeric ratio. Techniques for determination of enantiomeric excess, specific rotation, Chiral NMR; Chiral derivatizing agents, Chiral solvent, Chiral shift reagents and Chiral HPLC.

UNIT – III

15 Hrs

**Pericyclic Reactions-I**

Molecular orbital symmetry, frontier orbitals of ethylene, 1,3 Butadiene, 1,3,5- Hexatriene, allyl system, classification of pericyclic reactions FMO approach, Woodward- Hoffman correlation diagram method and perturbation of molecular (PMO) approach for the explanation of pericyclic reactions under thermal and photochemical conditions.

Electrocyclic Reactions: Conrotatory and disrotatory motions ( $4n$ ) and ( $4n+2$ ), allyl systems  
Cycloadditions: Antarafacial and suprafacial additions, notation. of cycloadditions, ( $4n$ ) and ( $4n+2$ ) systems with a greater emphasis on ( $2+2$ ) and ( $4+4$ ) - cycloadditions, ( $2+2$ ) - additions of ketenes and chelotropic reactions.



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UNIT-IV

15 Hrs

**Pericyclic Reactions-II**

FMO approach and perturbation of molecular (PMO) approach for the explanation of sigma tropic rearrangements under thermal and photochemical conditions. suprafacial and antarafacial shifts of H Sigmatropic shift involving carbon moieties, retention and inversion of configurations, (3, 3) and (5, 5) sigmatropic rearrangements detailed treatment of Claisen and Cope rearrangements, fluxional tautomerism, aza-Cope rearrangement and Barton reaction.

Text Books and Reference Books:

- 1) Advanced Organic Chemistry: Reactions Mechanisms and Structure by Jerry March, Mc.Graw Hill and Kogakush.
- 2) Molecular reactions and Photochemistry by Charles Dupey and O. Chapman, Prentice Hall.
- 3) Pericyclic reactions by S.N. Mukharji, Mcmilan.
- 4) Mechanisms and Theory in Organic Chemistry by T.H. Lowery and K.S. Rich gardson.
- 5) The modern structural theory in Organic Chemistry by L.N.Ferguson, Pretice Hall
- 6) Physical Organic Chemistry by jack Hine, Mc. Graw Hill
- 7) Advanced Organic Synthesis, Part B-Reactions and Synthesis, Francis A. Carey and Richard J. Sudenburg, Fourth edition, Kluwer academic publishers, New York
- 8) Organic Synthesis, Christine Willis and Martin Willis, Oxford Chemistry primers.
- 9) Principles of Organic Synthesis, ROC Norman and JM Coxon, third edition, CBS, Publisher, Delhi.
- 10) Organic Synthesis, M. B. Smith, Mc Graw Hill, International Edition.
- 11) Organic Chemistry, Clayden, Greeves and Stuwart Warren.
- 12) Modern Organic Synthesis-an introduction by George S.Zweifel and Michael H. Nantz, W. H. Freeman & company, New York.
- 13) Pericyclic Reactions — a problem solving approach, Lehr and Merchand.
- 14) Conservation of Orbital Symmetry by Woodward and Hoffmann.





ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY

**THIRD SEMESTER**

**Paper – II- ORGANIC SPECTROSCOPY-I**

**(Effective from the 2016-17 Admitted Batch)**

UNIT-I 15 Hrs

**UV-Visible spectroscopy:**

A) Beer-Lambert's law-Deviations from Beers law-Instrumentation-Mechanics of measurement- Energy transitions-Simple chromophores- Auxochrome, Absorption shifts (Bathochromic, Hypsochromic, Hyper chromic and Hypo chromic shifts) UV absorption of Alkenes-Polyenes unsaturated cyclic systems.

B) UV absorption of carbonyl compounds:  $\alpha,\beta$ -unsaturated carbonyl systems-UV absorption of aromatic systems-solvent effects-geometrical isomerism-acid and base effects-typical examples-calculation of  $\lambda$  max values using Woodward Fieser rules, applications.

UNIT-II 15 Hrs

**Infrared spectroscopy:**

A) Mechanics of measurement-Fundamental modes of vibrations-stretching and bending vibrations-Factors effecting Vibrational frequency-hydrogen bonding.

B) Finger print region and its importance, typical group frequencies for –CH,-OH, N-H, CC,-CO and aromatic systems-Application in structural determination-Examples-simple problems.

UNIT-III 15 Hrs

**Nuclear Magnetic Resonance Spectroscopy ( $^1\text{H}$ NMR):**

A) Introduction: Basic principle of- NMR Nuclear spin- nuclear resonance-saturation-Relaxation-Instrumentation (CW&FT).

B) Shielding and deshielding of magnetic nuclei-chemical shift and its measurements, factors influencing chemical shift – spin-spin interactions- factors influencing –coupling constant J and factors effecting J value.

C)  $^{13}\text{C}$  NMR Spectroscopy: Similarities and Differences between PMR and CMR, general considerations, chemical shift (aliphatic, olefinic, alkyne, aromatic, hetero aromatic and carbonyl carbon), coupling constants, typical examples of CMR spectroscopy-simple systems.

UNIT-IV 15 Hrs

**Mass spectrometry**

A) Introduction: Ion production-E1, C1, ES, MALDI and FAB- determination of Molecular weight and formulae-Behavior of organic compounds in mass spectrometer- factors affecting fragmentation, ion analysis, and ion abundance.

B) Mass spectral fragmentation of organic compounds, Common functional groups, molecular ion peak, meta stable peak, Mc Lafferty rearrangement, Nitrogen rule, High resolution mass spectrometry, Examples of mass spectral fragmentation of organic compounds with respect of their structure determination.



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Suggested Books:

- 1) Spectroscopic Methods in Organic Chemistry- Forth Edition, D.H. Williams and I.Fleming  
Tata McGraw Hill, New Delhi, 1990.
- 2) Organic Spectroscopy- Second Edition, W.Kemp, ELBS Macmillan, 1987.
- 3) Applications of absorption spectroscopy of Organic Compounds J.R.Dyer,  
Prentice Hall of India, New Delhi, 1984.
- 4) Spectrometric identification of Organic Compounds-Fourth Edition, R.M.  
Silverstein: G.C.Vassiellr and T.C. Merrill, Johne Willey, Singapore, 1981.
- 5) Introduction to spectroscopy-D.L.Pavia, G.M.Lampman, G.S.Kriz, 3rdEd  
(Harcourt college publishers).
- 6) Absorption spectroscopy of organic molecules-V.M.Parkih.
- 7) Nuclear Magnetic Resonance-Basic principles-Atta-Ur-Rehman, Springer-Verlag, 1986.



ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY

**THIRD SEMESTER**

**Paper – III- MODERN ORGANIC SYNTHESIS-I**  
**(Effective from the 2016-17 Admitted Batch)**

UNIT-I

**Formation of C-C single bonds** 15 Hrs

Alkylations via enolate, Thermodynamic and kinetic enolate, Asymmetric Aldol reaction: a) Chiral enolate and achiral aldehyde b) Achiral enolate and chiral aldehyde – explanation by Zimmerman Traxler model; Stork enamine reaction and its synthetic applications; Organo sulphur chemistry: Umpolung and its synthetic applications (Corey Seebach Reaction), sulphur ylides: dimethyl sulphonium methylide, dimethyloxosulphonium methylide preparations and their synthetic applications; Organo Palladium Chemistry: Heck Reaction, Stille coupling, Suzuki coupling, Sonogashira coupling, Negishi coupling, Wacker Oxidation; Organo copper chemistry: Gilman's reagent and synthetic applications; Synthetic applications of carbenes and carbenoids; Baylis Hilman reaction.

UNIT-II

**Formation of Carbon-Carbon double bonds** 15 Hrs

Stereochemistry of E1 and E2 reactions (Different examples of acyclic and cyclic molecules, Saytzeff rule, Hofmann rules and Bredt's rule); Pyrolytic Syn eliminations (focus should be given on stereochemistry of syn eliminations of amine oxides, xanthates and esters of acyclic and cyclic molecules); Sulphoxide-Sulphenate rearrangement (Mislow-Evans rearrangement); Wittig reaction, Wadsworth Emmons reaction, Corey-Fuchs reaction, Aza Wittig reaction, Wittig-Horner reaction and stereo chemistry of Wittig reaction; Shapiro reaction, Eschen-Moser Tanabe fragmentation, Claisen rearrangement of allyl vinyl ethers, Julia Lythgoe olefination, Mc Murray coupling, Peterson Olefination, Tebbs reagent and its application, Metathesis: Grubbs 1st and 2nd generation catalyst, Olefin cross coupling (OCM), ring closing (RCM) and ring opening (ROM) metathesis, applications, olefination by Nysted reagent.

UNIT-III

**Reactions of unactivated C-H bonds and organoboranes** 15 Hrs

The Hoffmann Loeffler- Freytag reaction, the Barton reaction and Photolysis of organic hypothalites;

Organoboranes: Preparation of Organoboranes



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viz hydroboration with  $\text{BH}_3\text{-THF}$ , dicyclohexyl borane, disiamyl borane, theryl borane, 9-BBN mono isopinacamplyl borane ( $\text{IPC}_2\text{BH}_2$ ) and diisopinacamplyl borane ( $\text{IPC}_2\text{BH}$ ) functional group transformations of Organo boranes-Oxidation, protonolysis and isomerisation. Formation of carbon-carbon-bonds viz organo boranes carbonylation and cyanidation, reactions of alkenyl boranes and trialkyl alkynyl borates.

UNIT-IV

**Protecting groups and simple applications of microwave and ultrasound assisted reactions** 15 Hrs

(A) Protecting Groups

- 1) Protection of **alcohols** as **ethers** [methyl ether ( $\text{RO-Me}$ ), Tertiary butyl ether ( $\text{ROCM}_3$ ), Benzyl ethers ( $\text{RO-Bn}$ ), *p*-methoxybenzylethers ( $\text{RO-PMB}$ )], as **Silyl ethers** [Trimethyl silylether ( $\text{R-OTMS}$ ), tri ethyl silyl ethers ( $\text{RO-TEs}$ ), *t*-butyldimethylsilyl ether ( $\text{R-OTBDMS}$  in the presence of imidazole), tri isopropylsilyl ether ( $\text{RO-TIPS}$ ), *t*-butyl diphenylsilyl ether ( $\text{RO-TBDPS}$ )], as **acetals** [tetrahydropyranyl ethers ( $\text{RO-THP}$ ), methoxymethyl ethers ( $\text{RO-CH}_2\text{-OCH}_3 = \text{RO-MOM}$ ) and **ester formation** (carboxylic acid ester and *p*-toluene sulphonate esters).
- 2) Protection of 1,2-diols by acetal, ketal and carbonate formation.
- 3) Protection of amines by acetylation, benzoylation, benzoyloxy carbonyl, Fmoc and triphenyl methyl groups.
- 4) Protection of carbonyl by acetal, ketal and thio acetal (Umpolung) groups.
- 5) Protection of carboxylic acids by esters and ortho ester formation.

(B)

Synthetic applications of PTC and crown ethers

1. Microwave Technology: Microwave equipment, activation-benefits, limitations, microwave effects. Microwave assisted reactions in organic solvents-Esterification reactions, Fries rearrangement, Orthoester Claisen rearrangement, Diels- Alder reaction, decarboxylation.
2. Ultrasound assisted reactions: introduction, substitution reactions, addition, oxidation, reduction reactions.
3. Click chemistry: criterion for click reaction, Sharpless azides cycloadditions



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Textbooks and Books for Reference:

- 1) Some Modern Methods of Organic Synthesis W. Carruthers, Third & Fourth Edition, Cambridge University Press, Cambridge, 1988.
- 2) Modern Organic Synthesis-an introduction by George S.Zweifel and Michael H. Nantz, W. H. Freeman & company, New York.
- 3) Advanced Organic Synthesis, Part B-Reactions and Synthesis, Francis A. Carey and Richard J. Sudenburg, Fourth edition, Kluwer academic publishers, New York
- 4) Organic Synthesis, Christine Willis and Martin Willis, Oxford Chemistry primers.
- 5) Principles of Organic Synthesis, ROC Norman and JM Coxon, third edition, CBS, Publisher, Delhi.
- 6) Organic Synthesis, M. B. Smith, McGraw Hill, International Edition.
- 7) Organic Chemistry, Clayden, Greeves and Stuart Warren.
- 8) Guide Book to Organic Synthesis (3<sup>rd</sup> edition), R. Mackie, D. M. Smith and Aitken.
- 9) Organo Boranes and Silanes, Thomson, Oxford Chemistry primers.
- 10) Strategic applications of named reactions in organic synthesis, Laszlo Kurti and Barbara Czako.
- 11) Modern Synthetic Reactions, Herbert O. House, Second Edition, W.A. Benzamine Inc. Menio Park, California, 1972.
- 12) Organic Synthesis viz Boranes, Herbert C. Brown Gray, W. Kramer Alan B. Levy and M. Mark Midland John Wiely &. Sons, New York, 1975.
- 13) Organic Synthesis: Special Techniques, V. K. Ahluwalia and Renu Agarwal.
- 14) Organic Synthesis, Jagadamba Singh and Dr. A. Yadav, Pragati Edition.



ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY

**THIRD SEMESTER**

**Paper – IV- : CHEMISTRY OF NATURAL PRODUCTS**

**(Effective from the 2016-17 Admitted Batch)**

**UNIT–I: Alkaloids** 15 Hrs

Introduction, isolation, general methods of structure elucidation and physiological action, degradation, classification based on nitrogen heterocyclic ring, structure, stereochemistry, synthesis and biosynthesis of morphine, strychnine, vincristine, colchicine, camptothecin and reserpine.

**UNIT–II: Terpenoids** 15 Hrs

Occurrence, isolation, general methods of structure determination, isoprene rule. Structure determination, stereochemistry, biosynthesis and synthesis of Farnesol, Zingiberene, Forskolin, Taxol, Azadirachtin and  $\beta$ -amyrin.

**UNIT–III: Steroids** 15 Hrs

Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and its stereochemistry. Isolation, structure determination and synthesis of cholesterol (total synthesis not expected), androsterone, testosterone, estrone and progesterone, Biosynthesis of steroids.

**UNIT–IV: Flavonoids and Isoflavonoids** 15 Hrs

Occurrence, nomenclature and general methods of structure determination, Isolation, structure elucidation and synthesis of Kaempferol, Quercetin, Cyanidin, Genestein, Butein and Daidzein. Biosynthesis of flavonoids and Isoflavonoids: Acetate Pathway and Shikimic acid Pathway.

Books Suggested:

1. Natural Products: Chemistry and Biological Significance, J. Mann, R.S.Davidson, J. B. Hobbs, D. V. Banthrope and J. B. Hatrbnome, Longman, Essex.
2. Organic Chemistry, Vol. 2, I. L. Finar, ELBS.
3. Chemistry of Organic Natural Products, O. P. Agrawal, Vols. 1 &2, Goel Pubs.
4. Natural Products Chemistry K. B. G. torsell, John Wiley, 1983
5. New Trends in Natural Products Chemistry, Atta-ur-Rahman and M.I.Choudhary, Harwood Academic Publisher.
6. Chemistry of Natural products P. S. Kalsi, Kalyani Publishers
7. Biosynthesis of steroids, terpenes and acetogenins, J. H. Richards & J. R. Hendrieson
8. The biosynthesis of secondary metabolites, R. D. Herbert, Chapman & Hall
9. The Biosynthesis of Secondary Metabolite, R. D. Herbert, Second edn, Chapman and Hall 1984
10. Chemical aspects of Biosynthesis, John Mann, Oxford University Press, Oxford, 1996.



ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY

FOURTH SEMESTER

Paper – I- ORGANIC REACTION MECHANISMS-II and  
ORGANIC PHOTO CHEMISTRY

(Effective from the 2016-17 Admitted Batch)

UNIT – I 15 Hrs

A) **Free Radical Reactions:**

Free radical substitution mechanisms; Mechanism at an aromatic substrate; Neighboring group assistance in free radical reactions; Reactivity for aliphatic substrates; Reactivity in aromatic substrates; Reactivity at bridge head; Reactivity in the attacking radical; Effect of solvent on reactivity, Allylic halogenations using NBS (Wohl – Ziegler bromination); Hydroxylation at aromatic carbon by Fentons reagent; Oxidation of aldehydes to carboxylic acids; Formation of cyclic ethers using Leadtetraacetate; Formation of hydroperoxides (autooxidation); Coupling of alkynes (Eglinton reaction and Glaser reaction); Arylation of Aromatic compounds by diazonium salts (Gomberg – Bachman reaction); Mechanisms of Sandmeyer reaction, Kolbes reaction, Hunsdiecker reaction, Reed reaction; free radical rearrangements.

B) **Quantitative relationships between Molecular structure and Chemical reactivity:**

Hammett and Taft Equations

C) **Rearrangements:** Wagner – Meerwein Rearrangement, Demjanov Rearrangement, Wittig Rearrangement and Stevens Rearrangement

Unit – II: 15 Hrs

**Methodologies in asymmetric synthesis**

Strategies in Asymmetric Synthesis: 1. Chiral substrate controlled, 2. Chiral auxiliary controlled, 3. Chiral reagent controlled and 4. Chiral catalyst controlled.

1. **Chiral Substrate controlled asymmetric synthesis:** Nucleophilic additions to chiral carbonyl compounds. 1, 2- asymmetric induction, Cram's rule and Felkin-Anh model.

2. **Chiral auxiliary controlled asymmetric synthesis:**  $\alpha$ -Alkylation of chiral enolates, azaenolates, imines and hydrazones. 1, 4-Asymmetric induction and Prelog's rule. Use of chiral auxiliaries in Diels-Alder reaction.

3. **Chiral reagent controlled asymmetric synthesis:** Asymmetric reductions using BINAL-H. Asymmetric hydroboration using IPC2 BH and IPCBH2.

4. **Chiral catalyst controlled asymmetric synthesis:** Sharpless and Jacobsen asymmetric epoxidations. Sharpless asymmetric dihydroxylation. Asymmetric hydrogenations using chiral Wilkinson biphosphine and Noyori catalysis. Enzyme mediated enantioselective synthesis

5. **Asymmetric aldol reaction:** Diastereoselectivity aldol reaction (chiral enolate & achiral aldehydes and achiral enolate & chiral aldehydes) its explanation by Zimmerman-Traxel model.

UNIT – III 15 Hrs

**Photo Chemistry-I**

Photochemical energy, Frank Condon Principle, Types of Electronic Excitation and Molecular orbital view of excitation, Jablonski Diagram, singlet and triplet states, dissipation of photochemical energy, photosensitization, quenching, quantum efficiency and quantum yield, Determination of Quantum yield

Photo Chemistry of Carbonyl Compounds: Norrish Type I reaction (alpha cleavage reaction), Norrish Type – II reaction, Paterno- Buchi reaction, Photo reduction & photo enolisation; photochemical Oxidations [Backstrom mechanism], Photo oxidation of alkenes with singlet oxygen.



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Unit – IV

**Photochemistry-II**

Di – Pi methane Rearrangement, Aza di – Pi methane rearrangement; Photochemistry of Benzene and substituted benzene, 1, 2 , 1,3 ,& 1, 4-additions; Photo Fries rearrangement of Phenolic acetates and Anilides; Photochemistry of unsaturated systems, Cis- Trans Isomerisation of alkenes (Direct and sensitized) (Photoisomerisation of Stilbene), Photochemistry of Butadiene; Dimerisations of alkenes, Intramolecular dimerisation.

Photochemical rearrangement of Cyclohexadienenones; Photochemistry of alpha, beta Unsaturated ketones (dimerisations and addition across the double bond); Photochemical rearrangement reactions of Cyclohexenone, Photorearrangements of Beta, gamma unsaturated systems (Mechanism of 1,2 & 1,3 – acyl shifts); Photochemistry of Nitrite esters (Barton reaction); Photochemistry of alpha diazoketones; Photo Aromatic Substitutions; Photochemistry of Pyridinium ylides.

Text Books and Reference Books:

- 1) Advanced Organic Chemistry: Reactions Mechanisms and Structure by Jerry March, Mc.Graw Hill and Kogakush.
- 2) Molecular reactions and Photochemistry by Charles Dupey and O. Chapman, Prentice Hall.
- 3) Mechanisms and Theory in Organic Chemistry by T.H. Lowery and K.S. Richardson.
- 4) The modern structural theory in Organic Chemistry by L.N.Ferguson, Prentice Hall
- 5) Physical Organic Chemistry by Jack Hine, Mc. Graw Hill
- 6) Advanced Organic Synthesis, Part B-Reactions and Synthesis, Francis A. Carey and Richard J. Sudenburg, Fourth edition, Kluwer academic publishers, New York
- 7) Organic Synthesis, Christine Willis and Martin Willis, Oxford Chemistry primers.
- 8) Principles of Organic Synthesis, R.C. Norman and J.M. Coxon, third edition, CBS, Publisher, Delhi.
- 9) Organic Synthesis, M. B. Smith, Mc Graw Hill, International Edition.
- 10) Organic Chemistry, Clayden, Greeves and Stuart Warren.
- 11) Modern Organic Synthesis-an introduction by George S.Zweifel and Michael H. Nantz, W. H. Freeman & company, New York.
- 12) Organic Photochemistry by D Coyle
- 13) Molecular Photochemistry by Gilbert & Baggo
- 14) Organic Photochemistry by Turro
- 15) Photochemistry by C W J Wells





ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY

**FOURTH SEMESTER**

**Paper – II- ORGANIC SPECTROSCOPY-II**  
**(Effective from the 2016-17 Admitted Batch)**

UNIT-I:

- A) Optical Rotatory Dispersion: Theory of Optical Rotatory Dispersion-Cotton effect –CD curves-types of ORD and CD curves–similarities and difference between ORD and CD curves
- B) The octant rule-application in structural studies- $\alpha$ - halo keto rule.

UNIT-II

A) Improving the PMR spectrum: Chemical and Magnetic Equivalence. Chemical exchange, First and Non-First Order Spectra and analysis of AB, AMX and ABX systems.

B) Simplification of complex spectra-: Nuclear Magnetic double resonance, Lanthanide shift reagents, solvent effects, Fourier transforms technique, Nuclear Overhauser Effect (NOE), Deuterium Exchange, spectra at higherfields. Hindered Rotations and Rate processes. Resonance of other nuclei- $^{19}\text{F}$  and  $^{31}\text{P}$

C) 2D NMR spectroscopy: Definitions and importance of COSY, DEPT, HOMCOR, HETCOR, INADEQUATE, INDOR INEPT, NOESY, HOM2DJ, HET2DJ and DQFCOSY.

UNIT-III

Solution of structural problems by joint application of UV, IR, NMR ( $^1\text{H}$ & $^{13}\text{C}$ ) and mass spectrometry.

UNIT-IV

A) Separation Techniques: Solvent extraction chromatography-paper-thin layer partition-column chromatography, Electrophoresis.

B) Instrumentation – Gas Chromatography, High performance Liquid Chromatography, X – Ray diffraction (XRD)

**Suggested Books:**

- 1) Spectroscopic Methods in Organic Chemistry- Forth Edition, D.H. Williams and I. Fleming  
Tata - McGraw Hill, New Delhi, 1990.
- 2) Organic Spectroscopy- Second Edition, W.Kemp, ELBS Macmillan, 1987.
- 3) Spectrometric identification of Organic Compounds-Fourth Edition, R.M. Silverstein: G.C.Vassillr and T.C. Merill, John Willey, Singapore, 1981.
- 4) Introduction to spectroscopy-D.L.Pavia, G.M.Lampman, G.S.Kriz, 3rdEd  
(Harcourt college publishers).
- 5) "Applications of Optical rotation and Circular Dichroism", G.C. Barret, in  
"Elucidation of Organic structures by Physical and Chemical Methods"  
Part I (Eds) K.W. Bentley and G.W.Rirty John Wiley, 1972, Chapter VIII  
(only those aspects mentioned in the syllabus).
- 6) Instrumental methods of chemical analysis by H.Kaur, Pragati Prakasan,meerut.
- 7) Separation Techniques by M.N.Sastri, Himalaya publishing House (HPH), Mumbai.



ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY

**FOURTH SEMESTER**

**Paper – III- MODERN ORGANIC SYNTHESIS-II**  
**(Effective from the 2016-17 Admitted Batch)**

UNIT-I

**Organo Silanes**

15 Hrs

Synthetic applications of trimethylsilyl chloride dimethyl-*t*-butylsilyl chloride, trimethylsilyl cyanide, trimethylsilyl iodide and trimethylsilyl triflate, synthetic applications of  $\alpha$ -silyl carbanion and  $\beta$ -silyl carbonium ions. Synthetic applications of silyl enol ethers, Preparation and synthetic applications of alkynyl silanes, aryl silanes, allyl silanes and vinyl silanes, Nazarov cyclization, Synthetic conversion of  $\alpha$ ,  $\beta$ -epoxy silanes, Peterson Olefination, Brook rearrangement and Rubottom oxidation.

UNIT-II

15 Hrs

**Oxidation**

Synthetic applications of the following reagents in the oxidation of functional groups like alkenes, alkynes, alcohols, aldehydes and ketones: 1)  $\text{Pb}(\text{OAc})_4$  2)  $\text{HIO}_4$  3)  $\text{SeO}_2$  4)  $\text{CrO}_3$  (Sodium or potassium dichromate in  $\text{H}_2\text{SO}_4$ , Collins reagent, Jones reagent, Etard reagent,  $\text{CrO}_3$  in acetic anhydride, PCC (Coreys reagent), PDC, Babler oxidation), 4)  $\text{MnO}_2$  5)  $\text{KMnO}_4$  6)  $\text{OsO}_4$  7) Oxidations by using DMSO involving alkoxy sulphonium salts (Kornblum oxidation), DCC- DMSO (Pfitzner-Muffat reagent), Swern oxidation, Corey-Kim oxidation, Albright-Goldman oxidation 8) Oxidations by using IBX, DMP, TPAP, TEMPO, CAN 9) Bayer villager oxidation and Prilzhev epoxidation 10) Oxidation of alkenes using Woodward and Prevost reagents 11) Oxidation by using DDQ 12) Sharpless asymmetric epoxidation and Sharpless asymmetric dihydroxylation 13) Thallium nitrate 14) Oxidative coupling of phenols and alkynes.

UNIT-III

**Reduction**

15 Hrs

- (1) Catalytic reductions: Homogeneous (Wilkinson's Catalytic reduction) and heterogeneous catalytic reductions and their synthetic applications.
- (2) Reductions by using electrophilic nucleophilic metal hydrides:  $\text{LiAlH}_4$  (Various examples of reductions and Cram's rule), related reagents of LAH,  $\text{NaBH}_4$ ,  $\text{NaBH}_3\text{CN}$ , Trialkyl Borohydrides (Super Hydride and Selectride).
- (3) Reductions by using electrophilic metal hydrides:  $\text{BH}_3$ , DIBAL



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- (4) Reductions by dissolving metals: Clemenson reduction, Acyloin condensation, Bouveault-Blanc reduction, Birch reduction (Various examples should be discussed).
- (5) Reductions by using Diimide and Wolf-Kishner Reduction (6) Hydrogenolysis
- (7) Reductions by using tri n-butyl tin hydride.

UNIT-IV

**Retro Synthetic Analysis**

15 Hrs

1. Basic definitions of the following:
  - a) Retro synthetic analysis
  - b) Disconnection
  - c) Target molecule
  - d) Synthone
  - e) Synthetic equivalent
  - f) Functional Group Inter Conversion (FGI)
  - g) Functional Group Addition (FGA)
2. Guidelines for the order of events: One group C-X disconnections One Group C-X disconnections (Carbonyl derivatives, ethers, sulphides and alcohols); Two group C-X disconnections (1,1-difunctionalised, 1,2-difunctionalised and 1,3-difunctionalised compounds), One group C-C disconnections (Alcohols and carbonyl compounds, 1,1-C-C, 1,2-C-C and 1,3-C-C); Synthesis of alkenes (Wittig disconnections and diene synthesis), Two group disconnections (Diels Alder reaction and 1,3-difunctionalised compounds); Linear and convergent synthesis.

Textbooks and Books for Reference:

- 1) Some Modern Methods of Organic Synthesis W. Carothers, Third Edition, Cambridge University Press, Cambridge, 1988.
- 2) Modern Organic Synthesis-an introduction by George S.Zweifel and Michael H. Nantz, W. H. Freeman & company, New York.
- 3) Advanced Organic Synthesis, Part B-Reactions and Synthesis, Francis A. Carey and Richard J. Sudenburg, Fourt edition, Kluwer academic publishers, New York.
- 4) Organic Synthesis, Christine Willis and Martin Willis, Oxford Chemistry primers.
- 5) Principles of Organic Synthesis, ROC Norman and JM Coxon, third edition, CBS, Publisher, Delhi.
- 6) Organic Synthesis, M. B. Smith, McGraw Hill, International Edition.
- 7) Organic Chemistry, Clayden, Greeves and Stewart Warren.
- 8) Guide Book to Organic Synthesis (3<sup>rd</sup> edition), R. Mackie, D. M. Smith and Aitken.
- 9) Organo Boranes and Silanes, Thomson, Oxford Chemistry primers.
- 10) Strategic applications of named reactions in organic synthesis, Laszlo Kurti and Barbara Czako.
- 11) Organic Synthesis: The disconnection approach, S. Warrant John Wiley & sons, New York, 1984.
- 12) Modern Synthetic Reactions, Herbet O. Horase, Second Edition, W.A. Benzamine Inc. Menio Park, California, 1972.



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DEPARTMENT OF CHEMISTRY

**FOURTH SEMESTER**

**Paper – IV- BIO-ORGANIC CHEMISTRY**  
**(Effective from the 2016-17 Admitted Batch)**

UNIT-I 15 Hours

**Biopolymers and Enzymes**

Peptides:  $\alpha$ -Amino acids, their general properties and synthesis, Synthesis of peptides by Merrified solid phase synthesis. Chemistry of oxytocin and dolastain-10  
Enzymes-Oxidoreductases, hydrolases, transferases, synthesis of ATP, Baker's Yeast.  
Enzyme models-NADH models, Bio transformations, Remotefunctionalization

UNIT-II 15 Hours

**Antimalarials & Antibiotics**

**i. Antimalarials**

Chemotherapy, synthesis and activity of antimalarial drugs- quinoline group-quinine, acridine group-quinacrine and guanidine group-paludrine.

**ii. Antibiotics**

General characteristics, structure- activity relationships, synthesis and activity of antibiotics: Pencillin G, Cephalosporin-C and streptomycin.

UNIT-III 15 Hours

**Vitamins and Prostaglandins**

Definition, occurrence, structural formulae, physiological functions and synthesis of Vitamins.

Vitamins: Structure determination and synthesis of Retinol (A), Thiamine (B<sub>1</sub>), Riboflavin (B<sub>2</sub>), Pyridoxine (B<sub>6</sub>) and Biotins (H), Nicotininc acid.

**Prostaglandins**

Occurrence, nomenclature, classification, biogenesis and physiological effects. Synthesis of PGE<sub>2</sub> and PGF<sub>2</sub>

UNIT-IV 15 Hours

**Nucleic Acids:**

Nucleic acids: Basic concepts of the structures of RNA and DNA and their hydrolysis products, nucleotides, nucleosides and heterocyclic bases, Genetic Code, Finger Print test.

Application of recombinant DNA technology in production of pharmaceuticals, diagnosis of diseases, insect control, improved biological detergents, gene therapy-examples.



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Reference Books and Material:

1. Chemical Aspects of Biosynthesis, John Man, Oxford University Press, Oxford, 1996.
2. Chemistry of Natural Products: A Unified Approach, N. R. Krishnaswamy, University Press (India) Ltd., Orient Longman Limited, Hyderabad, 1999.
3. Introduction to Organic Chemistry, A Streitwieser, CH Heathcock and E.M./Kosover IV Edition, McMillan, 1992. (For Merrifield synthesis of peptides and also for other aspects of Unit IV)
4. Bio-organic Chemistry, H.Dugas and C. Penney, springer, New York, 1981.
5. Details of Primary literature: Nomenclature: Structure: Dolastatin-10: JACS, 1987, 109, 6883 (structure), ibdi, 1989, 111, 5463, JCS, Parkin I, 1996, 859 (synthesis).



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**III SEMESTER**  
**Laboratory Course-1**

**100 M**

**Multistep Synthesis of Organic Compounds:**

The experiments should illustrate the use of organic reagents and may involve purification of the products by chromatographic techniques.

1. Beckmann rearrangement: Benzanilide from Benzophenone  
Benzophenone → Benzophenone oxime → Benzanilide
2. Benzilic acid rearrangement: Benzilic acid from benzoin  
Benzoin → Benzil → Benzilic acid
3. P-Bromo Aniline from Aniline :  
Aniline → Acetanilide → P-Bromo Acetanilide → P-Bromo Aniline
4. Symmetrical Tribromo Benzene from aniline:  
Aniline → Tribromoaniline → Tribromobenzene
5. 2,4,6-trimethylquinoline from p-toluidine  
p-toluidine → 4-(p-tolylamino) pent-3-ene-2-one → 2,4,6-trimethylquinoline
6. Flavone from o-hydroxy acetophenone  
o-hydroxy acetophenone → o-benzoyl acetophenone → o-hydroxy- dibenzoylmethane → Flavone
7. 2-phenylindole from phenylhydrazine  
phenylhydrazine → acetophenone phenylhydrazone → 2-phenylindole

**Laboratory Course-2**

**100 M**

**Spectral Identification of Organic Compounds (UV, IR,  $1^{\text{H}}$ - and  $^{13}\text{C}$ - NMR, MASS).**

A minimum of 40 representative examples should be studied

**Books Suggested**

1. Modern Organic Synthesis in the Laboratory *A Collection of Standard Experimental Procedures*, Jie Jack Li, Chris Limberakis, Derek A. Pflum
2. Practical organic chemistry by Mann & Saunders
3. Text book of practical organic chemistry by Vogel
4. Spectrometric Identification of organic compounds, R.M. Silverstein, F.X. Webster and D.J. Kiemle, 7th Ed., (Wiley)



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**IV – SEMESTER**  
**Laboratory Course-1**

**100 M**

**Chromatographic Separation and Isolation & identification of Natural Products**

1. Thin layer chromatography: Determination of purity of a given sample, monitoring the progress of chemical reactions, identification of unknown organic compounds by comparing the R<sub>f</sub> values of known standards.
2. Isolation and identification of Natural Products
  - (a) Isolation of caffeine from tea leaves
  - (b) Isolation of eugenol from cloves
  - (c) Isolation of casein and lactose from milk
  - (d) Isolation of limonene from lemon peel
  - (e) Isolation of piperines from black pepper
  - (f) Isolation of lycopene from tomatoes
  - (g) Isolation of β-carotene from carrots

**Laboratory Course-2**  
**Estimations and Chromatography**

**100 M**

1. Estimation of (a) Glucose (b) Phenol (c) Aniline (d) Acetone (e) Aspirin (f) Ibuprofen (g) Paracetamol
2. Separation by column chromatography: Separation of a mixture of *ortho* and *para* nitroanilines using silicagel as adsorbent and chloroform as the eluent. The column chromatography should be monitored by TLC.

**Books Suggested:**

1. Ikan, R. *Natural Products, A Laboratory Guide*, 2nd ed.; Academic Press: New York, 1991.
2. Adapted from *Introduction to Organic Laboratory Techniques: A Microscale Approach*. Pavia, Lampman, Kriz and Engel. (1999) Saunders College Publishing.
3. Pharmaceutical drug analysis by Ashutoshkar
4. Quantitative analysis of drugs in pharmaceutical formulations by P D Sethi
5. Practical pharmaceutical chemistry part-1 and part-2 by A H Beckett and J B Stenlake
6. Practical organic chemistry by Mann & Saunders
7. Text book of practical organic chemistry including qualitative organic analysis by A.I. Vogel (Longman)



ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY  
**THIRD SEMESTER**  
PAPER-I: ADVANCED CHEMICAL KINETICS AND PHYSICAL  
CHEMISTRY OF POLYMERS  
(Effective from the 2016-17 admitted Batch)

UNIT-I

Theories of reaction rates – Potential energy surfaces – Reaction coordinate – theories of unimolecular gas phase reactions – Lindemann hypothesis – Hinshelwood treatment – Reactions in solutions – Kinetic Isotope effect – Linear free energy relationships – Hammett equation – Okamoto–Brown Equation – Taft Equation; Chain Reactions  $H_2-Cl_2, H_2-Br_2$  and  $H_2-O_2$  reaction – Explosion limits.

UNIT-II

Complex reactions – Consecutive – Parallel and Opposing reactions – Equilibrium and Steady state technique – Michaelis – Menten Models. Flow and relaxation Technique for fast reactions – NMR methods determining exchange rates.

UNIT-III

Characteristics of macro molecules (addition & condensation of polymerization), degree of polymerization. Shapes of macro – molecules, bulk, solution and emulsion polymerization – Co-Polymerization, block and graft copolymers, Ziegler natta catalysis. The structure and properties of polymers – Crystallinity. Glass-transition temperature, Rheology and solubility of polymers, processing of polymers – Additives.

UNIT-IV

Interaction of polymers and liquids – Flory – Huggins treatment and its limitation, Fractionation, Viscosities of polymer solutions, Synthesis and properties of polyesters, polyamides, polyurethanes, polystyrene and bakelite. Determination of molecular Weights of polymers by osmometry, light scattering, Ultra centrifuge and Viscometry.

Suggested books :

1. Chemical Kinetics by Laidler.
2. Physical Organic Chemistry by Wiberg.
3. Kinetics and Mechanism by Frost and Pearson.
4. Molecular connectivity in Chemistry and Drug Research L.B.Kier and L.H.Hall Academic press, 1976.
5. Chemical Kinetics – The study of Reaction Rates in solution – Kenneth A. CANNORSV – VCH Publishers.
6. An introducer to polymer Chemistry – W.R. Moore.
7. Introduction to polymer Chemistry – R.B. Seymour.
8. Fundamentals of Polymer Science and Engineering – Anil Kumar and S.K. Gupta.





ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY  
**THIRD SEMESTER**  
PAPER II: QUANTUM CHEMISTRY –II AND CHEMICAL  
APPLICATIONS OF SYMMETRY AND GROUP THEORY  
(Effective from the 2016-17 admitted Batch)

UNIT –I:

Wave mechanics of simple systems –Systems with discontinuity in the Potential field  
–Quantum Mechanical tunneling effect –potential barrier with finite thickness.

Wave mechanics of systems with variable potential energy – Harmonic Oscillator –  
Hermite polynomials –recursion formula –Energy levels of three dimensional harmonic  
oscillator – degeneracy of the energy levels.

UNIT –II:

Hydrogen like atoms –Solutions of the wave equation –solution of  $R(r)$ ,  $\phi(\phi)$  and  $\theta(\theta)$   
equations – Shapes of atomic orbitals – Space quantization of electronic orbitals.

Angular momentum – Commutation relations – Commutation with Hamiltonian-Spin-  
Orbit interaction – Vector model of the atom.

UNIT–III:

Representation – reducible and irreducible representations – Orthogonality theorem and  
its consequences – Constructions of Character table for  $C_{2v}$  and  $C_{3v}$  point groups – Wave  
functions as bases for irreducible representations – Direct Product

Hybridization scheme for  $AB_n$  type of molecules –  $AB_3$ ,  $AB_4$ ,  $AB_5$  and  $AB_6$  under point  
groups  $D_{3h}$ ,  $D_{4h}$ ,  $T_d$ ,  $C_{4v}$  and  $O_h$

Ligand field theory: Splitting of d-orbitals under  $D_{4h}$ ,  $T_d$ ,  $C_{4v}$  and  $O_h$  environments.

Construction of molecular orbital correlation diagram (1) for  $\sigma$  bonds in octahedral  
environment and (2) for  $H_2O$  molecule.

UNIT-IV:

Symmetry selection rules for I.R. and Raman activity – transition moment integral –  
application of direct product.

Determination of symmetries of total degrees of freedom: Calculation of Character per  
un-shifted atom for different symmetry operations and evaluation of  $SF_6$ .

Determination of symmetries of I.R. and Raman active vibrational modes for different  
molecules  $SO_2$ ,  $NO_2$ ,  $CCl_4$ ,  $POCl_3$ ,  $PCl_5$  and  $SF_6$ .

Accidental degeneracy and Fermi Resonance.

Recommended Text Books:

1. Chemical Applications of Group Theory, F.A.Cotton Wiley Eastern Limited, New Delhi.
2. Group Theory and its Applications to Chemistry, K.V.Ramana, Tata McGraw-Hill Publishing Company Limited New Delhi.
3. Introductory Quantum Chemistry, A.K.Chandra, TATA MCGRAW-HILL Publishing Company Ltd., New Delhi.
4. Quantum Chemistry, Iran Levine, Pearson Education.
5. Theoretical Chemistry, S.Glastone.



ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY  
**THIRD SEMESTER**  
PAPER-III: STATISTICAL THERMODYNAMICS AND SOLUTION  
EQUILIBRIA OF PROTON LIGAND COMPELXES  
(Effective from the 2016-17 admitted Batch)

UNIT-I:

Statistical mechanics : Ensembles (Canonical and micro canonical ) –Basic definition distribution and microstates ,thermodynamic probability . The classical distribution law . The Maxwell – Boltzmann distribution law ,method of lagrangian multiplies ,indistinguishable particles, quantum statistics – Bose –Einstein and Fermi Dirac Statistics, Conditions for the applicability of Maxwell – Boltzmann statistics, Bose – Einstein statistics and radiation, extreme gas degeneration, degenerate electron gas.

UNIT-II :

Statistical thermodynamics: Partition function. Thermodynamics functions from partition functions for multiple degree of freedom, theories of heat capacities of solids, stastical evaluation of entropy, comparison of statistical values with third law entropies (thermal entropies).

UNIT-III :

Gran analysis of acid base titrations –Determination of Carbonate content and correction factors for  $P^H$  meter dial readings ; Secondary formation function  $nbarh$ ; Calculation of stability constants of proton ligand complexes –successive approximation method –half  $nbarh$  method; Simulation of  $p^H$  metric titration data for proton –ligand systems.

UNIT –IV :

Prediction of proton –ligand formation constants using Molecular mechanics/ Quantum Chemical methods; Effect of solvent on stability – Abraham multi layer model –LD model; Components of expert systems – knowledge base, inference engine and user interface.

Suggested Books:

1. M.T.Beck,Complex Equilibria,1991
2. Alcock,solution Equilibria,1992
3. Richard E. Dickerson,Molecular Thermodynamics
4. S.Glasstone, Theoretical Chemistry
5. S.Glasstone,Thermodynamics for Chemists
6. C.Andrews ,Equilibrium Statistical Mechanics
7. Davies, Thermodynamics
8. Yeremin, Thermodynamics
9. J. Rajaram, and T.C. Kuriacose, Thermodynamics for student of chemistry.



ADIKAVI NANNAYA UNIVERSITY  
DEPARTMENT OF CHEMISTRY  
**THIRD SEMESTER**

PAPER –IV : INSTRUMENTATION

**(Effective from the 2016-17 admitted Batch)**

UNIT –I :

Spectrophotometry – deviations from Beer - lamberts law Instrumentation –Errors in Spectrophotometry – photometric titrations composition and stability constants of mononuclear complexes by linear extrapolation methods.Fundamental principles of Fluorescence spectroscopy and basic instrumentation of spectrofluorimeter.

UNIT –II :

Chromatographic methods - Ion exchange chromatography separation of transition metal ion – solvent extraction - partition coefficient – distribution ratio - classification of solvent extraction systems and evaluation of formation constants and applications Gas liquid Chromatography principal - Instrumentation - retention time - retention volume – Elementary principles of HPLC and hyphenated instruments.

UNIT –III :

Techniques and instrumentation of IR , Microwave and Raman. Theory and instrumentation Atomic absorption spectroscopy - Atomic emission spectroscopy with ICP source - Elementary principles of laser mass spectrometry.

UNIT – IV :

Polarography - Introduction - types of currents - qualitative and quantitative aspects of polarography – analytical applications to organic and inorganic compounds - Evaluation of stability constants by deford and hume method – amperometric titrations. Principles of thermo gravimetry - Apparatus and working, Differential methods of analysis - principle factors affecting DTA curve. Application of DTA .

Suggested Books:

1. Quantitative Analysis – R.A.Day and A.L.Underwood
2. Quantitative Inorganic Analysis – A . I . Vogel
3. Spectroscopy S.Walker and Straw Volumes I, II and III
4. Instrumental Methods of Chemical Analysis - Kudesla Snwheny (Pragati Prallesan Meerut) 1988.
5. Instrumental Techniques for Analytical Chemistry-Frank settle (Pearson Eddition )2004.

2015-16

DEPARTMENT OF PHYSICAL AND NUCLEAR CHEMISTRY AND CHEMICAL  
OCEANOGRAPHY  
ANDHRA UNIVERSITY

S.K. Anju Begum

M.Sc. (Final) PHYSICAL CHEMISTRY  
IV SEMESTER

**Paper I: ADVANCED CHEMICAL KINETICS AND PHOTO CHEMISTRY**

**UNIT - I:**

Correlation analysis - Marcus Theory of electron transfer adiabatic and non adiabatic electron transfer - outer and inner sphere mechanism - effect of solvent on rates - effect of dielectric constants on ion - ion, ion - molecule, molecule - molecule reactions - BET isotherm determination of surface area - semiconductor catalysis - Homogeneous catalysis - acid base and redox catalysis.

**UNIT - II:**

Correlation of rate with  $H_0$ ,  $H_R$ , acidity functions and their use in the illustration of mechanism in acid base catalysis - catalysis by transition metal ions and their complexes - Industrially important processes - substitution reactions in Octahedral complexes.

**UNIT - III:**

Photochemistry : Absorption Excitation - photochemical laws - quantum yield of electronically excited states - measurements of life times - Flash photolysis - Stopped flow Techniques: energy dissipation by radiative and non - radiative processes, absorption spectra - Franck - Condon principles. Photochemical stages - Primary processes and secondary processes - Rate constants and life times of reactive excited states.

**UNIT - IV:**

Properties of excited states : structure, dipole moment acid base strengths - reactivity, kinetics of bimolecular processes - quenching, Stern - Volmer equation. Photo-reduction and oxidation. Cyclo addition reactions, Woodward - Hoffmann's rules.

**Suggested Books**

1. Chemical kinetics by Laidler
2. Physical Organic Chemistry by Wiberg
3. Kinetics and mechanism by Frost and Pearson
4. Techniques in Organic Reaction Mechanism by Zuman and Patel.
5. Chemical kinetics - The study of Reaction Rates in solution - Kenneth A. CONNORS - VCH Publishers.
6. Fundamentals of photochemistry - k.k.Rohatgi - Mukherjee
7. Photochemistry - Cox and Kemp
8. Photochemistry - Calvert by Pitts,

ANDHRA UNIVERSITY  
M.Sc. (Final) PHYSICAL CHEMISTRY  
IV SEMESTER

PAPER II: QUANTUM CHEMISTRY-III, NUMERICAL METHODS FOR CHEMISTS AND  
ADVANCED COMPUTER PROGRAMMING

QUANTUM CHEMISTRY:

**UNIT I:**

Approximation methods. Variation method and its application- Ground state of helium atom- ground state energy of one dimensional harmonic oscillator- Perturbation theory- time dependent perturbation- First and second order approximations- Stark effect- Calculation of first and second order perturbation effects on simple systems. Time dependent perturbations- Interaction of matter with radiation; Zeeman effect- Derivation of Fermi's Golden rule.

**UNIT II:**

Born-Oppenheimer approximation- The LCAO approximation- application to  $H_2^+$  ion- MO theory and its application- Correlation diagrams- Hartee-Fock self consistent field method. Chemical bonding in poly atomic molecules- Hybrid orbitals- Huckel theory of linear conjugated systems and cyclic conjugated molecules- Aromaticity- Calculations of delocalization energy of simple conjugated systems.

**UNIT III:**

**NUMERICAL METHODS:**

Precision and Accuracy, Determinate and indeterminate errors, computational errors truncation and rounding off errors, algorithm errors-absolute and relative errors-Error propagation. Measures of Dispersion – range, arithmetic mean, mean deviation variance and standard deviation – moments – skewness and kurtosis.

Interpolation: interpolation for linear fit, linear interpolation in non-linear fit, polynomial interpolation – Lagrange interpolation formula – Application to complex equilibria.

Numerical techniques of solving ordinary first order differential equations:- Euler's method, Predictor-corrector method, Rungae-Kutta method- application to chemical kinetics.

**UNIT IV:**

Fortan programming: Concepts of algorithms and flow-charts, logical variables and logical expressions, order of evaluation of logical expressions, logical assignment statements, logical if and block if statements, computed GO TO statement, writing a decision, chain of decisions, arrays-one dimensional and two dimensional arrays. DO loop and its application in Input and Output statements. Statement Function, Function and Subroutine sub-programs.

Application to Chemical Problems: : Flowcharts and Programs for

1. Calculation of skewness and kurtosis of replicate measurements.
2. Polynomial interpolation using Lagrange interpolation formula
3. Euler's step by step iteration method for solving ordinary first order differential equation.
4. Calculation of first order rate constant of acid catalyzed hydrolysis of an ester, using a subprogram for the calculation of slope by linear least-squares method.

**RECOMMENDED TEXT BOOKS:**

1. Introductory Quantum Chemistry, A.K.Chandra, TATA McGRAW-HILL Publishing company Ltd., New Delhi.
2. Quantum Chemistry, Iran Levine, Pearson Education.
3. Theoretical Chemistry, S.Glastone
4. Computer programming in Fortan-IV by V.Rajaraman, Prentice-Hall of India Pvt. Ltd., New Delhi.

**DEPARTMENT OF PHYSICAL AND NUCLEAR CHEMISTRY AND CHEMICAL  
OCEANOGRAPHY  
ANDHRA UNIVERSITY  
M.Sc. (Final) PHYSICAL CHEMISTRY  
IV SEMESTER**

**Paper- III: ADVANCED THERMODYNAMICS AND SOLUTION EQUILIBRIA OF  
METAL-LIGAND COMPLEXES**

**UNIT - I:**

Thermodynamics and phase changes – Free energy and meaning of phase changes, calculation of phase equilibrium curves, Pressure as a measure of escaping tendency, single components phase diagrams, free energy diagrams and the critical point, first and second order transitions, partial molar quantities and their determination, chemical potential and phase rule. Thermodynamics of chemical reactions, Real gases and fugacity and its determination from PVT data.

**UNIT - II:**

Thermodynamics of living systems: Simultaneous coupled reactions, coupled reactions and metabolism free energy utilization, free energy utilization in metabolism, citric acid cycle, Terminal oxidation, Chain aerobic metabolism. Elementary aspects of non-equilibrium thermodynamics conservation of mass and energy – entropy production and flow in open system – Onsager theory – principles of microscopic reversibility.

**UNIT - III:**

Calvin Wilson Titration Techniques for metal ligand complexes – Determination of Stability constants using formation function, hydroxylated complexes stability constant by Martell method – Leden's procedure. Solution of a non – linear function of two variables – A Algorithm of MINQUAD programme – criteria of best fit model.

**UNIT - IV:**

Prediction of metal ligand stability constants – Irving and William order. Neural networks – Processing element, Transfer function, Training algorithm – BFGS, MAFQUARDT and back propagation. Multi layer perception and radial basis function NN's. Features of Trajan software – Input Output – Intelligent problem solver.

**Suggested Books**

1. M.T.Beck, complex Equilibria, 1991
2. Alcock, Solution Equilibria, 1992
3. Neural Networks systems Techniques and Applications – Ciornelices T. leondes; Vol.1:Algorithms and Architectures.
4. J.Zupan, Neural Network for Chemists, VCH,1992
5. Richard E.Dickerson , molecular Thermodynamics
6. S.Glasstone, Theroretical Chemistry
7. S.Glasstone, Thermodynamics for chemists
8. C.Andrews, Equilibrium Statistical Mechanics
9. Davies, Thermodynamics
10. Yereimin, thermodynamics
11. J.Rajaram, and T.C.Kuriacose, Thermodynamics for students of chemistry.

ANDHRA UNIVERSITY  
DEPARTMENT OF PHYSICAL AND NUCLEAR CHEMISTRY AND CHEMICAL  
OCEANOGRAPHY  
M.Sc. (Final) PHYSICAL CHEMISTRY  
IV SEMESTER

Paper IV: SPECTROSCOPY  
(Common for Physical Chemistry and Marine Chemistry)  
Effective from 2010-11 admitted batch

**UNIT - I:**

Rotational (Microwave) Spectroscopy - The rotational energies of polyatomic molecules - Rotational selection rules for linear molecules - symmetric top - Asymmetric top molecules - degeneracy of rotational energy levels - The Stark effect in molecular rotational spectra - Molecular Rotation - Nuclear spin coupling - Application of Rotation Spectra - Determination of Inter Nuclear distance - Moment of Inertia and Dipole moment.

**UNIT - II:**

Rotation vibration spectra - selection rules and transitions for the rigid rotator - harmonic oscillator model - parallel and perpendicular bands of linear and symmetric top molecules - Raman active fundamental - Criterion for their appearance - Rotational and vibrational Raman; Raman and Infrared studies of  $AB_2$ ,  $AB_3$  type molecules - correlation of infrared and Raman spectra.

**UNIT - III:**

ESR spectroscopy - the resonance condition - anisotropy in g-factor - Theory and applications of ESR method - Crystalline solids - free radicals in solutions - interpretation of ESR spectra of typical radicals and ion like  $Mn^{2+}$ ,  $Cr^{3+}$ ,  $Cu^{2+}$  - Hyperfine interactions in the following systems. P-Benzoquinone - (semi) naphthalene radical anion and anthracene radical anion.

NMR spectroscopy - chemical shifts and shielding - some application of NMR spectra - effect of chemical exchange on spectra - Effect of quadrupole interactions on NMR spectra - an elementary study of isotopes other than proton - Fluorine -19, phosphorous-31, Carbon-13, Boron-11 - NQR spectroscopy - Electric field gradient and quadrupole coupling constant - Splitting in NQR spectra - Applications of NQR spectroscopy

**UNIT - IV:**

Electron Spectroscopy - basic principles of Photo Electron Spectroscopy (PES) - Koopman's theorem and chemical shift. PES of simple molecules. Electron Spectroscopy for Chemical Analysis (ESCA) - Chemical information from ESCA. Principles and applications of Auger Electron Spectroscopy (AES) - comparison between PES, ESCA and AES - X-ray methods - X-ray fluorescence (XRF) - techniques of X-ray absorption and X-ray emission methods and their applications.

**Suggested Books**

1. Spectroscopy S. Walker and straw, volumes I, II and III
2. Molecular Spectroscopy, - Gordon M. barrow
3. Fundamentals of Molecular Spectroscopy - Banwell
4. Spectroscopy - B.K.Sharma - Goe! Publishing House Meerut. 1990.



**Adikavi Nannaya University, Rajamahendravaram**  
**Department of Commerce**  
**(M. Com)**  
**(With effect from 2016 – 2017)**

<b>M. COM- COURSE STRUCTURE</b>								
				Intrl	Extrl	Total	Periods/ Week	Credits
<b>SEMESTER-I</b>								
1	CP	101	Principles of Management	25	75	100	6	4
2	CP	102	Business Environment	25	75	100	6	4
3	CP	103	Business Economics	25	75	100	6	4
4	CP	104	Business Communication & Soft skills	25	75	100	6	4
5	CP	105	Advanced Management Accounting	25	75	100	6	4
<b>SEMESTER-II</b>								
1	CP	201	Financial Management	25	75	100	6	4
2	CP	202	Human Resource Management	25	75	100	6	4
3	CP	203	Marketing Management	25	75	100	6	4
4	CP	204	Research Methodology & Quantitative Techniques	25	75	100	6	4
5	CP	205	Computer Application in Business	25	75	100	6	4
<b>SEMESTER-III</b>								
1	CP	301	Micro Finance	25	75	100	6	4
2	CP	302	Entrepreneurship	25	75	100	6	4
4	AT1	303	Corporate Accounting	25	75	100	6	4
5	AT2	304	Strategic Cost Management	25	75	100	6	4
6	AT3	305	Management Control Systems	25	75	100	6	4
7	FB1	303	Security Analysis and Portfolio Management	25	75	100	6	4
8	FB2	304	International Financial Management	25	75	100	6	4
9	FB3	305	Financial Derivatives	25	75	100	6	4
<b>SEMESTER - IV</b>								
1	CP	401	Financial Markets and Services	25	75	100	6	4
2	CP	402	Insurance Products & Management	25	75	100	6	4
3	AT1	403	Direct Taxes	25	75	100	6	4
4	AT2	404	Indirect Taxes	25	75	100	6	4
5	AT3	405	Tax Planning and Management	25	75	100	6	4
6	FB1	403	Advanced Banking	25	75	100	6	4
7	FB2	404	Rural Banking	25	75	100	6	4
8	FB3	405	Financial Institutions	25	75	100	6	4
			Project Report			50		4
			Comprehensive Viva Voce			50		4
<b>GRAND TOTAL</b>						<b>2100</b>		

## **M. Com SPECIALIZATIONS**

### **M. COM III SEMESTER**

#### **ACCOUNTING & TAXATION SPECIALIZATION**

303 AT 1	Corporate Accounting
304 AT 2	Strategic Cost Management
305 AT 3	Management Control Systems

#### **FINANCE & BANKING**

303 FB 1	Security Analysis & Portfolio Management
304 FB 2	International Financial Management
305 FB 3	Financial Derivatives

### **M. COM IV SEMESTER**

#### **ACCOUNTING & TAXATION SPECIALIZATION**

403 AT 1	Direct Taxes
404 AT 2	Indirect Taxes
405 AT 3	Tax Planning & Management

#### **FINANCE & BANKING**

403 FB 1	Advanced Banking
404 FB 2	Rural Banking
405 FB 3	Financial Institutions

**ADIKAVI NANNAYA UNIVERSITY**  
**M. COM - SEMESTER I**  
**CP – 101: PRINCIPLES OF MANAGEMENT**

**Objectives:** to familiarize the students with basic management concepts and the process of organization.

**Unit – I:** Introduction: Concept of Management: Definition, Nature, Purpose, Scope and Significance – Evolution of Management Thought – Approaches to Management – Process of Management – External Environment Functions of Management.

**Unit – II:** Planning: Types of Plans – Objectives, Management by Objectives, Planning Premises Decision Making: Decision Making Process – Decision Tree Analysis.

**Unit – III:** Organization: Principles of Organization: Formal and Informal Organization – Span of Control – Delegation of Authority – Centralization and Decentralization – Line and Staff Conflict and Cooperation. Staffing Process: Nature and purpose of staffing – Executive Development Programme (EDPs).

**Unit – IV:** Directing: Elements of Directing - Motivation – Leadership – Concept, Styles, Theories – Managerial Grid: Likerts Four Systems of Leadership.

**Unit – V:** Process of Control, Techniques of control, PERT and CPM.

***Suggested Books:***

1. James A. F. Stoner, R. Edward Freeman and Daniel R. Gilbirth Jr. – Management, Prentice Hall of India.
2. Heinz Wehrich and Harold Koontz, Essentials of Management – Tata McGraw Hill International.
3. Stephen Robbins and Mary Coulter, Management, Prentice Hall of India.
4. Bajaj: Management Processing and Organization, Excel Publications.
5. Tripathy and Reddy – Principles of Management – Tata McGraw Hill.
6. John F. Wilson – The Making of Modern Management, Oxford University Press.
7. Heiny Wehrich and Harold Koontz – Management, A Global Perspective – McGraw Hill International.
8. R.K. Suri, Organizational Behaviour, Wisdom Publication.
9. A. Pardhasaradhy & R. Satya Raju: Management Text and Cases, Prentice Hall of India.

## CP – 102: BUSINESS ENVIRONMENT

**Objective:** To familiarize the students with the business environment prevailing in India and international and understand its implications to business.

**Unit-I:** Business Environment: Nature and scope - Significance – Cultural, Political, Technological and External Factors Influencing Business Environment – Dimensions of International Business Environment – Challenges.

**Unit-II:** Structure of Indian Economy: Economic systems- Economic planning with special reference to last three plans, public, private joint and cooperative sectors - Industrial Policy of the Government - Policy Resolutions of 1956, 1991 Industrial Policy and Economic Policy - Subsequent policy Statements.

**Unit-III:** Indian Companies -Competitiveness, Changes and Challenges, Sustainable Development, Social Responsibilities, Ethics in Business- Competition Act 2002 - Emerging Trends in Indian Business Environment.

**Unit – IV:** International Trade Theories, Balance of Payments – Concepts, Disequilibrium in BOP Structural, Cyclical and Monetary Disequilibrium, Methods, Trade Barriers and Trade Strategy - Free Trade vs. Protection- Foreign Exchange Market.

**Unit – V:** Globalization: International Economic Integration, Country Evaluation and Selection, Foreign Market Entry Methods, International Trade Stocks – Objectives; WTO Origin, Objectives, Organization Structure and Functioning – WTO and India.

### ***Suggested Books:***

1. K.V.Sivayya and VBM Das: Indian Industrial Economy, Sultan Chand Publishers, Delhi.
2. Suresh Bedi: Business Environment, Excel, New Delhi.
3. Francis Cherunilam: Business Environment - Text & Cases.
4. M.Adhikari, Economic Environment of Business.
5. Pandey G.N., Environmental Management, Vikas Publishing House.
6. Raj Agarwal: Business Environment, Excel Publications.
7. Govt. of India, Latest Economic Survey.
8. Chari, S. N: International Business, Wiley India
9. Francis Cherunilam: International Business: Text and Cases, Prentice Hall of India.
10. E. Bhattacharya: International Business, Excel Publications.
11. Sundaram & Black: International Business Environment Text and Cases, PHI.
12. Sajahan: International Business, Mac-Milan India. New Delhi.

## CP – 103: BUSINESS ECONOMICS

**Objective:** To enable the students to understand economic concepts and theories and their application in management decision-making.

**Unit - I:** Introduction: Nature and Scope of Business Economics; Objectives of the Firm – Traditional Theory, Sales and Revenue Maximizing Theories, Managerial Theories and Behavioral Theories; Profit Maximization Vs. Wealth Maximization; Demand Forecasting – Methods of forecasting demand for Existing and New Products, Criteria for Good Forecasting Method.

**Unit - II:** Production Analysis and Cost Analysis: Production Function – Law of Variable Proportions, Isoquant and Isocost Curves, Least Cost Combination, and Returns to Scale; Economies of Large Scale; Cobb-Douglas Production Function and C.E.S. Production Function; Cost-Output Relationships – Short and Long Run; Cost Oriented Pricing Methods – Full Cost Pricing, Marginal Cost and Differential Cost Pricing.

**Unit - III:** Market Analysis: Price and Output Determination under Perfect Competition, Monopoly, Monopolistic Competition, Oligopoly and Duopoly.

**Unit - IV:** Profit Analysis: Meaning of Profit, Limiting Factors of Profit, Criteria for Standard Profit: Theories of Profit; Business Forecasting – Nature and Scope of Forecasting and Different Methods of Business Forecasting and their Advantages and Disadvantages.

**Unit - V:** Macro Economic Concepts: National Income, Trade Cycles, Inflation, Monetary and Fiscal Policies.

### ***Suggested Books:***

1. Mukherjee Sampat: Business and Managerial Economics (In the Global Context), Third Edition, New Central Book Agency (P) Ltd., Kolkatta, 1996.
2. Dwivedi, D.N.: Managerial Economics, Vikas Publishing House Pvt. Ltd., 2003.
3. Dhingra, I.C., Essentials of Managerial Economics; Theory, Applications and Cases, Sultan Chand, New Delhi, 2003.
4. Mithani, D.M.: Managerial Economics; Theory and Applications, Himalaya Publishing House, 2003.
5. Mehta, P.L.: Managerial Economics, Text and Cases, S.Chand & Co., Delhi.
6. Varshney, R.L. and Maheswari, K.L.: Managerial Economics, S.Chand & Co, Delhi.
7. Dwivedi, D.N.: Macroeconomics; Theory and Policy, Tata McGraw Hill Publishing Company, 2002.
8. Gupta, G.S.: Macroeconomics; Theory and Applications, Tata McGraw Hill Publishing Company Ltd.
9. Yogesh Maheswari, Managerial Economics, 2<sup>nd</sup> Edition, Prentice Hall of India.

## CP – 104: BUSINESS COMMUNICATION & SOFT SKILLS

**Objective:** To equip the students with the necessary techniques and skills of communication to inform others, inspire them enlist their activity and willing cooperation in the performance of their jobs.

**Unit – I:** Importance of Communication in Business Organizations – Communication Objectives –Types of Communication - Communication Barriers – Communication Gateways – Developing Listening Skills – Influence of Culture on Communication – Media of Communication: Written, Oral, Visual – Audio Visual Communication- Use of Electronic Media in Business Communication.

**Unit – II:** Interpersonal Communication – Intrapersonal Communication – Communication Models: Exchange Theory – Johari Window – Transactional Analysis, Communication Styles – Completing Job Application forms with required details – Effective techniques of making and accepting offers – Efficient written offer making and accepting.

**Unit – III:** Business Correspondence – Meaning, Scope and Significance – Formal, Informal and Semiformal introductions – Understanding and writing letters –Planning effective initial business letters and responses – email writing skills, call taking skills.

Report Writing – Meaning and Significance; Structure of Reports – Formal Reports – Informal Reports.

**Unit – IV:** Meetings and Oral Presentations – Presentations of oral instructions – effective presentation of written instructions - Basic presentation techniques – Use of information in presenting product features – Oral and written conventions for expressing numerical information in English.

**Unit – V:** Feedback and Evaluation – Giving feedback to others – Use of questions in self-assessment elicitation – Functional language of agreement and opinion giving – Use of tone and intonation in good/bad feedback – Use of emphatic structures in English- Use of conditionals to discuss future possibilities – Discourage strategies for effective relationship – Team building skills.

### ***Suggested Books:***

1. Jerry C. Wofford, Edwin A. Gerloff and Robert C. Cummins, Organisational Communication – The Key stone of Managerial Effectiveness.
2. McGrath, Basic Managerial Skills for All, 5<sup>th</sup> ed., Prentice Hall of India.
3. Urmila Rai & S.M. Rai, Business Communication, Himalaya Publishers, Mumbai.
4. Meenakshi Raman – Business Communication, Oxford University Press.
5. Bovee, Thill and Schatzman: Business Communication Today: Pearson Education.
6. Biswajit Das: Business Communication personality Development, Excel Publications.
7. Parag Diwan: Business Communication, Excel Publications.
8. Lesikar I Flatley, Basic Business Communication, Tata McGraw Hill.
9. Dalmar Fisher, Communication in Organizations, A Jaico Book.
10. Scot Ober, Contemporary Business Communication, Wiley India, New Delhi.

## CP 105: ADVANCED MANAGEMENT ACCOUNTING

**Objective:** To develop an insight of postulates, principles and techniques of accounting and utilization of financial and accounting information for planning, decision-making and control.

**Unit – I:** Management Accounting – Nature and Scope – Management Accounting Vs Financial Accounting and Cost Accounting – Role of Management Accountant in a Modern Organization.

**Unit – II:** Cost Concepts for Decision Making - Cost – Volume – Profit Analysis – Behaviour of Variable Cost – Behaviour of Fixed Cost – Relationships among Cost and Profits at Various Levels of Activity – Break-Even Point – Margin of Safety.

**Unit – III:** Cost Analysis for Pricing Decisions – Evaluating the cost Effects of Price – Quantity Relationships Price Elasticity of Demand and Optimal Pricing Decisions – Cost Analysis for Pricing during Recession Conditions – Flexible Cost Data for Pricing Decisions – Special Order Pricing – Impact of Special Order Pricing on Regular Sales and Overall Profits – Make or Buy Decisions.

**Unit – IV:** Cost Analysis for Product Decisions – Breakeven Analysis of Multi-Product Firms – Differential Costs for Product – Mix Alterations Decisions – Product Additions Decision – Adding New Products Combining Pricing Decisions with Product Addition Decision and Selecting Profitable Product-Price Strategies – Produce Deletion – Sell or Process further Decision of Joint and By-Products.

**Unit – V:** Budgeting – Types of Budgets – Financial Budgets – Operating Budgets – Cash Budget – Production Budget – Flexible Budget – Concepts of Performance Budgeting and Zero Based Budgeting.

### ***Suggested Books:***

1. I.M. Pandey: Management Accounting, Vikas Publishing House.
2. N.M. Singhvi, Management Accounting: Text and Cases, Prentice Hall of India.
3. T.P. Ghosh: Fundamentals of Management Accounting, Excel Publications.
4. Ravi M. Kishore, Management Accounting, Taxman Publications.
5. Chakraborty, Hrishikesh – Management Accountancy, Oxford University Press.
6. Horngren, C.T., Introduction to Management Accounting, Prentice Hall of India.
7. Khan and Jain, Management Accounting, Tata McGraw Hill, Delhi.
8. J.C. Varshney: Financial and Management Accounting, Wisdom Publication.
9. Horngren Sundem Stratton, Management Accounting, Prentice Hall of India.
10. Pares P. Shah, Management Accounting, Wiley India, New Delhi.

**ADIKAVI NANNAYA UNIVERSITY, RAJAMAHENDRAVARAM**  
**M.COM. - SEMESTER II**  
**CP – 201: FINANCIAL MANAGEMENT**

**Objective:** to develop an understanding of the Finance functions and relevant techniques of financial administration.

**Unit – I: INTRODUCTION:** Nature, Scope and Objectives of Financial Management: Finance Function – Profit Goal vs. Wealth Goal Maximization; Techniques of Financial Analysis: Funds Flow Analysis and Ratio Analysis Role of Financial Manager in Modern Environment.

**Unit – II: INVESTMENT DECISION:** Techniques of Appraisal; Process of Capital Budgeting – Risk Vs. Return Traditional and Modern Techniques. (including problems).

**Unit – III: FINANCING DECISIONS:** Capital Structure – Determinants; Leverages – Financial, Operating and Combined: Cost of Capital. (including problems)

**Unit – IV: DIVIDEND AND RETAINED EARNINGS:** Dividend Policy Decisions; Parameters, Dividend Models; Policies Regarding Retained Earnings.

**Unit – V: WORKING CAPITAL MANAGEMENT:** Concept, Need and Determinants of Working Capital - Working Capital Cycle – Working Capital Policy.

***Suggested Books:***

1. Brearley, Richard and Myers, Steward: Principles of Corporate Finance, New York, McGraw Hill.
2. Soloman, Ezra, Theory of Financial Management, Columbia Press.
3. James C. Van Horne, Financial Management and Policy, Prentice Hall of India.
4. Weston J. Fred and Brigham, Eugne F., Managerial Finance, Dryden Press.
5. Prasanna Chandra, Financial Management, Tata McGraw Hill.
6. Khan, M.Y. and Jain, Financial Management, Tata McGraw Hill.
7. Pandey, 1M, Financial Management, Delhi, Vikas Publishing House.
8. Ravi M. Kishore: Financial Management, Taxman.
9. Sudhirbhat, Financial Management, Excel Books.



## CP – 202: HUMAN RESOURCE MANAGEMENT

**Objective:** to enable the students to familiarize with the main aspects of Human Resource Management at the organization level and apply the same in management of Human Resources.

**Unit – I:** Human Resources Management: Concept, Significance and Evolution; Functions of HR Manager, Place of HR Department in Organization.

**Unit – II:** Human Resource Planning: Significance – Methods and Techniques - Job Analysis – Recruitment and Selection Processes - Induction – Placement – Promotion and Transfers.

**Unit – III:** Training and Development: Significance – Identification of Training Needs – Employee Training Methods – Executive Development Methods – Evaluation of Training and Development Programmes.

**Unit – IV:** Wage and Salary Administration: Wage Concepts; Job Evaluation – Methods & Techniques Wage Structure & Policy – Wage Differentials – Wage Payment Methods – Incentives – Fringe Benefits – Performance Appraisal: Scope & Significance – Methods of Appraisal - Limitations of Appraisal.

**Unit – V:** Industrial Relations: Significance, Causes of Disputes and Settlement - Collective Bargaining - Employee Participation in Management.

### ***Suggested Books:***

1. Venkat Ratnam C.S., and Srivastava B.K., Personnel / Human Resource Management, Tata McGraw Hill.
2. Cynthia D. Fisher & Lyle F. Schoenfeldt, Human Resource Management, Wiley India, New Delhi.
3. N.K. Singh: Human Resources Management, Excel Publications.
4. Jyothi – Human Resource Management, Oxford University Press.
5. Gary Dessler, Human Resource Management.
6. Edwin B Flippo, Personnel Management.
7. Decenzo / Robbins, Personnel / Human Resource Management, 3rd Ed, John Wiley & Sons Pvt. Ltd.
8. P. Subba Rao, Human Resource Management, Himalaya Publishers, Mumbai.
9. Deepak Kumar, B. Human Resource Management, Excel Books.
10. Ghosh, HRD and Management, Vikas.
11. Ian Badwel, Len Holden: Human Resource Management – A Contemporary Perspective, Macmillan India Ltd.

## **CP – 203: MARKETING MANAGEMENT**

**Objective:** to develop an understanding of the concepts, strategies and issues involved in marketing and management.

**Unit – I:** Importance of Marketing – Concepts – Approaches to the Study of Marketing – Marketing Environment.

**Unit – II:** Consumer Behaviour – Market Segmentation – Market Targeting and Positioning – Marketing Information System and Research.

**Unit – III:** Marketing Mix: Product Planning – New Product Development – Product Life Cycle – Branding Packaging – Product Mix Management.

**Unit – IV:** Pricing: Objectives – Methods and Strategies – Distribution – Channel Selection and Management Retail Management.

**Unit – V:** Promotion: Integrated Marketing Communications: Personal Selling – Advertising – Sales Promotion, Publicity and Public Relations – Direct Marketing: Evaluation of Communication Effort.

### ***Suggested Books:***

1. Philip Kotler and Kevin Lane Keller: Marketing Management, Prentice Hall of India / Pearson Education, New Delhi.
2. William J Stanton & Futrell: Fundamentals of Marketing.
3. V. J. Ramaswami and S. Namakumari: Marketing Management, Macmillan Business Books, Delhi.
4. S. Jayachandran: Marketing Management, Text and Cases, Excel Publications.
5. Tapan K. Panda, marketing management, Excel.
6. Zinkota & Kotabe: Marketing Management, Prentice Hall of India.
7. Joel R. Evans & Barry Berman: Marketing, Wiley India, New Delhi.
8. Mukesh Dhunna: Marketing Management, Wisdom Publication.
9. Rajiv Lal, John A. Quelch & V. Kasturi Rangan, Marketing Management, Tata McGraw Hill.

## **CP – 204: RESEARCH METHODOLOGY & QUANTITATIVE TECHNIQUES**

**Objective:** To equip the students with the basic understanding of research methodology and to provide insight into the application of modern analytical tools and techniques for the purpose of management decision making.

**Unit – I:** Meaning and Importance of Research – Research Process – Types of Research – Defining Research Problem – Formulation of Hypothesis – Testing of Hypothesis.

**Unit – II:** Research Design – Exploratory Research – Descriptive Research – Casual Research – Sampling and Sampling Design – Sampling Methods – Simple Random Sampling – Stratified Sampling – Systematic Sampling – Cluster Sampling – Multistage Sampling, Non-Probability Sampling – Convenience Sampling – Judgement Sampling – Quota Sampling.

**Unit – III:** Data Collection – Primary and Secondary Data – Designing of Questionnaire – Measurement and Scaling – Nominal Scale – Ordinal Scale – Interval Scale – Ratio Scale – Guttman Scale – Likert Scale – Schematic Differential Scale.

**Unit – IV:** Quantitative Techniques – Meaning – Nature and Scope – Importance in Research.

**Unit – V:** Measures of Central Tendency – Measures of Dispersion – Simple Correlation and Regression Analysis.

### **Suggested Books:**

1. Mark Saunders, Philip Lewis, Adrian Thornbill, Research Methods for Business Students, Pearson, ND
2. Churchill, Iacobucci & Israel, Marketing Research: A South Asian Perspective, Cengage, New Delhi
3. C.R. Kothari, Research Methodology, New Age International.
4. Carver & Nash, Data Analysis with SPSS, Cengage, New Delhi
5. Alan Bryman & Emma Bell, Business Research Methods, Oxford University Press.
6. Donald R. Cooper & Pamela S. Schindler, Business Research Methods 8<sup>th</sup> Edition, Tata McGraw Hill.
7. K.V.S. Sarma, Statistics made simple, do it yourself on PC, Prentice Hall.
8. V P Michael, Research Methodology in Management, Himalaya, Mumbai

## **CP 205 : COMPUTER APPLICATION IN BUSINESS**

**Objective:** The objective of this course is to provide an insight into basic features of Computer Systems and their Applications in Business Decision Making.

**Unit-I:** Introduction to Computer Concepts – Elements of computer – Characteristics of a Computer – Classification of Computers – Basic Computer Architecture – Input-output Devices.

**Unit-II** Software Concepts: Types of software – Software: its nature and qualities — Windows Operating System Functions.

**Unit-III:** MS Office- Applications of MS Word in Business Correspondence: letters, tables, mail merge, labels.

Computer Networks - Overview of a Network – Communication processors – Communications Media – Types of Network – Network Topologies.

**Unit-IV:** E-commerce - Meaning, Advantages and Disadvantages of E-Commerce – Conducting Business On-line – Issues in implementing in E-Commerce – Comparison between Traditional Commerce and E-Commerce – Incentives for engaging E-commerce.

**Unit-V:** Electronic Data Interchange (EDI) – Concept – History of EDI – Phases of EDI – Business Models – Major types of E- Commerce models.

### **Suggested Books:**

1. Sanjay Saxena and Prathpreet Chopra, Computer Applications in Management, Vikas, New Delhi
2. Aksoy, Introduction to Information Technology, Cengage, ND
3. Parameswaran: Computer Application in Business – S Chand, New Delhi.
4. Management Information Systems by Mahadeo Jaiswal, Monika Mittal, Oxford University Press.
5. Sudalaimuthu & Anthony Raj, Computer Applications in Business, Himalaya, Mumbai
6. David Whitley “E-Commerce – Strategy, Technologies and Application” Tata Mc Graw Hill
7. Parag Diwan and Sunil Sharma “E-Commerce”, Excel Books

**M.COM. - SEMESTER III  
CP 301 : MICRO FINANCE**

**M.COM. - SEMESTER III  
CP 301 : MICRO FINANCE**

**Unit I : Overview of Microfinance:** Indian rural financial system, introduction to microfinance, concepts, products (savings, credit, insurance, pension, equity, leasing, hire purchase service. Micro finance in kind, Micro-remittances. Micro-securitization, franchising etc.,). Micro finance models (Generic models viz., SHG, Grameen and Co-operative, variants SHG NABARD model, SIDBI model, SGSY model, Grameen model, NMDFC model.

**Unit II : Catalyst Role of NGOs:** Educating and formation of SHGs, Linkages with Banks & Markets, Liasoning with Government Dept. Capacity building of SHGs members about value additions, record keeping etc.

**Pricing of Micro Finance Products:** Purpose base, Activity base, Economic class base open bidding etc. Pricing saving products, Amount of savings base, Attendance at periodical meeting adding to corpus.

**Unit III :** Gender Issues in Micro finance and Conflict Resolution in Microfinance – Client impact studies measuring impact of microfinance and microenterprises.

**Micro enterprise:** Characteristics, merits and demerits.

**Unit IV: Commercial Microfinance:** MFIs: Evaluating MFIs – Social and Performance Metrics, Fund structure, Value added Services. The rise of commercial Microfinance – Transforming NGOs, Structure of Microfinance Industry and Constraints on MFI Growth. The partnership model – MFI as the servicer.

**Credit Rating of MFIs:** Need and basic criteria/indicators for rating MFIs-Credit rating agencies in India and abroad-CAMEL – ACCION rating tools: An introduction.

**Unit V: Micro insurance:** Products, eligibility, insurance premium and claim administration systems, regulatory guidelines, relevant cases. Micro-securitization. Financial inclusion and micro-finance. Role or NABARD in Microfinance promotion.

**Field visits and field surveys are recommended.**

**Suggested Books**

1. S. Teki and R.K. Mishra, “Microfinance & Financial Inclusion”, Academic foundation, New Delhi, 2012.
2. Beatiz Armendariz and Jonathan Morduch, “The Economics of Microfinance”, Prentice Hall of India Pvt. Ltd., Delhi, 2005.
3. Joanna Ledgerwood, “Microfinance Handbook”: An Institutional and Financial Perspective, The World Bank, Washington, D.C.
4. Malcolm Harper, “Practical Microfinance” A Training guide for South Asia, Vistaar Publication, New Delhi, 2003.
5. C.K. Prahalad, “The Market at the Bottom of the Pyramid, 2006”, The Fortune at the Bottom of the Pyramid, Wharton School Publishing.
6. Jorritt De Jong, et al Edited, ‘Microfinance in Access to Government’, Cambridge, 2008.

## CP 302 : ENTREPRENEURSHIP

**Objective:** The objective of this course is to expose the students to the subject of entrepreneurship and small business management, so as to prepare them to establish and a new enterprise and effectively manage the same.

**Unit – I:** Entrepreneurship: Importance, Characteristics and Qualities of Entrepreneurship; Entrepreneurial; Role of Entrepreneurship, Ethics and Social Responsibilities.

**Unit – II:** Role of Government; Role of IDBI, NIESBUD, SISI, DIC Financial Institutions Commercial Banks, Entrepreneurial Development Institutes, Universities and other Educational Institutions Offering Entrepreneurial Development Programme.

**Unit – III:** Training: Designing Appropriate Training Programme to Inculcate Entrepreneurial Spirit, Training for New and Existing Entrepreneurs, Feedback and Performance of Trainees.

**Unit – IV:** Women Entrepreneurship – Role & Importance, Profile Women Entrepreneur, Problems of Women Entrepreneurs, Women Entrepreneurship Development in India.

**Unit – V:** Creativity and Entrepreneurship Sources and Methods of Ideas Planning and Development of Programmes - E-Business Ventures; New Venture Management.

### Suggested Books:

1. NVR Naidu and T. Krishna Rao, Management and Entrepreneurship, IK Int Pub House, New Delhi
2. S Anil Kumar, Small Business and Entrepreneurship, IK Int Pub House, New Delhi
3. Balraj Singh, Entrepreneurship Development, Wisdom, Delhi
4. Timmons and Spinelli, New Venture Creation :Entrepreneurship for 21<sup>st</sup> Century, TMH, ND
5. Tabarrok – Entrepreneurial Economics, Oxford University Press.
6. C.V. Bakshi, Entrepreneurship Development, Excel Publications.
7. Jain, Hand Book of Entrepreneurs, Oxford University Press.
8. Vasant Desai, Small Business in Entrepreneurship, Himalaya Publishing House.

### 303 – AT 1: CORPORATE ACCOUNTING

**Objective:** The Objective of this course is to expose students to advanced accounting issues and practices such as maintenance of company accounts, valuation of goodwill and shares, and handling accounting adjustments.

**Unit - I:** Corporate Financial Accounting: Objectives-Scope - Role of Corporate Accountant-Analysis and Interpretation of Financial Statements - Inflation Accounting.

**Unit - II:** Valuation of Shares: Need for Valuation of Shares – Factors Effecting Value of Shares – Methods of Valuation – Impact of Earnings on Share Valuation – Role of Fundamental Analysis and Technical Analysis in Share Valuation – Fair Value of a Share – Buy Back of Equity Shares.

**Unit - III:** Consolidated Financial Statements: Definition of Parent or Holding and its Subsidiary – Need for Consolidated Financial Statement – Preparation of Consolidated Balance Sheet of a Holding Company with one Subsidiary – Consolidation of Profit and Loss Account – Consolidated Statement of Changes in Financial Position.

**Unit - IV:** Accounting Standards: Objectives – Advantages and Disadvantages of Accounting Standards – Accounting Standards Board (ASB) – International Accounting Standards and Linkage with Indian Accounting Standards – Accounting Standards under US GAAP and Indian GAAP.

**Unit - V:** Financial Reporting: Concept, Objectives – Purpose of Financial Reporting and Specific Purpose of Report – Segment Reporting – Difficulties in Segment Reporting– Interim Reporting – Problems in Interim Reporting – Improving Financial Reporting – Value Added Statements – Disclosure of Value Added Statements – Economic Value Added – Human Resource Reporting - Environmental Reporting.

#### ***Suggested Books:***

1. Advanced Accounting – Corporate Accounting Vol. 2 – Ashok Sehgal & Deepak Sehgal, Taxmann Allied Services Pvt Ltd, New Delhi.
2. Advanced Accounting – Volume – 2; R.L. Gupta & Radhaswami S. Chand & Co. Delhi.
3. Financial Accounting: A Managerial Perspective, R. Narayana Swamy, Prentice Hall of India.
4. Financial Accounting for Business Managers: Asish K. Bhattacharyya, Prentice Hall of India.
5. Human Resource Accounting – D. Prabhakara Rao.
6. Advanced Accounts – Chakravarthy – Oxford Publishers.
7. Modern Accountancy Vol.2 – A. Mukharjee and M. Hanieff – Tata McGraw Hill Publishing Company. New Delhi.
8. Financial Accounting – A Managerial Perspective – R. Narayana Swami – Prentice Hall of India, New Delhi.
9. Corporate Accounting – S.N. Maheswari & S.K. Maheswari, Vikas Publishing House, New Delhi.

## 304 AT 2: STRATEGIC COST MANAGEMENT

**Objectives:** The course aims at to impart and inculcate the knowledge of controlling and effective management of cost among the students.

**Unit – I:** Cost Management – Nature and Scope – Management of Value Chain – Tools of Cost Management. Product Costing Systems – Concepts and Design Issues.

**Unit – II:** Activity Based Costing System – Meaning and Scope – Limitations of Traditional Costing Allocation Methods – Application of ABC System – Activity – Based Management – Concept and Scope – Target Costing – Benchmark Costing.

**Unit – III:** Quality Cost Systems – Meaning and Application – Conflict Between Quality and Cost – Trade–off Between Quality and Price – Value Analysis – Life Cycle Costing – Learning Curve Analysis – JIT.

**Unit – IV:** Cost Estimation – Methods – Costing Engineering – Using Regression Analysis – Evaluating Performance – Variance Analysis – Kaizen Costing.

**Unit – V:** Cost Control and Cost Reduction – Managerial and Technical Aspects – Meeting the Cost Reduction Challenges Role of Cost Accountant.

### ***Suggested Books:***

1. ‘Cost Management’ – Strategies for Business Decisions HILTON, MAHER and SELT, Tata McGraw Hill, II ed. 2002.
  2. ‘Cost Accounting’ – Principles and Practice, B. M.Lall Nigam, Prentice Hall of India.
  3. Cost Accounting: Theory and Practice, Bhabatosh Benarjee, Prentice Hall of India.
  4. ‘Principles of Quality Costs’ Principles, Implementation and Use Jack Companella, Prentice Hall of India Pvt. Ltd. 2000 (3rd Ed.) ‘Cost Accounting’ – Jain and Narang.
- ‘Cost Accounting’ – A Managerial Emphasis’ Chrles Tn Horngren.
- ‘Cost Accounting’ – B. Benerjee, World Press, Calcutta.



### 305 AT 3: MANAGEMENT CONTROL SYSTEMS

**Objective:** The course aims at to impart and inculcate the knowledge of controlling and effective strategic systems of management among the students.

**Unit -I:** Management Control: Objectives- Basic Concepts- The Formula Control Systems, Characteristics of Management Control Systems- Inter Relationship Among Strategic Planning, Management Control and Operational Control – Designing and Introduction of Management Control System – Management Control System and Responsibility Accounting -Informal Management Controls.

**Unit -II:** Structure of Management Control : Need for Delegation- Responsibility Centers – Expense Centers -Revenue Centers – Profit Centers- Investment Centers, Research and Development Centers – Administrative and Support Centers – Performance of Expense Centers – Revenue Centers – Profit Centers – Investment centers – Organizational Structure of Responsibility Centers – Transfer Pricing – Objectives – Methods – Pricing Corporate Services and Administration of Transfer Prices.

**Unit -III:** Management Control Process: Strategic Planning – Nature, Analysis of New Programmes – Ongoing Programmes – Strategic Planning Process – Programming and Budgeting – Budget Preparation Process; Performance Evaluation – Performance Evaluation Systems Interactive Control – Analyzing and Reporting – Types of Reports.

**Unit -IV:** Special Applications: Controls for Differentiated Strategies – Corporate Strategy – Strategic Business Unit Concept – Top Management Style – Management Control in Service Organizations; Professional Services – Financial Services – Healthcare Service Organizations – Management Control in Non-profit Organizations – Characteristics – Measuring Output – Pricing Management Structure.

**Unit -V:** Management Control in Multinational and Multi project Corporations (MNCs): Objectives, Characteristics, Performance Measurement of Subsidiaries Reporting System – Need for MIS between Parent and Subsidiary Companies – Structure of Multi Project Organization – Characteristics, Project Planning and Control Techniques, Control Indicators in Multi Project Organizations.

***Suggested Books:***

1. Management control Systems – Robert Anthony and Vijay Govindarajan Tata – McGrawhill publishing Company, New Delhi.
2. Management Control Systems, N. Ghosh, Prentice Hall of India.
3. Management information and control systems – Dr. Sushila Madan. Taxmann Allied Services Pvt. Ltd., New Delhi.
4. Management Control systems Text and Cases – Subhash Sharma Tata- McGrawhill publishing Company, New Delhi.

### **303 FB 1: SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT**

**Objective:** to enlighten the students with the Concepts and Practical applications of Security Analysis and Portfolio Management

**Unit – I:** Concept of Investment, Investment Vs Speculation, and Security Investment Vs Non-security Forms of Investment. Investment Process; Sources of Investment Information. Security Markets – Primary and Secondary.

**Unit – II:** Return and Risk – Meaning and Measurement of Security Returns. Meaning and Types of Security Risks, Systematic Vs Non-systematic Risk. Measurement of total risk.

**Unit – III:** Fundamental Analysis – Economy, Industry and Company Analysis, Intrinsic Value Approach to Valuation of Bonds and Equity Shares.

**Unit – IV:** Technical Analysis – Concept and Tools of Techniques Analysis – Technical Analysis Vs Fundamental Analysis. Efficient Market Hypothesis; Concept and Forms of Market Efficiency.

**Unit – V:** Elements of Portfolio Management, Portfolio Models – Markowitz Model, Sharpe Single Index Model and Capital Asset Pricing Model. Efficient Frontier and Selection of Optimal Portfolio. Performance Evaluation of Portfolios; Sharpe Model, Treynor's Model, Jensen's Model for Portfolio Evaluation.

***Suggested Books:***

1. Donald E. Fischer, Ronald J. Jordan, Security Analysis and Portfolio Management; Prentice Hall of India.
2. Prasanna Chandra, Investment Analysis and Portfolio Management, Tata McGraw Hill.
3. S. Kevin, Security Analysis and Portfolio Management, Prentice Hall of India.
4. S. Kevin, Portfolio Management, Prentice Hall of India.
5. J.C. Francis, Investments – Analysis and Management, McGraw Hill Int.
6. Elton, EJ & Grober, MJ, Modern Portfolio Theory and Investment Analysis, John Wiley.
7. Avadhani, VA, SAPM, Himalaya Publishers.
8. Bhalla, VK Investment Management, S Chand.
9. Punitavathy Pandian, SAPM, Vikas.
10. Preeti Singh, Investment Management, Himalaya Publishers.

## **304 FB 2: INTERNATIONAL FINANCIAL MANAGEMENT**

**Objective:** to enlighten the students with the Concepts and Practical applications of International Financial Management.

**Unit I:** International Monetary and Financial System: Evolution; Breton Woods Conference and Other Exchange Rate Regimes; European Monetary System, South East Asia Crisis and Subprime crisis-2008.

**Unit II:** Foreign Exchange Risk: Transaction Exposure; Accounting Exposure and Operating Exposure – Management of Exposures – Internal Techniques, Management of Risk in Foreign Exchange Markets.

**Unit III:** Features of Different International Markets: Euro Loans, CPs, Floating Rate Instruments, Loan Syndication, Euro Deposits, International Bonds, Euro Bonds and Process of Issue of GDRs and ADRs.

**Unit IV:** Foreign Investment Decisions: Corporate Strategy and Foreign Direct Investment; Multinational Capital Budgeting; International Acquisition and Valuation, Adjusting for Risk in Foreign Investment.

**Unit V:** International Accounting and Reporting; Foreign Currency Transactions, Multinational Transfer Pricing and Performance Measurement; Consolidated Financial Reporting.

### **Suggested Books:**

1. Buckley Adrin, Multinational Finance, 3rd Edition, Engle Wood Cliffs, Prentice Hall of India.
2. S.P.Srinivasan, B.Janakiram, International Financial Management, Wiley India, New Delhi.
3. Clark, International Financial Management, Cengage, ND
4. V.Sharan, International Financial Management, 3rd Edition, Prentice Hall of India.
5. A.K.Seth, International Financial Management, Galgothia Publishing Company.
6. P.G.Apte, International Financial Management, Tata Mc Grw Hill, 3rd Edition.
7. Bhalla, V.K., International Financial Management, 2nd Edition, New Delhi, Anmol, 2001.
8. V.A.Avadhani, International Financial Management, Himalaya Publishing House.
9. Bhalla, V.K., Managing International Investment and Finance, New Delhi, Anmol, 1997.

### 305 FB 3: FINANCIAL DERIVATIVES

**Objective:** to enlighten the students with the concepts and practical applications of derivatives in the security markets.

**Unit - I:** Introduction to Financial Derivatives – Meaning and Need – Growth of Financial Derivatives in India – Derivative Markets – Participants- Functions – Types of Derivatives – Forwards – Futures – Options-Swaps – The Regulatory Framework of Derivatives Trading in India.

**Unit - II:** Features of Futures –Differences Between Forwards and Futures – Financial Futures – Trading – Currency Futures – Interest Rate Futures – Pricing of Future Contracts- Value at Risk (VaR)-Hedging Strategies – Hedging with Stock Index Futures – Types of Members and Margining System in India – Futures Trading on BSE & NSE.

**Unit - III:** Options Market – Meaning & Need – Options Vs Futures -Types of Options Contracts – Call Options – Put Options- Trading Strategies Involving Options – Basic Option Positions – Margins – Options on Stock Indices – Option Markets in India on NSE and BSE.

**Unit - IV:** Option Pricing – Intrinsic Value and Time Value- Pricing at Expiration – Factors Affecting Options pricing- Put-Call Parity Pricing Relationship- Pricing Models - Introduction to Binominal Option Pricing Model – Black Scholes Option Pricing Model.

**Unit – V:** Swaps – Meaning – Overview – The Structure of Swaps – Interest Rate Swaps – Currency Swaps – Commodity Swaps – Swap Variant – Swap Dealer Role –Equity Swaps – Economic Functions of Swap Transactions - FRAs and Swaps.

#### ***Suggested Books:***

1. Hull C. John, “Options, Futures and Other Derivatives”, Pearson Educations Publishers,
2. David Thomas. W & Dubofsky Miller. Jr., Derivatives valuation and Risk Management, Oxford University, Indian Edition.
3. ND Vohra & BR Baghi, Futures and Options, Tata McGraw-Hill Publishing Company Ltd.
4. Red Head: Financial Derivatives: An Introduction to Futures, Forward, Options” Prentice Hall of India.
5. David A. Dubofsky, Thomas W. Miller, Jr.: Derivatives: Valuation and Risk Management, Oxford University Press.
6. Sunil K.Parameswaran, “Futures Markets: Theory and Practice” Tata-McGraw-Hill Publishing Company Ltd.
7. D.C. Patwari, Financial Futures and Options, Jaico Publishing House.
8. T.V. Somanathan, Derivatives, Tata McGraw-Hill Publishing Company Ltd.
9. NSE Manual of Indian Futures & Options & www. Sebi.com
10. S.C. Gupta, Financial Derivatives: Theory, Concepts and Problems, Prentice Hall of India.

**M.COM. - SEMESTER IV**  
**CP 401: FINANCIAL MARKETS AND SERVICES**

**Objective:** to enlighten the students with the concepts and practical dynamics of financial markets and financial services.

**Unit - I:** Structure of Financial System – Role of Financial System in Economic Development- Financial Markets and Financial Instruments- Capital Markets – Money Markets –Primary Market Operations- Role of SEBI – Secondary Market Operations - Regulation – Functions of Stock Exchanges – Listing - Formalities -Financial Services Sector Problems and Reforms.

**Unit - II:** Financial Services: Concept, Nature and Scope of Financial Services – Regulatory Frame Work of Financial Services – Growth of Financial Services in India – Merchant Banking – Meaning –Types – Responsibilities of Merchant Bankers – Role of Merchant Bankers in Issue Management – Regulation of Merchant Banking in India.

**Unit - III:** Venture Capital – Growth of Venture Capital in India – Financing Pattern Under Venture Capital – Legal Aspects and Guidelines for Venture Capital. Leasing – Types of Leases – Evaluation of Leasing Option. Vs. Borrowing.

**Unit - IV:** Credit Rating – Meaning, Functions - Debt Rating System of CRISIL, ICRA and CARE. Factoring, Forfeiting and Bill Discounting –Types of Factoring Arrangements- Factoring in the Indian Context.

**Unit - V:** Mutual Funds – Concept and Objectives, Functions and types, Working of Public and Private Mutual Funds in India. Debt Securitization - Concept and Application - De-mat Services need and Operations-role of NSDL and CSDL.

***Suggested Books:***

1. I.M. Bhole, Financial Institutions and market, Tata McGraw Hill.
2. V.A. Avadhani, Marketing of Financial Services, Himalayas Publishers, Mumbai.
3. Vasant Desai, Indian financial system, Himalaya Publisher.
4. Benton E.G., Financial Intermediaries An introduction.
5. Edminister R. D, Financial Institution, Markets and Management.
6. Verma J.C A manual of Merchant Banking.
7. West Lake. M, Factoring.
8. N. Vinaykan, A Profile of Indian Capital Market.

## CP 402 : INSURANCE PRODUCTS & MANAGEMENT

**Objective:** to enlight the students with the concepts and practical dynamics of insurance products and management.

**Unit – I** Risk and Insurance : Concept of Risk – Types of risk – Risk management – Objectives – Importance – Tools of risk management – Concept of insurance – fundamental principles – Indian insurance sector –Insurance Regulatory and Development Authority (IRDA) – Challenges and recent developments in insurance sector in India. (Theory only)

**Unit – II** Types of Insurance: Life insurance – Essentials of life insurance contract – Insurance pricing – Classification of life insurance policies – Re-insurance – Double insurance – Assignments – Surrender value – Computation of premium – Settlement of Claims – Progress of life insurance business in India – Role of LIC (Theory only)

**Unit – III** Non-Life Insurance: Marine insurance – Marine losses – Types of marine insurance – Settlement of claims – Progress of marine insurance – Fire insurance – Objectives – Types and uses – Settlement of claims – Progress of fire insurance. (Theory only)

**Unit – IV** Miscellaneous Insurance: Health insurance – objectives – Importance – Types of health insurance policies – Settlement of claims – Employee benefits – Retirement plans – Crop insurance – salient features – Importance – Problems of crop insurance (Theory only)

**Unit – V** Investment of funds: Investment of funds – Principles –Types of investment – Factors influencing investment decisions – Legal restrictions on investments by LIC and GIC – Prospects of insurance business in India (Theory only)

### ***Suggested books:***

1. George E.Rejda, Principles of Risk management and Insurance (Ninth Ed.,) Pearson education, Inc. and Dorling Kindersley Publishing Inc. Delhi.
2. Gupta, P.K., Insurance and Risk Management, Himalaya Publishing House, Hyderabad.
3. Mathew, J.J., Insurance: Principles and Practice, RBSA Publishers, Jaipur.
4. Mishra, M.N., and Mishra, S.B., Insurance Principles and practice, S.Chand& Co., Ltd., New Delhi.
5. Nalini Prava Tiripathy and Prabir pal, Insurance: Theory and practice, PHI Learning Pvt., Ltd., New Delhi.
6. Periasamy, P., and Veera Selvam, Risk and Insurance Management, Vijay Nicole Imprints Ltd., Chennai.
7. Periasamy, P., Principles and practice of Insurance, Himalaya Publishing House, New Delhi.
7. Periasamy, P., Principles and practice of Insurance, Himalaya Publishing House, New Delhi.

## 403 – AT 1: DIRECT TAXES

**Objective:** to acquaint the students with the theoretical and practical aspects of direct taxes including wealth taxes.

**Unit – I:** Income Tax Act 1961: Basic Concepts, Income, Agriculture Income –Residential Status and Incidence of Tax - Incomes Exempt from Tax.

**Unit – II:** Income from Salaries: Chargeability, Deductions, Perquisites, Computation of Salary Income.

**Unit – III:** Income from House Property, Chargeability, and Computation of Income.

**Unit – IV:** Income from Business or Profession - Capital Gains and Income from Other Sources –Computation of Total Income.

**Unit – V:** Wealth Tax Act, 1957 – Chargeability – Incidence of Tax – Assets – Deemed Assets - Assets Exempt from Wealth Tax - Return of Wealth and Assessment – Rates of Tax - Computation of Net Wealth.

### *Suggested Books:*

1. Dr. V.K. Singhania & Dr. Kapil Singhania, Direct Taxes Law and Practice, Taxman Publications Pvt. Ltd., New Delhi.
2. Bhagavati Prasad, Direct Taxes Law and Practice, Wishwa Prakashan, New Delhi.
3. Dinkar Pagare, Income Tax and Practice, Sultan Chand and Sons, New Delhi.

## 404 – AT 2: INDIRECT TAXES

**Objective:** to acquaint the students with the basics and latest developments in the areas of Indirect taxes.

**Unit – I:** Excise Duty - Introduction – Laws Relating to Excise Duty – Nature of Excise Duty – Basic Concepts – Taxable Event for Excise Duty – Types of Excise Duties – Exempted Goods.

**Unit – II:** Excisable Goods – Classification of Goods – Valuation of Goods.(Simple problems on Excise Duty)

**Unit – III:** CENVAT Credit – Input Goods and Services for CENVAT Credit – Capital Goods for CENVAT Credit – Exempted Final Products / Output Services.

**Unit – IV:** Customs Duty - Introduction – Basic Concepts – Scope and Coverage of Customs Duty - Nature of Customs Duty – Classification for Customs – Types of Custom Duties. Exemptions from Customs Duty – Valuation for Customs Duty.(Simple problems on Custom Duty)

**Unit – V:** Customs Procedures: Import Procedures - Export Procedures - Baggage, Courier and Post – Warehousing in Customs – Duty Draw Back.

### ***Suggested Books:***

1. V.S. Datey, Indirect Taxes Law & Practice, Taxman Publications Pvt. Ltd., New Delhi.
2. V.K.Sareen and Ajay Sharma, Indirect Tax laws, Kalyani Publications, New Delhi.



### **405 – AT 3: TAX PLANING AND MANAGEMENT**

**Objective:** to acquaint the students with the theoretical and practical aspects of tax planning and management.

**Unit – I:** Introduction: Tax Planning and Management – Tax Avoidance, Tax Planning, Tax Evasion – Tax Evasion in India – Measures of the State for Tax Evasion.

**Unit – II:** Tax Planning for Salaried Persons – Application of Sec 80C in reducing the tax bill of Salaried Persons – Choice between Perquisites and Allowances.

**Unit – III:** Tax Planning for Firms and HUF- Meaning-Different Schools of HUF-Assessment of HUF and Firms – Partition of a HUF- Scheme of taxation of firms – Allowance and Disallowance for remunerations paid to partners.

**Unit – IV:** Tax Planning for Companies – Meaning – Types of Companies and Tax rates – Provisions relating to Company assessment – Dividend distribution tax – Deemed Dividend – Minimum alternative tax.

**Unit – V:** Tax Planning for Small Business – Provision relating to SEZs, Software Parks, SSI – Exemptions on Central Excise on SEZs, Software Parks, SSIs.

***Suggested Books:***

1. Dr. V.K. Singhania & Dr. Kapil Singhania, Direct Taxes Law and Practice, Taxman Publications Pvt. Ltd., New Delhi.
2. Bhagavati Prasad, Direct Taxes Law and Practice, WishwaPrakashan, New Delhi.

## 403 FB 1: ADVANCED BANKING

**Objective:** The course aims at to impart and inculcate the knowledge of development and financial sector reforms among the students.

**Unit – I:** Central Banking Concept – Central Banking Policy in Developed and Developing Economics – Functions – Note Issues – Banker to the Government; Banker to Commercial Banks – Credit Control – Techniques – Structure and Organization of RBI – Role of RBI as Central Bank.

**Unit – II:** Structure and Organization of Central Bank in USA and UK – Objectives and Techniques of Central Banking Policy in Developed and Less Developed Countries – A Critical Study of Theory and Practice of Central Banking in USA and UK.

**Unit – III:** Development of Commercial Banking in UK, USA and India – Study of Nature and Structure of Commercial Banking in India and Abroad – Theories of Asset Management of Commercial Banks, Recent Developments in Commercial Banking in USA, UK and India. A Study of Money and Capital Markets in UK, USA and India.

**Unit – IV:** Economic Stabilization Policy – Objectives of Monetary Policy – Choosing Between Conflicting Objectives – Monetary Policy and Economic Stabilization – Fiscal Policy and Economic Stabilization – Interdependence of Monetary and Fiscal Policies – Debt Management Policy.

**Unit –V:** Financial Sector Reforms in India – Need for Reforms – Major Reforms After 1991 – Issues and Impact of Financial Reforms.

### ***Suggestive Books:***

1. Hawtrey “The art of Central Banking “ Augustus M.Kelley Publishers, 1970 – New York.
2. Narendra Kumar – Bank Nationalism of India – A Symposium – Lalvani Publishing House, 1969 – Mumbai.
3. Pai Panandikar & N C Mehra – Rural Banking – National Institute of Bank Management – Mumabi.
4. Vasant Desai – Indian Banking – Nature and Problems – Himalaya Publications House – Mumbai.
5. Benjamin H Bankhurt – Banking Systems – Times of India Press – Mumbai.
6. Charless L Prather – Money & Banking – Richard.D.Irwin Inc. – Illinois
7. Mongia J.N. – Banking Around the world – Allied Publishers Pvt Ltd., Mumbai.
8. Bhole, L.M – Financial Institutions and Markets, Tat McGraw – Hill Publishing Company Limited, New Delhi, 2004.
9. Khan, M.Y – Indian Financial System, Tat McGraw Hill Publishing Company Limited, New Delhi, 2004.

## **404 FB 2: RURAL BANKING**

**Objective:** To expose the students with the functioning of rural credit institutions in India along with the prospects and problems of financial inclusion including priority sector.

**Unit I – Rural India:** Demographic features-Economic features-Rural poverty-main causes and methods of measuring rural poverty-Rural Infrastructure-Rural Development Policy- Govt. policies and programmes-Economic Reforms and its impact on rural economy.

**Unit II-Financing Rural Development:** Functions and policies of RBI and NABARD ;Rural Credit Institutions-Role and functions -Role of Information and Communication Technologies in rural banking- Regulation of Rural Financial Services.

**Unit III-Financial inclusion:** Concept and its role in inclusive growth- Micro credit, micro insurance scheme - Business Facilitators and Business Correspondents in rural financing-SHG/NGOs, linkages with banking, latest guidelines of GOI and RBI.

**Unit IV-Priority Sector Financing and Govt. initiatives:** Components of priority sector-RBI Guidelines; Government initiatives: Poverty alleviation programmes/Employment programmes/Production oriented programmes-Rural housing and Urban housing schemes under priority sector-Educational loans.

**Unit V-Problems and prospects of Rural Banking:** Problems of rural branches of commercial banks and regional rural banks-emerging trends in rural banking-financing poor as bankable opportunity.

### **Suggested Books:**

1. Vasantha Desai, Indian Banking-Nature and Problems, Himalaya Publishing House, Mumbai
2. Khan, M.Y., Indian Financial System, Tata McGraw Hill Publishing Company Ltd., New Delhi
3. Pai Panandikar & NC Mehra, Rural Banking, National Institute of Bank Management, Pune
4. Guruswamy, S., Banking in the New Millenium, New Century Publications, New Delhi
5. Uppal RK, & Rimpi Kaur, Banking Sector Reforms in India, New Century Publications, New Delhi
6. Indian Institute of Banking & Finance, Rural Banking, Mumbai
7. Uppal RK & Pooja, Transformation in Indian Banks-Search for better tomorrow, Sarup Book Publisher Private Ltd., New Delhi
8. Shyam Ji Mehrotra, New Dimensions of Bank Management, Skylark Publications, New Delhi.

### **405 FB 3: FINANCIAL INSTITUTIONS**

**Objective:** To acquaint the student with the different types of NBFCs and their contribution to the overall development of the Indian financial system.

**Unit – I:** Origin – Concept – Definition – Structure – Role of Financial Institutions.

**Unit – II:** Non-Bank Financial Companies – Introduction – Concept – Definition – Scope and Meaning – Role.

**Unit – III:** NBFCs – Structure – Growth – Regulation of NBFCs.- An Overview of the Present Position of NBFCs.

**Unit – IV:** Non – Bank Statutory Financial Organizations – Concept – Structure – Nature, Functions and Role of NBSFOs.

**Unit – V:** Financial Performance of Non-Banking Statutory Financial Organizations – Investment Pattern – Strengthening of NBFCs. – Reforms in NBSFOs.

***Suggested Books:***

1. Bhole, L.M – Financial Institutions and Markets, Tat McGraw – Hill Publishing Company Limited, New Delhi, 2005.
2. Khan, M.Y – Indian Financial System, Tat McGraw Hill Publishing Company Limited, New Delhi, 2004.
3. Indian Banks Association, Indian Banking Year Book 2004, Mumbai, 2005.
4. RBI, Report on Trends and Progress of Banking in India, various issues, Mumbai.

ANDHRA UNIVERSITY



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Telephone: 284 4000  
Fax: 0891-755324

All Official letters, packages  
etc, should be addressed to  
the Registrar by designation  
and not by name.

No. L.II (7)/M.Com./Combi./2009.

Visakhapatnam  
Dt: 18.08.2009

From: The Dean, Academic Affairs,

- To
- The Special Officer,  
A.U. Campus Centre,  
Tadepalle Gudem,  
W.G. District. (AP.)
  - The Principals of A.U. Affiliated Colleges offering  
M.Com. Degree Courses.

Sir,

Sub: M. Com. Degree Course – Combinations as elective papers in III & IV Semesters – Regarding.

- Ref: 1. Minutes of the meeting of the Board of Studies in Commerce & Mgt. Studies held on 25-07-2009 in the Dept. of Commerce & Mgt. Studies, A.U., VSP.  
2. Clarification dated 06-08-2009 received from the Chairman, Board of Studies in Commerce & Mgt. Studies, A.U.

With reference to the above subject, I am by direction to inform you, that the students studying M.Com. III & IV Semesters of 2008-09 admitted batch have been permitted to select any two of the following combinations as elective papers.

**1. Combinations:**

- Accounting ✓
- Finance ✓
- Banking ✓
- Taxation ✓

**2. Electives:**

	Electives	III Semester	IV Semester
1.	Accounting	A-1 Corporate Accounting A-2 International Accounting	A-3 Strategic Cost Management A-4 Management Control systems
2.	Finance	F-1 Strategic Financial Management F-2 Financial Markets & Services	F-3 Security Analysis & Portfolio Management F-4 Financial Derivatives
3.	Banking	B-1 Advanced Banking ✓ B- Bank Financial Management	B-3 Financial Institutions B-4 Banking & Technology
4.	Taxation	T-1 Direct Taxes T-2 Indirect Taxes ✓	T-3 VAT & Service Tax ✓ T-4 Tax Planning and Management ✓

I request you, to kindly circulate the same among the teaching staff and students concerned.  
Yours faithfully,

*M. Sudhakar Rao*  
(M. SUDHAKARA RAO)  
Assistant Registrar (Academic)

Copy to:

- The Principal, A.U. College of Arts & Commerce, VSP.
- Prof. Balla Appa Rao, Chairman, Faculty of Commerce & Head of the Dept. of Commerce & Mgt. Studies, A.U., VSP.
- Prof. B. Rama Krishna Rao, Chairman, Board of Studies in Commerce & Mgt. Studies, A.U., VSP.
- The Dean of Academic Affairs, A.U., V.S.P.
- The Dean of Examinations, A.U., VSP.
- The Special Registrar and Controller of Examinations, A.U., VSP.
- B.V.F.I. & B.I. Sections for Information.

M.Com. Courses Structure-2008

ANNEXURE -- I

(Scheme of Instruction and Scheme of Examination)

**I - Semester:**

✓CP - 101	Management Theory and Practice ✓	100
CP - 102	Business Environment (India & International)	100
CP - 103	Advanced Management Accounting G, C	100
CP - 104	Business Economics	100
CP - 105	Business Communication	100
CP - 106	Softskills-I (Business and Spoken English) G, C	150

**II - Semester:**

CP - 201	Quantitative Techniques for Business Decisions	100
CP - 202	IT for Business I (Practicals: 25)	100
✓CP - 203	Financial Management ✓	100
CP - 204	Human Resource Management	100
CP - 205	Marketing Management	100
CP - 206	Softskills-II (Personality Development & GD)	150

**III - Semester:**

✓CP - 301	Insurance Products & Management	100
	Four Papers from Specialisation	400

**IV - Semester:**

CP - 401	Computer Applications in Accounting (Tally) (25marks/Practicals)	100
	Four Papers from Specialisation	400

Project

100

Viva

100

**SPECIALISATIONS**

**Finance & Banking**

- ✓3S- F1: Strategic Financial Management ✓
- 3S- F2: Financial Markets and Services
- ✓3S- B1 Advanced Banking
- ✓3S- B2: Bank Financial Management
- ~~4S- F1: Security Analysis and Portfolio Management~~
- ✓4S- F2: Financial Derivatives
- ✓4S- B1 Financial Institutions
- ✓4S- B2 Banking and Technology

**Accounting & Taxation**

- 3S- A1 Corporate Accounting
- 3S- A2 International Accounting
- 3S- T1 Direct Taxes
- 3S- T2 Indirect Taxes ✓
- ~~4S- A1 Strategic Cost Management~~
- 4S- A2 Management Control Systems
- 4S- T1 VAT and Service Tax
- 4S- T2 Tax Planning and Management

**M.COM. (2008) - SEMESTER I**

**CP – 101: MANAGEMENT THEORY AND PRACTICE**

**Objectives:**

To familiarise the students with basic management concepts and the process of organisation.

**Unit – I:**

Introduction: Concept of Management: Definition, Nature, Purpose, Scope and Significance – Evolution of Management Thought – Approaches to Management – Process of Management – External Environment Functions of Management.

**Unit – II**

Planning: Types of Plans – Objectives, Management by Objectives, Planning Premises Decision Making: Decision Making Process – Decision Tree Analysis – Linear Programming, Game Theory.

**Unit – III**

Organisation: Principles of Organization: Formal and Informal Organisation – Span of Control – Delegation of Authority – Centralisation and Decentralization – Line and Staff Conflict and Cooperation. Staffing Process The nature and Purpose of Staffing – Executive Development Programme (EDPs).

**Unit – IV**

Directing: Elements of Directing Communication – Importance, Process, Media, Barriers to Communication. Effective Communication. Motivation – Leadership – Concept, Styles, Theories – Managerial Grid: Likerts Four Systems of Leadership.

**Unit – V**

Process of Control, Techniques of control, PERT and CPM.

*Suggested Books:*

1. James A. F. Stoner, R. Edward Freeman and Daniel R. Gilbirth Jr. – Management, Prentice Hall of India.
2. Heinz Wehrich and Harold Koontz, Essentials of Management – Tata McGraw Hill International.
3. Stephen Robbins and Mary Coulter, Management, Prentice Hall of India.
4. Bajaj: Management Processing and Organization, Excel Publications.
5. Tripathy and Reddy – Principles of Management – Tata McGraw Hill.
6. John F. Wilson – The Making of Modern Management, Oxford University Press.
7. Heiny Wehrich and Harold Koontz – Management, A Global Perspective – McGraw Hill International.
8. R.K. Suri, Organizational Behaviour, Wisdom Publication.
9. A. Pardhasaradhy & R. Satya Raju: Management Text and Cases, Prentice Hall of India

## CP – 102: INDIAN BUSINESS ENVIRONMENT

### Objective:

To familiarize the students with the business environment prevailing in India and international and understand its implications to business.

### Unit-I

Business Environment: Components and Significance – Economic Scope – Cultural, Political, Technological and External Factors Influencing Business Environment – Dimensions of International Business Environment – Challenges.

### Unit-II

Structure of Indian Economy; Economic systems- Economic planning with special reference to last three plans, public, private joint and cooperative sectors - Industrial Policy of the Government - Policy Resolutions of 1956, 1991 Industrial Policy and Economic Policy - Subsequent policy Statements.

### Unit-III

Indian Companies -Competitiveness, Changes and Challenges, Sustainable Development, Social Responsibilities, Ethics in Business- Competition Act 2002 - Emerging Trend in Indian Business Environment.

### Unit – IV:

International Trade Theories, Balance of Payments – Concepts, Disequilibrium in BOP Structural, Cyclical and Monetary Disequilibrium, Methods of Correction, Trade Barriers and Trade Strategy - Free Trade vs. Protection-World Financial Environment – Foreign Exchange Market Mechanism, Exchange Rate Determination, Euro Currency.

### Unit – V

Globalisation: International Economic Integration, Country Evaluation and Selection, Foreign Market Entry Methods, International Trade Stocks – Their Objectives; WTO Origin, Objectives, Organisation Structure and Functioning – WTO and India.

### Suggested Books:

1. K.V.Sivayya and VBM Das: Indian Industrial Economy, Sultan Chand Publishers, Delhi.
2. Suresh Bedi: Business Environment, Excel, New Delhi.
3. Francis Cherunilam: Business Environment - Text & Cases.
4. M.Adhikari, Economic Environment of Business.
5. Pandey G.N.. Environmental Management, Vikas Publishing House.
6. Raj Agarwal: Business Environment, Excel Publications.
7. Govt. of India, Latest Economic Survey.
8. Chari, S. N: International Business, Wiley India
9. Francis Cherunilam: International Business: Text and Cases, Prentice Hall of India.
10. E. Bhattacharya: International Business, Excel Publications.
11. Sundaram & Black: International Business Environment Text and Cases, PHI.
12. Sajahan: International Business, Mac-Milan India. New Delhi.



## CP – 103: ADVANCED MANAGEMENT ACCOUNTING ✓

### Objective:

To develop an insight of postulates, principles and techniques of accounting and utilisation of financial and accounting information for planning, decision-making and control.

### Unit – I

Management Accounting – Nature and Scope – Management Accounting Vs Financial Accounting and Cost Accounting – Role of Management Accountant in a Modern Organisation.

### Unit – II

Cost Concepts for Decision Making - Cost – Volume – Profit Analysis – Behaviour of Variable Cost – Behaviour of Fixed Cost – Relationships Among Cost and Profits at Various Levels of Activity – Break-Even

Point – Margin of Safety – Contribution Approach for Decision Making – Analysis of Contribution Per Unit of Critical Factor.

### Unit – III

Cost Analysis for Pricing Decisions – Evaluating the cost Effects of Price – Quantity Relationships Price Elasticity of Demand and Optimal Pricing Decisions – Cost Analysis for Pricing During Recession Conditions – Flexible Cost Data for Pricing Decisions – Special Order Pricing – Impact of Special Order Pricing on Regular Sales and Overall Profits – Partial Fulfilment of Special Order Vs Outsourcing Decisions – Make or Buy Decisions.

### Unit – IV

Cost Analysis for Product Decisions – Breakeven Analysis of Multi-Product Firms – Differential Costs for Product – Mix Alterations Decisions – Product Additions Decision – Adding New Products Combining Pricing Decisions with Product Addition Decision and Selecting Profitable Product-Price Strategies – Produce Deletion – Sell or Process Further Decision of Joint and By-Products.

### Unit – V

Budgeting – Types of Budgets – Financial Budgets – Operating Budgets – Cash Budget – Production Budget – Flexible Budget – Concepts of Performance Budgeting and Zero Based Budgeting.

### Suggested Books:

1. I.M. Pandey: Management Accounting, Vikas Publishing House.
2. N.M. Singhvi, Management Accounting: Text and Cases, Prentice Hall of India.
3. T.P. Ghosh: Fundamentals of Management Accounting, Excel Publications.
4. Ravi M. Kishore, Management Accounting, Taxman Publications.
5. Chakraborty, Hrishikesh – Management Accountancy, Oxford University Press.
6. Horngren, C.T., Introduction to Management Accounting, Prentice Hall of India.
7. Khan and Jain, Management Accounting, Tata McGraw Hill, Delhi.
8. J.C. Varshney: Financial and Management Accounting, Wisdom Publication.
9. Horngren Sundem Stratton, Management Accounting, Prentice Hall of India.
10. Paresh P. Shah, Management Accounting, Wiley India, New Delhi.

## CP- 104: BUSINESS ECONOMICS

### Objective:

To enable the students to understand economic concepts and theories and their application in management decision making.

### Unit - I:

Introduction: Nature and Scope of Business Economics; Objectives of the Firm – Traditional Theory, Sales and Revenue Maximizing Theories, Managerial Theories and Behavioral Theories; Profit Maximization Vs. Wealth Maximization; Demand Forecasting – Methods of forecasting demand for Existing and New Products, Criteria for Good Forecasting Method.

### Unit - II:

Production Analysis and Cost Analysis: Production Function – Law of Variable Proportions, Isoquant and Isocost Curves, Least Cost Combination, and Returns to Scale; Economies of Large Scale; Cobb-Douglas Production Function and C.E.S. Production Function; Cost-Output Relationships – Short and Long Run; Cost Oriented Pricing Methods – Full Cost Pricing, Marginal Cost and Differential Cost Pricing.

### Unit - III:

Market Analysis: Price and Output Determination Under Perfect Competition, Monopoly, Monopolistic Competition, Oligopoly and Duopoly.

### Unit - IV:

Profit Analysis: Meaning of Profit, Limiting Factors of Profit, Criteria for Standard Profit: Theories of Profit; Business Forecasting – Nature and Scope of Forecasting and Different Methods of Business Forecasting and their Advantages and Disadvantages.

### Unit - V:

Macro Economic Concepts: National Income, Trade Cycles, Inflation, Monetary and Fiscal Policies.

### Suggested Books:

1. Mukherjee Sampat: Business and Managerial Economics (In the Global Context), Third Edition, New Central Book Agency (P) Ltd., Kolkatta, 1996.
2. Dwivedi, D.N.: Managerial Economics, Vikas Publishing House Pvt. Ltd., 2003.
3. Dhingra, I.C., Essentials of Managerial Economics; Theory, Applications and Cases, Sultan Chand, New Delhi, 2003.
4. Mithani, D.M.: Managerial Economics; Theory and Applications, Himalaya Publishing House, 2003.
5. Mehta, P.L.: Managerial Economics, Text and Cases, S.Chand & Co., Delhi.
6. Varshney, R.L. and Maheswari, K.L.: Managerial Economics, S.Chand & Co, Delhi.
7. Dwivedi, D.N.: Macroeconomics; Theory and Policy, Tata McGraw Hill Publishing Company, 2002.
8. Gupta, G.S.: Macroeconomics; Theory and Applications, Tata McGraw Hill Publishing Company Ltd.
9. Yogesh Maheswari, Managerial Economics, 2<sup>nd</sup> Edition, Prentice Hall of India.

## CP – 105: BUSINESS COMMUNICATIONS ✓

### Objective:

To equip the students with the necessary techniques and skills of communication to inform others, inspire them enlist their activity and willing cooperation in the performance of their jobs.

### Unit – I

Importance of Communication in Business Organisations – Communication Objectives – Media of Communication: Written, Oral, Visual – Audio Visual Communication.

### Unit – II

Interpersonal Communication – Interpersonal Communication – Communication Models: Exchange Theory – Johari Window – Transactional Analysis, Communication Styles.

### Unit – III

Communication Barriers – Communication Gateways – Developing Listening Skills – Influence of Culture on Communication.

### Unit – IV

Report Writing – Formal Reports – Informal Reports – Writing Good News and Bad News.

### Unit – V

Meetings and Oral Presentations – Communication Through Visuals – Use of Electronic Media in Business Communication.

### Suggested Books:

1. Jerry C. Wofford, Edwin A. Gerloff and Robert C. Cummins, Organisational Communication – The Key stone of Managerial Effectiveness.
2. McGrath, Basic Managerial Skills for All, 5<sup>th</sup> ed., Prentice Hall of India.
3. Urmila Rai & S.M. Rai, Business Communication, Himalaya Publishers, Mumbai.
4. Meenakshi Raman – Business Communication, Oxford University Press.
5. Bovee, Thill and Schatzman: Business Communication Today, Pearson Education.
6. Biswajit Das: Business Communication personality Development, Excel Publications.
7. Parag Diwan: Business Communication, Excel Publications.
8. Lesikar I Flatley, Basic Business Communication, Tata McGraw Hill.
9. Dalmar Fisher, Communication in Organizations, A Jaico Book.
10. Scot Ober, Contemporary Business Communication, Wiley India, New Delhi.

**CP – 106: SOFTSKILLS – I**  
**(Business and Spoken English)**

**Objective:**

To train students in English language to improve their oral and written business communication

**Unit-I:**

Business Correspondence: Meaning, Scope and Significance - Formal, informal and semiformal introductions – Describing company activities and structures – Describing job responsibilities – Understanding and writing letters - Differences between formal and informal writing – Use of formal vocabulary and functional language in business letter writing – Planning effective initial business letters and responses – email writing skills, call taking etiquette/skills/

**Unit-II**

Business Information: Completing forms with required details: Asking appropriate questions to gather information – Polite phrases of confirmation and communication breakdown- understanding native speaking accents and dialects; Functional language used in making verbal agreements – Effective techniques of making and accepting offers – Efficient written offer making and accepting.

**Unit-III**

Business Presentations: Basic presentation techniques – Use of information in presenting product features – Explaining technical features for simplification; Giving and interpreting numerical data, common useful business abbreviations and acronyms - Oral and written conventions for expressing numerical information in English – Pronunciation issues in expressing numbers and the alphabet.

**Unit-IV**

Business Reporting: Use of grammar in giving instructions– Effective presentation of oral instructions – effective presentation of written instructions, Presenting and describing company information: Vocabulary of describing graphical and numerical information – Expressing cause and result in English – Summarizing important information concisely.

**Unit-V**

Feedback and Evaluation: Giving feedback to others - Use of questions in self-assessment elicitation – Functional language of agreement/disagreement and opinion giving – Use of tone and intonation in good/bad feedback – Motivating others – Use of emphatic structures in English – Use of conditionals to discuss future possibilities – Discourse strategies for effective relationship – team building skills.

**Suggested Books:**

1. K. Srinivasa Krishna & B. Kuberudu: Business Communication and soft skills, excel, Hyderabad, 2008.
2. Seghal, M.K. Business Communication, Excel Books, New Delhi.
3. Mary Ellen Guffey, Business English.
4. Marie M. Stewart, Business & Communication
5. G.L. Handesson, P.R. Voiles, Business English & Communication.
6. Robert E. Barry, Pat Taylor Ellison, Business English for 21st Century.

## SEMESTER - II

### CP – 201: QUANTITATIVE TECHNIQUES FOR BUSINESS DECISIONS

#### Objective:

To make the students familiar with the statistical and mathematical techniques and their applications in business decision making.

#### Unit – I

Functions, Linear, Quadratic, Logarithmic and Exponential Functions – Permutations and Combinations – Matrices – Solving System of Equations with Matrix Methods – Differentiation and Integration of Simple Functions and their Applications.

#### Unit – II

Measures of Central Tendency – Measures of Dispersion – Simple Correlation and Regression Analysis – Concept and Applications of Multiple Regressions.

#### Unit – III

Concept of Probability – Probability Rules – Joint and Marginal Probability – Baye's Theorem – Probability Distributions – Binomial, Poisson, Normal and Exponential Probability Distributions.

#### Unit – IV

Sampling and Sampling Distributions – Estimation – Point and Interval Estimates of Averages and Proportions of Small and Large Samples – Concepts of Testing Hypothesis – One Sample Test for Testing Mean and Proportion of Large and Small Samples.

#### Unit – V

Tests of Two Samples – Tests of Difference Between Mean and Proportions of Small and Large Samples – Chi-square Test of Independence and Goodness of Fitness – Analysis of Variance.

#### Suggested Books:

1. K.V. Sivayya and K. Satya Rao, Business Mathematics.
2. R. Selvaraj, Quantitative Techniques, Excel Books, New Delhi.
3. Misra: Quantitative Techniques for Management, Excel Publications.
4. Barry Render, Ralph M. Stair Jr. & Michael E. Hanna, Quantitative Analysis for Management, 8<sup>th</sup> ed., Prentice Hall of India.
5. Levin, Krehbiel and Berenson, Business Statistics: A first course, Pearson Education Asia.
6. Nagar, Das – Basic Statistics, Oxford University Press.
7. Shenoy, Sarma and Srivatsava, Quantitative Techniques for Management, New Age (International) Pvt. Ltd.
8. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill, 2001.
9. C.R. Kothari, Quantitative Techniques, Vikas Publishers.
10. Anand Sharma, Quantitative Techniques for Decision Making, Himalaya Publishers, Mumbai.
11. Zameerudding, Khanna and Bhambri, Business Mathematics, Vikas Publishing House.

## CP – 202: IT FOR BUSINESS

### Objective:

To equip students with the basic information technologies available for improving managerial performance.

### Unit-I

Introduction to Computer Concepts – Elements of computer – Characteristics of a Computer – Classification of Computers – Basic Computer Architecture – Input-output Devices

### Unit-II

Software Concepts: Types of software – Software: its nature and qualities — Windows Operating System Functions.

### Unit-III

MS Office- Applications of MS Word in Business Correspondence: letters, tables, mail merge, labels.

Applications of MS Excel: Graphs and Charts – Calculation of various financial functions - Ms Access: Tables and Queries.

### Unit-IV

MS Power Point: Introduction – Toolbar, their Icons and Commands – Navigating in Power point - Creation of slides, animation, and templates - Designing Presentations – Slide show controls – Making notes on Pages and Handouts – Printing Presentations – Customizing Presentations - Auto content Wizard.

### Unit-V

E-COMMERCE – BUSINESS MODELS: Business To Business (B2B); Business To Consumer (B2C); E-payments – E-cash or Digital Cash, E-cheques, Credit Cards, Smart Cards, E-wallets and Debit Cards- Internet and Web Technologies

1. C.S.V. Murthy, E-commerce; Concepts, Models, Strategies, Himalaya Publishing House, 2004.
2. P.T. Joseph, S.J., E-Commerce: An Indian Perspectives; 2<sup>nd</sup> Edition, Prentice Hall of India, New Delhi.
3. Deepak Bharihoke, Fundamentals of IT, Excel Books, New Delhi.
4. Dhiraj Sharma, Foundation of IT, Excel Books New Delhi.

## CP 203: FINANCIAL MANAGEMENT

### Objective:

To develop an understanding of the Finance functions and relevant techniques of financial administration.

### Unit – I:

Introduction: Nature, Scope and Objectives of Financial Management: Finance Function – Profit Goal vs. Wealth Goal Maximization; Techniques of Financial Analysis: Funds Flow Analysis and Ratio Analysis Role of Financial Manager in Modern Environment.

### Unit – II:

INVESTMENT DECISION: Techniques of Appraisal; Process of Capital Budgeting – Risk Vs. Return Traditional and Modern Techniques. (including problems).

### Unit – III:

FINANCING DECISIONS: Capital Structure – Determinants; Leverages – Financial, Operating and Combined: Cost of Capital. (including problems)

### Unit – IV:

DIVIDEND AND RETAINED EARNINGS: Dividend Policy Decisions; Parameters, Dividend Models; Policies Regarding Retained Earnings.

### Unit – V:

WORKING CAPITAL MANAGEMENT: Concept, Need and Determinants of Working Capital - Working Capital Cycle – Working Capital Policy.

### Suggested Books:

1. Brearley, Richard and Myers, Steward: Principles of Corporate Finance, New York, McGraw Hill.
2. Solomon, Ezra, Theory of Financial Management, Columbia Press.
3. James C. Van Horne, Financial Management and Policy, Prentice Hall of India.
4. Weston J. Fred and Brigham, Eugene F., Managerial Finance, Dryden Press.
5. Prasanna Chandra, Financial Management, Tata McGraw Hill.
6. Khan, M.Y. and Jain, Financial Management, Tata McGraw Hill.
7. Pandey, I.M., Financial Management, Delhi, Vikas Publishing House.
8. Ravi M. Kishore: Financial Management, Taxmann.
9. Sudhirbhat, Financial Management, Excel Books.

## CP – 204: HUMAN RESOURCE MANAGEMENT

### Objective:

To enable the students to familiarize with the main aspects of Human Resource Management at the organization level and apply the same in management of Human Resources.

### Unit – I:

Human Resources Management: Concept, Significance and Evolution; Functions of HR Manager, Place of HR Department in Organization.

### Unit – II:

Human Resource Planning: Significance – Methods and Techniques - Job Analysis – Recruitment and Selection Processes - Induction – Placement – Promotion and Transfers.

### Unit – III:

Training and Development: Significance – Identification of Training Needs – Employee Training Methods – Executive Development Methods – Evaluation of Training and Development Programmes.

### Unit – IV:

Wage and Salary Administration: Wage Concepts; Job Evaluation – Methods & Techniques Wage Structure & Policy – Wage Differentials – Wage Payment Methods – Incentives – Fringe Benefits – Performance Appraisal: Scope & Significance – Methods of Appraisal - Limitations of Appraisal.

### Unit – V:

Industrial Relations: Significance, Causes of Disputes and Settlement - Role of State in Industrial Relations - Collective Bargaining - Employee Participation in Management.

### Suggested Books:

1. Venkat Ratnam: C.S., and Srivastava B.K., Personnel / Human Resource Management, Tata McGraw Hill.
2. Cynthia D. Fisher & Lyle F. Schoenfeldt, Human Resource Management, Wiley India, New Delhi.
3. N.K. Singh: Human Resources Management, Excel Publications.
4. Jyothi – Human Resource Management, Oxford University Press.
5. Gary Dessler, Human Resource Management.
6. Edwin B Flippo, Personnel Management.
7. Decenzo / Robbins, Personnel / Human Resource Management, 3<sup>rd</sup> Ed, John Wiley & Sons Pvt. Ltd.
8. P. Subba Rao, Human Resource Management, Himalaya Publishers, Mumbai.
9. Deepak Kumar, B. Human Resource Management, Excel Books.
10. Ghosh, HRD and Management, Vikas.
11. Ian Badwel, Len Holden: Human Resource Management – A Contemporary Perspective, Macmillan India Ltd.



## CP – 205: MARKETING MANAGEMENT ✓

### Objective:

To develop an understanding of the concepts, strategies and issues involved in marketing and its Management.

### Unit – I:

Importance of Marketing – Concepts – Approaches to the Study of Marketing – Marketing Environment. ✓

### Unit – II:

Consumer Behaviour – Market Segmentation – Market Targeting and Positioning – Marketing Information System and Research. ✓

### Unit – III:

Marketing Mix: Product Planning – New Product Development – Product Life Cycle – Branding Packaging – Product Mix Management. ✓

### Unit – IV: ✓

Pricing: Objectives – Methods and Strategies – Distribution – Channel Selection and Management Retail Management. ✓

### Unit – V: ✓

Promotion: Integrated Marketing Communications: Personal Selling – Advertising – Sales Promotion, Publicity and Public Relations – Direct Marketing: Evaluation of Communication Effort.

### Suggested Books: ✓

1. Philip Kotler and Kevin Lane Keller: Marketing Management, Prentice Hall of India / Pearson Education, New Delhi.
2. William J Stanton & Futrell: Fundamentals of Marketing.
3. V. J. Ramaswami and S. Namakumari: Marketing Management, Macmillan Business Books, Delhi.
4. S. Jayachandran: Marketing Management, Text and Cases, Excel Publications.
5. Tapan K. Panda, marketing management, Excel.
6. Zinkota & Kotabe: Marketing Management, Prentice Hall of India.
7. Joel R. Evans & Barry Berman: Marketing, Wiley India, New Delhi.
8. Mukesh Dhunna: Marketing Management, Wisdom Publication.
9. Rajiv Lal, John A. Quelch & V. Kasturi Rangan, Marketing Management, Tata McGraw Hill.

**CP – 206: SOFTSKILLS – II**  
**( Personality Development & GD )**

**Objective:**

to equip students with the most needed personality characteristics of modern professional managers with an emphasis on positive thinking, creativity, goal-setting, time management, self-discipline and interview skills.

**Unit - I:**

CAREER PLANNING: Meaning And Importance – The Process Of Career Planning – Different Dimensions – Factors To Be Considered For Career Planning - Goal Setting - Positive Thinking

**Unit - II :**

PERSONALITY DEVELOPMENT: Intra-personal Skills - Inter-personal Skills - Communication Skills – Spoken, Written, Non-Verbal (Body Language), Listening skills - Time Management – Leadership – Creativity - Problem Solving - Strategic Planning.

**Unit - III:**

INTERVIEW PREPARATION: Art of Facing Interview - Resume Preparation- Preparation for Campus Interviews - Pre-requisites for Campus Interviews - Stress and Anxiety Management - Dress Code & Appearance.

**Unit - IV**

INTERVIEW PROCESS: Written Test - Group Discussion - Role-Play- Response to Oral Questions - Employer's Criteria.

**Unit - V:**

NEGOTIATION WITH PROSPECTIVE EMPLOYER: Terms and Conditions - Compensation Package - Place of Posting - Career, Succession - Multi-Skill Development.

**Suggested Books:**

1. Biswajit Das, Business Communication and Personality Development, Excel Books.
2. Subrahmanyam, et.al., Personality Development, Excel Books, New Delhi.

### SEMESTER - III

(One Core Paper and Four Papers from Specialisation)

#### CP 301 : Insurance Products & Management

##### Unit – I:

Life Insurance Concept – Basic Principles of Life Insurance Utmost Good Faith- Insurance Interest – types of Life Insurance – Variations of Whole Life Insurance – Other types of Life Insurance.

##### Unit – II:

Life Insurance Contractual Provisions – Dividend Options – Non Forfeiture Options – Settlement Options – Additional Life Insurance Benefits – Insurance Pricing – Objectives of Rate Making – Rate Making in Life Insurance.

##### Unit – III:

Health and Disability – Income – Insurance – Types of Individual Health Insurance Coverage's – Individual Medical Expense Contractual – Group Insurance Group Life Insurance Plans – Group Medical Expense Insurance.

##### Unit – IV:

Employee Benefits – Retirement Plans – Fundamentals of Private Retirement Plans – Types of Qualified Retirement Plans – Profit Sharing Plans – Self Retirement Plans for Employed – Single Retirement Plans – Simplified Retirement Pension.

##### Unit – V:

Re-Insurance Reasons For Reinsurance- Types of Reinsurance – Alternatives to Traditional Reinsurance Functions of Reinsurance – Advantage and Disadvantage of Reinsurance.

##### *Suggested Books:*

1. George E. Rejoa, Principles of risk management and insurance, Pearson Education, New Delhi, 2004.
2. Black Jr. Skipper Jr. Health Insurance, Pearson Delhi, 2003.
3. M.N. Mishra, Insurance Principles and Practice, S. Chand, New Delhi, 2003.
4. M.J. Mathew, Insurance Principles and Practice, RBSA publishers, Jaipur 2005.

## SEMESTER – IV

(One Core Paper and Four Papers from Specialisation)

### CP 401: COMPUTER APPLICATIONS IN ACCOUNTING (TALLY)

**Unit – I:** Introduction to Computerised Accounting: Significance of Computerized Accounting – Advantages – Disadvantages – Computerised General Ledger System – Spreadsheet Software and Its Applications – Different Software Available in the Market Advantages – Disadvantages.

**Unit – II:** Accounting Software Tally (Ver. 7.2): Characteristics of the Software – Creation of a Company – Security Control – Configuration – Accounts Information – Creation of Ledgers – Vouchers – Types of Vouchers – Cost Center Budgets – Balance Sheet – Alteration of Vouchers – Audit – Trial – P & L a/c – Ratio Analysis – Security – Limitations of Tally – Short Cut Keys. (Lab – with practicals)

**Unit – III:** Tally's Forte (Reports): Displaying Reports – Characteristics – Objectives – Printing Reports – Display Account Books – Display Statement of Bank Reconciliation of Bank Accounts – Display Inventory Reports – Expert Usage. (Lab – with practicals)

**Unit – IV:** Inventory Handling Using Tally Ver 7.2 – A Practical Approach: Creation of Stock Groups – Creation of Stock Categories – Creation of Stock Items – Creation of Godown – Creation of Units of Measure – Inventory Vouchers. (Lab – with practicals)

**Unit – V:** Accounts of Banking Companies and Departmental Accounting: Objectives – Characteristics – Advantages – Disadvantages – Preparation of Accounts Using Tally in Departmental Accounts – Usefulness in Banks – Ledger Preparation – Guidelines of RBI for Profit & Loss Account – Expert Usage. (Lab – with practicals)

#### **Suggested Books:**

1. Computers and Common Sense, Robert Hunt & John Shelly, Prentice Hall of India, New Delhi.
2. Computers and Information Management, S.C. Bhatnagar, K.V. Ramani, Prentice Hall of India, New Delhi.
3. Management Information Systems and Data Processing, Bently, Holt, Rinehart and Winston.
4. Principles of Data Base Management, Martin, Prentice Hall of India, New Delhi.
5. Introduction of Systems Software, Dhandhere, Tata-Mc Grawhill Publications, New Delhi.
6. Accounting Systems, M. Sulochana, K. Kameswara Rao & R. Kishore Kumar, Kalyani Publishers, Hyderabad.

**SPECIALISATIONS**  
**FINANCE & BANKING**

- 3S-F1: Strategic Financial Management ✓ P
- 3S-F2: Financial Markets and Services ✓ P
- 3S-B1: Advanced Banking
- 3S-B2: Bank Financial Management
- 4S-F1: Security Analysis and Portfolio Management ✓ P
- 4S-F2: Financial Derivatives ✓ P
- 4S-B1: Financial Institutions
- 4S-B2: Banking and Technology

Finance:

SFM

FMBS

SACPM

FD

**ACCOUNTING & TAXATION**

- 3S-A1: Corporate Accounting ✓
- 3S-A2: International Accounting ✓
- 3S-T1: Direct Taxes
- 3S-T2: Indirect Taxes
- 4S-A1: Strategic Cost Management ✓
- 4S-A2: Management Control Systems ✓
- 4S-T1: VAT and Service Tax
- 4S-T2: Tax Planning and Management.

## SEMESTER – III ( FINANCE & BANKING )

### 3S – F1: STRATEGIC FINANCIAL MANAGEMENT

**Unit – I:** Financial Goals and Strategy – Shareholder Value Creation (SCV): Market Value Added (MVA) – Market-to-Book Value (M/BV) – Economic Value Added (EVA) – Managerial Implications of Shareholder Value Creation.

**Unit – II:** Financial Strategy for Capital Structure: Leverage Effect and Shareholders' Risk – Capital Structure Planning and Policy – Financial Options and Value of the Firm – Dividend Policy and Value of the Firm.

**Unit – III:** Investment Strategy – Techniques of Investment Appraisal Under Risk and Uncertainty – Risk Adjusted Net Present Value – Risk Adjusted Internal Rate of Return – Capital Rationing – Decision Tree Approach for Investment Decisions – Evaluation of Lease Vs Borrowing Decision.

**Unit – IV:** Merger Strategy – Theories of Mergers – Horizontal and Conglomerate Mergers – Merger Procedure – Valuation of Firm – Financial Impact of Merger – Merge and Dilution Effect on Earnings Per Share – Merger and Dilution Effect on Business Control.

**Unit –V:** Takeover Strategy – Types of Takeovers – Negotiated and Hostile Bids – Takeover Procedure – Takeover Defences – Takeover Regulations of SEBI – Distress Restructuring Strategy – Sell offs – Spin Offs – Leveraged Buyouts.

#### **Suggested Books:**

1. Coopers & Lybrand, Strategic Financial: Risk Management, Universities Press (India) Ltd.
2. Robichek, A, and Myers, S., Optimal Financing Decisions, Prentice Hall Inc.
3. James T. Gleason, Risk: The New Management Imperative in Finance, A Jaico Book.
4. Van Horn, JC. Financial Management and Policy, Prentice Hall.
5. Prasanna Chandra, Financial Management Theory and Practice, Tata McGraw Hill.
6. Weston JF, Chung KS & Hoag SE., Mergers, Restructuring & Corporate Control, Prentice Hall.
7. Pandey IM, Financial Management, Vikas.
8. Shiva Ramu, S., Corporate Growth through Mergers & Acquisitions, Response Books (A Division of Sage Publications).
9. Khandawalla, PN, Innovative Corporate Turnarounds, Sage Publications.

### 3S – F2: FINANCIAL MARKETS AND SERVICES

**Unit - I:** Structure of Financial System – Role of Financial System in Economic Development- Financial Markets and Financial Instruments- Capital Markets – Money Markets –Primary Market Operations- Role of SEBI – Secondary Market Operations - Regulation – Functions of Stock Exchanges – Listing Formalities -Financial Services Sector Problems and Reforms.

**Unit - II:** Financial Services: Concept, Nature and Scope of Financial Services – Regulatory Frame Work of Financial Services – Growth of Financial Services in India - Merchant Banking – Meaning –Types – Responsibilities of Merchant Bankers – Role of Merchant Bankers in Issue Management – Regulation of Merchant Banking in India.

**Unit - III:** Venture Capital – Growth of Venture Capital in India – Financing Pattern Under Venture Capital – Legal Aspects and Guidelines for Venture Capital. Leasing – Types of Leases – Evaluation of Leasing Option. Vs. Borrowing.

**Unit - IV:** Credit Rating – Meaning, Functions - Debt Rating System of CRISIL, ICRA and CARE. Factoring, Forfeiting and Bill Discounting –Types of Factoring Arrangements- Factoring in the Indian Context.

**Unit - V:** Mutual Funds – Concept and Objectives, Functions and Portfolio Classification, Organization and Management, Guidelines for Mutual Funds, Working of Public and Private Mutual Funds in India. Debt Securitisation - Concept and Application - De-mat Services-need and Operations-role of NSDL and CSDL.

#### **Suggested Books:**

1. I.M. Bhole, Financial Institutions and market, Tata McGraw Hill.
2. V.A. Avadhani, Marketing of Financial Services, Himalayas Publishers, Mumbai.
3. Vasant Desai, Indian financial system, Himalaya Publisher.
4. Benton E.G., Financial Intermediaries An introduction.
5. Edminister R. D, Financial Institution, Markets and Management.
6. Verma J.C A manual of Merchant Banking.
7. West Lake. M, Factoring.
8. N. Vinaykan, A Profile of Indian Capital Market.

### 3S – B1: ADVANCED BANKING

**Unit – I:** Central Banking Concept – Central Banking Policy in Developed and Developing Economics – Functions – Note Issues – Banker to the Government; Banker to Commercial Banks – Credit Control – Techniques – Structure and Organization of RBI – Role of RBI as Central Bank.

**Unit – II:** Structure and Organisation of Central Bank in USA and UK – Objectives and Techniques of Central Banking Policy in Developed and Less Developed Countries – A Critical Study of Theory and Practice of Central Banking in USA and UK.

**Unit – III:** Development of Commercial Banking in UK, USA and India – Study of Nature and Structure of Commercial Banking in India and Abroad – Theories of Asset Management of Commercial Banks, Recent Developments in Commercial Banking in USA, UK and India. A Study of Money and Capital Markets in UK, USA and India.

**Unit – IV:** Economic Stabilization Policy – Objectives of Monetary Policy – Choosing Between Conflicting Objectives – Monetary Policy and Economic Stabilization – Fiscal Policy and Economic Stabilization – Interdependence of Monetary and Fiscal Policies – Debt Management Policy.

**Unit – V:** Financial Sector Reforms in India – Need for Reforms – Major Reforms After 1991 – Issues and Impact of Financial Reforms.

#### **Suggestive Books:**

1. Hawtrey "The art of Central Banking " Augustus M.Kelley Publishers, 1970 – New York.
2. Narendra Kumar – Bank Nationalism of India – A Symposium – Lalvani Publishing House, 1969 – Mumbai.
3. Pai Panandikar & N C Mehra – Rural Banking – National Institute of Bank Management – Mumbai.
4. Vasant Desai – Indian Banking – Nature and Problems – Himalaya Publications House – Mumbai.
5. Benjamin H Bankhurt – Banking Systems – Times of India Press – Mumbai.
6. Charless L Prather – Money & Banking – Richard.D.Irwin Inc. – Illinois
7. Mongia J.N. – Banking Around the world – Allied Publishers Pvt Ltd., Mumbai.
8. Bhole, L.M – Financial Institutions and Markets, Tat McGraw – Hill Publishing Company Limited, New Delhi, 2004.
9. Khan, M.Y – Indian Financial System, Tat McGraw Hill Publishing Company Limited, New Delhi, 2004.



### **3S – B2: BANK FINANCIAL MANAGEMENT**

**Unit – I: CONCEPTUAL FRAMEWORK:** Overview of Financial System – Introduction to Financial Management in Banks – Financial Analysis of Banks.

**Unit – II: MANAGEMENT OF FUNDS: SOURCES:** - Management of Owned Funds – Management of Borrowed Funds – Cost of Funds.

**Unit – III: MANAGEMENT OF FUNDS: INVESTMENTS:** Forms of Bank Investment – Long-term Investment – Short-term Investments – Investments in Bonds and other Financial Securities – Investment in Foreign Exchanges.

**Unit – IV: RISK MANAGEMENT:** Risk Management: An Overview – Estimating/Forecasting of Risks – Measuring Risks – Management of Risks – Asset-Liability Management.

**Unit – V: SPECIAL ISSUES:** Mergers and Acquisitions – Accounting Policies – Pricing of Bank Products & Services.

#### ***Suggested Books: To be typed***

1. Edminister R.D, Financial Institution, Markets and Management.
2. Verma J.C. A manual of Merchant Banking.
3. Hawtrey "The art of Central Banking " Augustus M.Kelley Publishers, 1970 – Newyork.
4. Vasant Desai – Indian Banking – Nature and Problems – Himalaya Publications House – Mumbai.
5. Khan, M.Y – Indian Financial System, Tat McGraw Hill Publishing Company Limited, New Delhi, 2004.
6. Narendra Kumar – Bank Nationalism of India – A Symposium – Lalvani Publishing House, 1969 – Mumbai.
7. A.V. Rajwade, Foreign Exchange, International Finance and Risk Management, Academy of Business Studies, New Delhi.

## SEMESTER – III (ACCOUNTING & TAXATION)

### 3S – A1: CORPORATE ACCOUNTING

**Unit - I:** Corporate Financial Accounting: Objectives-Scope - Role of Corporate Accountant- Analysis and Interpretation of Financial Statements - Inflation Accounting.

**Unit - II:** Valuation of Shares: Need for Valuation of Shares – Factors Effecting Value of Shares – Methods of Valuation – Impact of Earnings on Share Valuation – Role of Fundamental Analysis and Technical Analysis in Share Valuation – Fair Value of a Share – Buy Back of Equity Shares.

**Unit - III:** Consolidated Financial Statements: Definition of Parent or Holding and its Subsidiary – Need for Consolidated Financial Statement – Preparation of Consolidated Balance Sheet of a Holding Company with one Subsidiary – Consolidation of Profit and Loss Account – Consolidated Statement of Changes in Financial Position.

**Unit - IV:** Accounting Standards: Objectives – Advantages and Disadvantages of Accounting Standards – Accounting Standards Board (ASB) – Compliance with Accounting Standards – International Accounting Standards and Linkage with Indian Accounting Standards – Accounting Standards Under US GAAP and Indian GAAP.

**Unit - V:** Financial Reporting: Concept, Objectives – Users Purpose of Financial Reporting and Specific Purpose of Report – Segment Reporting – Difficulties in Segment Reporting– Interim Reporting – Problems in Interim Reporting – Improving Financial Reporting – Value Added Statements – Disclosure of Value Added Statements – Economic Value Added – Human Resource Reporting - Environmental Reporting.

#### *Suggested Books:*

1. Advanced Accounting – Corporate Accounting Vol. 2 – Ashok Sehgal & Deepak Sehgal, Taxmann Allied Services Pvt Ltd, New Delhi.
2. Advanced Accounting – Volume – 2; R.L. Gupta & Radhaswami S. Chand & Co. Delhi.
3. Financial Accounting: A Managerial Perspective, R. Narayana Swamy, Prentice Hall of India.
4. Financial Accounting for Business Managers: Asish K. Bhattacharyya, Prentice Hall of India.
5. Human Resource Accounting – D. Prabhakara Rao.
6. Advanced Accounts – Chakravarthy – Oxford Publishers.
7. Modern Accountancy Vol.2 – A. Mukharjee and M. Hanieff – Tata McGraw hill publishing Company. New Delhi.
8. Financial Accounting – A Managerial Perspective – R. Narayana Swami – Prentice Hall of India, New Delhi.
9. Corporate Accounting – S.N. Maheswari & S.K. Maheswari, Vikas Publishing House, New Delhi.

### 3S – A2: INTERNATIONAL ACCOUNTING

**Unit – I:** International Dimensions of Accounting – Definition and Importance of International Accounting – Scope of International Accounting – Status of International Accounting in India.

**Unit – II:** Internationalisation of Accounting Profession – Harmonization of Accounting Practices – Comparative Analysis Between US GAAP, Indian GAAP and IAS – Models of Uniformity in Accounting.

**Unit – III:** Accounting for Currency Translation – Need – Foreign Exchange and Procedural Issues – Practices.

**Unit – IV:** Transfer Pricing – Definition – Evolution and Approaches to Transfer Pricing in International Business with Special Reference to Multinational Corporations – Indian Experience.

**Unit – V:** International Dimensions of Financial Reporting – Introduction – Transactional Reporting – Considerations Reporting Practices – Recent Changes – Indian Experience.

**Suggested Books:**

1. 'International Accounting' – Dr. Shirin Rathore, Prentice Hall of India Pvt. Ltd., New Delhi.
2. FDC Choi and G.G. Mueller, 'An introduction to multinational Accounting' (Prentice Hall, 1982).
3. 'International Accounting and financial reporting, Rueshoff (Norlin G)
4. 'International Accounting – A User perspective Shahorkh M. Suddagaran, TAXMAN INDIA. 2000.
5. "Advanced Financial Accounting". Richard E Baker, Valdean C. Lembke Thomases King, McGraw-Hill Higher Education, Irwin, 2005.
6. "Comparative International Accounting" Christopher Nobes & Robert Parker, Pearson Education, 2002, New Delhi.

### 3S – T1: DIRECT TAXES

**Unit – I:** Income Tax Act 1961: Basic Concepts, Income, Agriculture Income -Residential Status and Incidence of Tax - Incomes Exempt from Tax.

**Unit – II:** Income from Salaries: Chargeability, Deductions, Perquisites, Computation of Salary Income.

**Unit – III:** Income from House Property, Chargeability, and Computation of Income.

**Unit – IV:** Income from Business & Professions - Capital Gains and Income from Other Sources –Computation of Total Income.

**Unit – V:** Wealth Tax Act, 1957 – Chargeability – Incidence of Tax – Assets – Deemed Assets - Assets Exempt from Wealth Tax - Return of Wealth and Assessment – Rates of Tax - Computation of Net Wealth.

***Suggested Books:***

1. Dr. V.K. Singhania & Dr. Kapil Singhania, Direct Taxes Law and Practice, Taxman Publications Pvt. Ltd., New Delhi.
2. Bhagavati Prasad, Direct Taxes Law and Practice, Wishwa Prakashan, New Delhi.
3. Dinkar Pagare, Income Tax and Practice, Sultan Chand and Sons, New Delhi.

### 3S – T2: INDIRECT TAXES

**Unit – I:** Excise Duty - Introduction – Laws Relating to Excise Duty – Nature of Excise Duty – Basic Concepts – Taxable Event for Excise Duty – Types of Excise Duties – Exempted Goods.

**Unit – II:** Excisable Goods – Classification of Goods – Valuation of Goods.

**Unit – III:** CENVAT – Input Goods and Services for CENVAT – Capital Goods for CENVAT – Exempted Final Products / Output Services.

**Unit – IV:** Customs Duty - Introduction – Basic Concepts – Scope and Coverage of Customs Duty - Nature of Customs Duty – Classification for Customs – Types of Custom Duties. Exemptions from Customs Duty – Valuation for Customs Duty.

**Unit – V:** Customs Procedures: Import Procedures - Export Procedures - Baggage, Courier and Post – Warehousing in Customs – Duty Draw Back.

***Suggested Books:***

1. V.S. Datey, Indirect Taxes Law & Practice, Taxman Publications Pvt. Ltd., New Delhi.
2. V.K.Sareen and Ajay Sharma, Indirect Tax laws, Kalyani Publications, New Delhi.

## SEMESTER – IV (FINANCE & BANKING)

### 4S – F1: SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT

**Unit – I:** Concept of Investment, Investment Vs Speculation, and Security Investment Vs Non-security Forms of Investment. Investment Process; Sources of Investment Information. Security Markets – Primary and Secondary – Market Indices.

**Unit – II:** Return and Risk – Meaning and Measurement of Security Returns. Meaning and Types of Security Risks, Systematic Vs Non-systematic Risk. Measurement of Total Risk.

**Unit – III:** Fundamental Analysis – Economy, Industry and Company Analysis, Intrinsic Value Approach to Valuation of Bonds, Preference Shares and Equity Shares.

**Unit – IV:** Technical Analysis – Concept and Tools of Techniques Analysis – Technical Analysis Vs Fundamental Analysis. Efficient Market Hypothesis; Concept and Forms of Market Efficiency.

**Unit – V:** Elements of Portfolio Management, Portfolio Models – Markowitz Model, Sharpe Single Index Model and Capital Asset Pricing Model. Efficient Frontier and Selection of Optimal Portfolio. Performance Evaluation of Portfolios; Sharpe Model – Jensen's Model for PF Evaluation.

#### *Suggested Books:*

1. Donald E. Fischer, Ronald J. Jordan, Security Analysis and Portfolio Management, Prentice Hall of India.
2. Prasanna Chandra, Investment Analysis and Portfolio Management, Tata McGraw Hill.
3. S. Kevin, Security Analysis and Portfolio Management, Prentice Hall of India.
4. S. Kevin, Portfolio Management, Prentice Hall of India.
5. J.C. Francis, Investments – Analysis and Management, McGraw Hill Int.
6. Elton, EJ & Grober, MJ, Modern Portfolio Theory and Investment Analysis, John Wiley.
7. Avadhani, VA, SAPM, Himalaya Publishers.
8. Bhalla, VK Investment Management, S Chand.
9. Punitavathy Pandian, SAPM, Vikas.
10. Preeti Singh, Investment Management, Himalaya Publishers.

## 4S – F2 FINANCIAL DERIVATIVES

**Unit - I:** Introduction to Financial Derivatives – Meaning and Need – Growth of Financial Derivatives in India – Derivative Markets – Participants- Functions – Types of Derivatives – Forwards – Futures – Options-Swaps – The Regulatory Framework of Derivatives Trading in India.

**Unit - II:** Features of Futures –Differences Between Forwards and Futures – Financial Futures – Trading – Currency Futures – Interest Rate Futures – Pricing of Future Contracts- Value at Risk (VaR)-Hedging Strategies – Hedging with Stock Index Futures – Types of Members and Margining System in India – Futures Trading on BSE & NSE.

**Unit - III:** Options Market – Meaning & Need – Options Vs Futures -Types of Options Contracts – Call Options – Put Options- Trading Strategies Involving Options – Basic Option Positions – Margins – Options on Stock Indices – Option Markets in India on NSE and BSE.

**Unit - IV:** Option Pricing – Intrinsic Value and Time Value- Pricing at Expiration – Factors Affecting Options pricing- Put-Call Parity Pricing Relationship- Pricing Models - Introduction to Binominal Option Pricing Model – Black Scholes Option Pricing Model.

**Unit – V:** Swaps – Meaning – Overview – The Structure of Swaps – Interest Rate Swaps – Currency Swaps – Commodity Swaps – Swap Variant – Swap Dealer Role –Equity Swaps – Economic Functions of Swap Transactions - FRAs and Swaps.

### *Suggested Books:*

1. Hull C. John, "Options, Futures and Other Derivatives", Pearson Educations Publishers,
2. David Thomas. W & Dubofsky Miller. Jr., Derivatives valuation and Risk Management, Oxford University, Indian Edition.
3. ND Vohra & BR Baghi, Futures and Options, Tata McGraw-Hill Publishing Company Ltd.
4. Red Head: Financial Derivatives: An Introduction to Futures, Forward, Options" Prentice Hall of India.
5. David A. Dubofsky, Thomas W. Miller, Jr.: Derivatives: Valuation and Risk Management, Oxford University Press.
6. Sunil K.Pameswaran, "Futures Markets: Theory and Practice" Tata-McGraw-Hill Publishing Company Ltd.
7. D.C. Patwari, Financial Futures and Options, Jaico Publishing House.
8. T.V. Somanathan, Derivatives, Tata McGraw-Hill Publishing Company Ltd.
9. NSE Manual of Indian Futures & Options & www. Sebi.com
10. S.C. Gupta, Financial Derivatives: Theory, Concepts and Problems, Prentice Hall of India.

#### 4S – B1: FINANCIAL INSTITUTIONS

**Unit – I:** Origin – Concept – Definition – Structure – Role of Financial Institutions.

**Unit – II:** Non-Bank Financial Companies – Introduction – Concept – Definition – Scope and Meaning – Role.

**Unit – III:** NBFCs – Structure – Growth – Regulation of NBFCs.- An Overview of the Present Position of NBFCs.

**Unit – IV:** Non – Bank Statutory Financial Organisations – Concept – Structure – Nature, Functions and Role of NBFCs.

**Unit – V:** Financial Performance of Non-Banking Statutory Financial Organisations – Investment Pattern – Strengthening of NBFCs. – Reforms in NBFCs.

*Suggested Books:*

1. Bhole, L.M – Financial Institutions and Markets, Tat McGraw – Hill Publishing Company Limited, New Delhi, 2005.
2. Khan, M.Y – Indian Financial System, Tat McGraw Hill Publishing Company Limited, New Delhi, 2004.
3. Indian Banks Association, Indian Banking Year Book 2004, Mumbai, 2005.
4. RBI, Report on Trends and Progress of Banking in India, various issues, Mumbai.



#### 4S – B2: BANKING AND TECHNOLOGY

**Unit – I:** IT IN BANKING: AN INTRODUCTION: - Information Technology and Its Implications  
– Information Technology – Indian Banking Scenario – Initiatives and Trends.

**Unit – II:** IT APPLICATIONS IN BANKING: Computer-based Information System for Banking  
– Electronic Banking – Electronic Fund Management.

**Unit – III:** ENABLING TECHNOLOGIES OF MODERN BANKING: Electronic Commerce and Banking – Supply Chain Management – Customer Relationship Management – Integrated Communication Networks for Banks.

**Unit – IV:** SECURITY AND CONTROL SYSTEMS: Computer Security and Disaster Management – System Audit and Computer Crime – Security and Control Aspects of Emerging Banking Technologies.

**Unit – V:** PLANNING AND IMPLEMENTATION OF INFORMATION SYSTEM: Security and Control Aspects of Emerging Banking Technologies – Data Warehousing and Data Mining – Designing and Implementing Computerization in Banking Sector.

*Suggested Books:*

1. Hawtrey "The art of Central Banking " Augustus M.Kelley Publishers, 1970 – Newyork.
2. Vasant Desai – Indian Banking – Nature and Problems – Himalaya Publications House – Mumbai.
3. Khan, M.Y – Indian Financial System, Tat McGraw Hill Publishing Company Limited, New Delhi, 2004.
4. R.G. Murdick, J.E. Ross and J. R. clagget, Information systems for modern management, PHI.
5. Charlie Kaufman, Radia Perlman and Mike Speciner, Network Security – Private Communication in a Public World, Pearson / PHI.
6. Steve Hedley – Statutes on IT & E-Commerce, Oxford University Press.

**SEMESTER – IV**  
**( ACCOUNTING & TAXATION )**

**4S – A1: STRATEGIC COST MANAGEMENT**

**Unit – I:** Cost Management – Nature and Scope – Management of Value Chain – Tools of Cost Management. Product Costing Systems – Concepts and Design Issues.

**Unit – II:** Activity Based Costing System – Meaning and Scope – Limitations of Traditional Costing Allocation Methods – Application of ABC System – Activity – Based Management – Concept and Scope – Target Costing – Benchmark Costing.

**Unit – III:** Quality Cost Systems – Meaning and Application – Conflict Between Quality and Cost – Trade-off Between Quality and Price – Value Analysis – Life Cycle Costing – Learning Curve Analysis – JIT.

**Unit – IV:** Cost Estimation – Methods – Costing Engineering – Using Regression Analysis – Evaluating Performance – Variance Analysis – Kaizen Costing.

**Unit – V:** Cost Control and Cost Reduction – Managerial and Technical Aspects – Meeting the Cost Reduction Challenges Role of Cost Accountant.

*Suggested Books:*

1. 'Cost Management' – Strategies for Business Decisions HILTON, MAHER and SELT, Tata McGraw Hill, II ed. 2002.
2. 'Cost Accounting' – Principles and Practice, B.M.Lall Nigam, Prentice Hall of India.
3. Cost Accounting: Theory and Practice, Bhabatosh Banerjee, Prentice Hall of India.
4. 'Principles of Quality Costs' Principles, Implementation and Use Jack Companella, Prentice Hall of India Pvt. Ltd. 2000 (3rd Ed.)
5. 'Cost Accounting' – Jain and Narang.
6. 'Cost Accounting' – A Managerial Emphasis' Chrles Tn Horngren.
7. 'Cost Accounting' – B. Benerjee, World Press, Calcutta.

## 4S – A2: MANAGEMENT CONTROL SYSTEMS

UNIT-I: Management Control: Objectives- Basic Concepts- The Formula Control Systems, Characteristics of Management Control Systems; Inter Relationship Among Strategic Planning, Management Control and Operational Control – Designing and Introduction of Management Control System –Management Control System and Responsibility Accounting -Informal Management Controls.

UNIT-II: Structure of Management Control : Need for Delegation- Responsibility Centers – Expense Centers -Revenue Centers – Profit Centers- Investment Centers, Research and Development Centers- Administrative and Support Centers – Performance of Expense Centers – Revenue Centers – Profit Centers – Investment centers – Organizational Structure of Responsibility Centers – Transfer Pricing – Objectives – Methods – Pricing Corporate Services and Administration of Transfer Prices.

UNIT-III: Management Control Process: Strategic Planning – Nature, Analysis of New Programmes – Ongoing Programmes – Strategic Planning Process – Programming and Budgeting – Budget Preparation Process; Performance Evaluation – Performance Evaluation Systems Interactive Control – Analysing and Reporting – Types of Reports – Report Preparation – MIS –MIS & Computers.

UNIT-IV: Special Applications: Controls for Differentiated Strategies – Corporate Strategy – Strategic Business Unit Concept – Top Management Style – Management Control in Service Organizations; Professional Services – Financial Services – Healthcare Service Organizations – Management Control in Non-profit Organizations – Characteristics – Measuring Output – Pricing Management Structure – Control in NPOs.

UNIT-V: Management Control in Multinational and Multi project Corporations (MNCs): Objectives, Characteristics, Performance Measurement of Subsidiaries Reporting System – Need for MIS Between Parent and Subsidiary Companies – Structure of Multi Project Organization – Characteristics, Project Planning and Control Techniques, Control Indicators in Multi Project Organizations.

### Suggested Books:

1. Management control Systems – Robert Anthony and Vijay Govindarajan Tata – McGrawhill publishing Company, New Delhi.
2. Management Control Systems, N. Ghosh, Prentice Hall of India.
3. Management information and control systems – Dr. Sushila Madan. Taxmann Allied Services Pvt. Ltd., New Delhi.
4. Management Control systems Text and Cases – Subhash Sharma Tata-McGrawhill publishing Company, New Delhi.

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#### **4S – T1: VAT AND SERVICE TAX**

**Unit – I:** A.P. VAT Act, 2005 – Basic Concepts – Salient Features of VAT – Incidence of VAT – Exempted Goods.

**Unit – II:** Registration of Dealers – Determination of Taxable Value – Calculation of VAT Payable.

**Unit – III:** Procedure and Administration of the Act - Maintenance of Books of Accounts by Dealers – Assessment Procedure.

**Unit – IV:** Service Tax: Nature of Service Tax - Service Provider and Service Receiver, Individual Service, CENVAT Vs. Service Tax – Exemptions.

**Unit – V:** Procedures of Service Tax: Registration, Maintenance of Records, Payment of Service Tax, Taxable Services – Computation of Service Tax.

*Suggested Books:*

1. Kul Bhushan, How to deal with VAT, Pearson Education, Pvt. Ltd., New Delhi.
2. A.P. VAT Bill 2005, Govt. of A.P. Commercial Taxes Department.
3. V.S. Datey, Indirect Taxes Law and Practice, Taxman Publications Pvt. Ltd., New Delhi.

## 4S – T2: TAX PLANING AND MANAGEMENT

Unit – I: Introduction: Tax Planning and Management – Tax Avoidance, Tax Planning, Tax Evasion - Tax Evasion in India - Measures of the State for Tax Evasion.

Unit – II: Tax Planning for Salaried Persons.

Unit – III: Tax Planning for Firms and HUF.

Unit – IV: Tax Planning for Companies.

Unit – V: Tax Planning for Small Business.

### Suggested Books:

1. Dr. V.K. Singhania & Dr. Kapil Singhania, Direct Taxes Law and Practice, Taxman Publications Pvt. Ltd., New Delhi.
2. Bhagavati Prasad, Direct Taxes Law and Practice, Wishwa Prakashan, New Delhi.

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ANDHRA UNIVERSITY



Telegrams:  
UNIVERSITY  
Telephone: 284 4000  
Fax: 0891-755324

All Official letters, packages  
etc, should be addressed to  
the Registrar by designation  
and not by name.

No. L.II (7)/M.Com./Combi./2009.

Visakhapatnam  
Dt: 18.08.2009

From: The Dean, Academic Affairs,

- To
- The Special Officer,  
A.U. Campus Centre,  
Tadepalle Gudem,  
W.G. District. (AP.)
  - The Principals of A.U. Affiliated Colleges offering  
M.Com. Degree Courses.

Sir,

Sub: M. Com. Degree Course – Combinations as elective papers in III & IV Semesters – Regarding.

- Ref: 1. Minutes of the meeting of the Board of Studies in Commerce & Mgt. Studies held on 25-07-2009 in the Dept. of Commerce & Mgt. Studies, A.U., VSP.  
2. Clarification dated 06-08-2009 received from the Chairman, Board of Studies in Commerce & Mgt. Studies, A.U.

With reference to the above subject, I am by direction to inform you, that the students studying M.Com. III & IV Semesters of 2008-09 admitted batch have been permitted to select any two of the following combinations as elective papers.

**1. Combinations:**

- Accounting ✓
- Finance ✓
- Banking ✓
- Taxation ✓

**2. Electives:**

	Electives	III Semester	IV Semester
1.	Accounting	A-1 Corporate Accounting A-2 International Accounting	A-3 Strategic Cost Management A-4 Management Control systems
2.	Finance	F-1 Strategic Financial Management F-2 Financial Markets & Services	F-3 Security Analysis & Portfolio Management F-4 Financial Derivatives
3.	Banking	B-1 Advanced Banking ✓ B- Bank Financial Management	B-3 Financial Institutions B-4 Banking & Technology
4.	Taxation	T-1 Direct Taxes T-2 Indirect Taxes ✓	T-3 VAT & Service Tax ✓ T-4 Tax Planning and Management ✓

I request you, to kindly circulate the same among the teaching staff and students concerned.  
Yours faithfully,

*M. Sudhakar Rao*  
(M. SUDHAKARA RAO)  
Assistant Registrar (Academic)

Copy to:

- The Principal, A.U. College of Arts & Commerce, VSP.
- Prof. Balla Appa Rao, Chairman, Faculty of Commerce & Head of the Dept. of Commerce & Mgt. Studies, A.U., VSP.
- Prof. B. Rama Krishna Rao, Chairman, Board of Studies in Commerce & Mgt. Studies, A.U., VSP.
- The Dean of Academic Affairs, A.U., V.S.P.
- The Dean of Examinations, A.U., VSP.
- The Special Registrar and Controller of Examinations, A.U., VSP.
- B.V.P. & B.I. Sections for Information.

M.Com. Courses Structure-2008

ANNEXURE -- I

(Scheme of Instruction and Scheme of Examination)

**I - Semester:**

✓CP - 101	Management Theory and Practice ✓	100
CP - 102	Business Environment (India & International)	100
CP - 103	Advanced Management Accounting G, C	100
CP - 104	Business Economics	100
CP - 105	Business Communication	100
CP - 106	Softskills-I (Business and Spoken English) G, C	150

**II - Semester:**

CP - 201	Quantitative Techniques for Business Decisions	100
CP - 202	IT for Business I (Practicals: 25)	100
✓CP - 203	Financial Management ✓	100
CP - 204	Human Resource Management	100
CP - 205	Marketing Management	100
CP - 206	Softskills-II (Personality Development & GD)	150

**III - Semester:**

✓CP - 301	Insurance Products & Management	100
	Four Papers from Specialisation	400

**IV - Semester:**

CP - 401	Computer Applications in Accounting (Tally) (25 marks/Practicals)	100
	Four Papers from Specialisation	400

Project

100

Viva

100

**SPECIALISATIONS**

**Finance & Banking**

- ✓3S- F1: Strategic Financial Management ✓
- 3S- F2: Financial Markets and Services
- ✓3S- B1 Advanced Banking
- ✓3S- B2: Bank Financial Management
- ~~4S- F1: Security Analysis and Portfolio Management~~
- ✓4S- F2: Financial Derivatives
- ✓4S- B1 Financial Institutions
- ✓4S- B2 Banking and Technology

**Accounting & Taxation**

- 3S- A1 Corporate Accounting
- 3S- A2 International Accounting
- 3S- T1 Direct Taxes
- 3S- T2 Indirect Taxes ✓
- ~~4S- A1 Strategic Cost Management~~
- 4S- A2 Management Control Systems
- 4S- T1 VAT and Service Tax
- 4S- T2 Tax Planning and Management

**M.COM. (2008) - SEMESTER I**

**CP – 101: MANAGEMENT THEORY AND PRACTICE**

**Objectives:**

To familiarise the students with basic management concepts and the process of organisation.

**Unit – I:**

Introduction: Concept of Management: Definition, Nature, Purpose, Scope and Significance – Evolution of Management Thought – Approaches to Management – Process of Management – External Environment Functions of Management.

**Unit – II**

Planning: Types of Plans – Objectives, Management by Objectives, Planning Premises Decision Making: Decision Making Process – Decision Tree Analysis – Linear Programming, Game Theory.

**Unit – III**

Organisation: Principles of Organization: Formal and Informal Organisation – Span of Control – Delegation of Authority – Centralisation and Decentralization – Line and Staff Conflict and Cooperation. Staffing Process The nature and Purpose of Staffing – Executive Development Programme (EDPs).

**Unit – IV**

Directing: Elements of Directing Communication – Importance, Process, Media, Barriers to Communication. Effective Communication. Motivation – Leadership – Concept, Styles, Theories – Managerial Grid: Likerts Four Systems of Leadership.

**Unit – V**

Process of Control, Techniques of control, PERT and CPM.

*Suggested Books:*

1. James A. F. Stoner, R. Edward Freeman and Daniel R. Gilbirth Jr. – Management, Prentice Hall of India.
2. Heinz Wehrich and Harold Koontz, Essentials of Management – Tata McGraw Hill International.
3. Stephen Robbins and Mary Coulter, Management, Prentice Hall of India.
4. Bajaj: Management Processing and Organization, Excel Publications.
5. Tripathy and Reddy – Principles of Management – Tata McGraw Hill.
6. John F. Wilson – The Making of Modern Management, Oxford University Press.
7. Heiny Wehrich and Harold Koontz – Management, A Global Perspective – McGraw Hill International.
8. R.K. Suri, Organizational Behaviour, Wisdom Publication.
9. A. Pardhasaradhy & R. Satya Raju: Management Text and Cases, Prentice Hall of India



## CP – 102: INDIAN BUSINESS ENVIRONMENT

### Objective:

To familiarize the students with the business environment prevailing in India and international and understand its implications to business.

### Unit-I

Business Environment: Components and Significance – Economic Scope – Cultural, Political, Technological and External Factors Influencing Business Environment – Dimensions of International Business Environment – Challenges.

### Unit-II

Structure of Indian Economy; Economic systems- Economic planning with special reference to last three plans, public, private joint and cooperative sectors - Industrial Policy of the Government - Policy Resolutions of 1956, 1991 Industrial Policy and Economic Policy - Subsequent policy Statements.

### Unit-III

Indian Companies -Competitiveness, Changes and Challenges, Sustainable Development, Social Responsibilities, Ethics in Business- Competition Act 2002 - Emerging Trend in Indian Business Environment.

### Unit – IV:

International Trade Theories, Balance of Payments – Concepts, Disequilibrium in BOP Structural, Cyclical and Monetary Disequilibrium, Methods of Correction, Trade Barriers and Trade Strategy - Free Trade vs. Protection-World Financial Environment – Foreign Exchange Market Mechanism, Exchange Rate Determination, Euro Currency.

### Unit – V

Globalisation: International Economic Integration, Country Evaluation and Selection, Foreign Market Entry Methods, International Trade Stocks – Their Objectives; WTO Origin, Objectives, Organisation Structure and Functioning – WTO and India.

### Suggested Books:

1. K.V.Sivayya and VBM Das: Indian Industrial Economy, Sultan Chand Publishers, Delhi.
2. Suresh Bedi: Business Environment, Excel, New Delhi.
3. Francis Cherunilam: Business Environment - Text & Cases.
4. M.Adhikari, Economic Environment of Business.
5. Pandey G.N.. Environmental Management, Vikas Publishing House.
6. Raj Agarwal: Business Environment, Excel Publications.
7. Govt. of India, Latest Economic Survey.
8. Chari, S. N: International Business, Wiley India
9. Francis Cherunilam: International Business: Text and Cases, Prentice Hall of India.
10. E. Bhattacharya: International Business, Excel Publications.
11. Sundaram & Black: International Business Environment Text and Cases, PHI.
12. Sajahan: International Business, Mac-Milan India. New Delhi.

## CP – 103: ADVANCED MANAGEMENT ACCOUNTING ✓

### Objective:

To develop an insight of postulates, principles and techniques of accounting and utilisation of financial and accounting information for planning, decision-making and control.

### Unit – I

Management Accounting – Nature and Scope – Management Accounting Vs Financial Accounting and Cost Accounting – Role of Management Accountant in a Modern Organisation.

### Unit – II

Cost Concepts for Decision Making - Cost – Volume – Profit Analysis – Behaviour of Variable Cost – Behaviour of Fixed Cost – Relationships Among Cost and Profits at Various Levels of Activity – Break-Even

Point – Margin of Safety – Contribution Approach for Decision Making – Analysis of Contribution Per Unit of Critical Factor.

### Unit – III

Cost Analysis for Pricing Decisions – Evaluating the cost Effects of Price – Quantity Relationships Price Elasticity of Demand and Optimal Pricing Decisions – Cost Analysis for Pricing During Recession Conditions – Flexible Cost Data for Pricing Decisions – Special Order Pricing – Impact of Special Order Pricing on Regular Sales and Overall Profits – Partial Fulfilment of Special Order Vs Outsourcing Decisions – Make or Buy Decisions.

### Unit – IV

Cost Analysis for Product Decisions – Breakeven Analysis of Multi-Product Firms – Differential Costs for Product – Mix Alterations Decisions – Product Additions Decision – Adding New Products Combining Pricing Decisions with Product Addition Decision and Selecting Profitable Product-Price Strategies – Produce Deletion – Sell or Process Further Decision of Joint and By-Products.

### Unit – V

Budgeting – Types of Budgets – Financial Budgets – Operating Budgets – Cash Budget – Production Budget – Flexible Budget – Concepts of Performance Budgeting and Zero Based Budgeting.

### Suggested Books:

1. I.M. Pandey: Management Accounting, Vikas Publishing House.
2. N.M. Singhvi, Management Accounting: Text and Cases, Prentice Hall of India.
3. T.P. Ghosh: Fundamentals of Management Accounting, Excel Publications.
4. Ravi M. Kishore, Management Accounting, Taxman Publications.
5. Chakraborty, Hrishikesh – Management Accountancy, Oxford University Press.
6. Horngren, C.T., Introduction to Management Accounting, Prentice Hall of India.
7. Khan and Jain, Management Accounting, Tata McGraw Hill, Delhi.
8. J.C. Varshney: Financial and Management Accounting, Wisdom Publication.
9. Horngren Sundem Stratton, Management Accounting, Prentice Hall of India.
10. Paresh P. Shah, Management Accounting, Wiley India, New Delhi.

## CP- 104: BUSINESS ECONOMICS

### Objective:

To enable the students to understand economic concepts and theories and their application in management decision making.

### Unit - I:

Introduction: Nature and Scope of Business Economics; Objectives of the Firm – Traditional Theory, Sales and Revenue Maximizing Theories, Managerial Theories and Behavioral Theories; Profit Maximization Vs. Wealth Maximization; Demand Forecasting – Methods of forecasting demand for Existing and New Products, Criteria for Good Forecasting Method.

### Unit - II:

Production Analysis and Cost Analysis: Production Function – Law of Variable Proportions, Isoquant and Isocost Curves, Least Cost Combination, and Returns to Scale; Economies of Large Scale; Cobb-Douglas Production Function and C.E.S. Production Function; Cost-Output Relationships – Short and Long Run; Cost Oriented Pricing Methods – Full Cost Pricing, Marginal Cost and Differential Cost Pricing.

### Unit - III:

Market Analysis: Price and Output Determination Under Perfect Competition, Monopoly, Monopolistic Competition, Oligopoly and Duopoly.

### Unit - IV:

Profit Analysis: Meaning of Profit, Limiting Factors of Profit, Criteria for Standard Profit: Theories of Profit; Business Forecasting – Nature and Scope of Forecasting and Different Methods of Business Forecasting and their Advantages and Disadvantages.

### Unit - V:

Macro Economic Concepts: National Income, Trade Cycles, Inflation, Monetary and Fiscal Policies.

### Suggested Books:

1. Mukherjee Sampat: Business and Managerial Economics (In the Global Context), Third Edition, New Central Book Agency (P) Ltd., Kolkatta, 1996.
2. Dwivedi, D.N.: Managerial Economics, Vikas Publishing House Pvt. Ltd., 2003.
3. Dhingra, I.C., Essentials of Managerial Economics; Theory, Applications and Cases, Sultan Chand, New Delhi, 2003.
4. Mithani, D.M.: Managerial Economics; Theory and Applications, Himalaya Publishing House, 2003.
5. Mehta, P.L.: Managerial Economics, Text and Cases, S.Chand & Co., Delhi.
6. Varshney, R.L. and Maheswari, K.L.: Managerial Economics, S.Chand & Co, Delhi.
7. Dwivedi, D.N.: Macroeconomics; Theory and Policy, Tata McGraw Hill Publishing Company, 2002.
8. Gupta, G.S.: Macroeconomics; Theory and Applications, Tata McGraw Hill Publishing Company Ltd.
9. Yogesh Maheswari, Managerial Economics, 2<sup>nd</sup> Edition, Prentice Hall of India.

## CP – 105: BUSINESS COMMUNICATIONS ✓

### Objective:

To equip the students with the necessary techniques and skills of communication to inform others, inspire them enlist their activity and willing cooperation in the performance of their jobs.

### Unit – I

Importance of Communication in Business Organisations – Communication Objectives – Media of Communication: Written, Oral, Visual – Audio Visual Communication.

### Unit – II

Interpersonal Communication – Interpersonal Communication – Communication Models: Exchange Theory – Johari Window – Transactional Analysis, Communication Styles.

### Unit – III

Communication Barriers – Communication Gateways – Developing Listening Skills – Influence of Culture on Communication.

### Unit – IV

Report Writing – Formal Reports – Informal Reports – Writing Good News and Bad News.

### Unit – V

Meetings and Oral Presentations – Communication Through Visuals – Use of Electronic Media in Business Communication.

### Suggested Books:

1. Jerry C. Wofford, Edwin A. Gerloff and Robert C. Cummins, Organisational Communication – The Key stone of Managerial Effectiveness.
2. McGrath, Basic Managerial Skills for All, 5<sup>th</sup> ed., Prentice Hall of India.
3. Urmila Rai & S.M. Rai, Business Communication, Himalaya Publishers, Mumbai.
4. Meenakshi Raman – Business Communication, Oxford University Press.
5. Bovee, Thill and Schatzman: Business Communication Today, Pearson Education.
6. Biswajit Das: Business Communication personality Development, Excel Publications.
7. Parag Diwan: Business Communication, Excel Publications.
8. Lesikar I Flatley, Basic Business Communication, Tata McGraw Hill.
9. Dalmar Fisher, Communication in Organizations, A Jaico Book.
10. Scot Ober, Contemporary Business Communication, Wiley India, New Delhi.

**CP – 106: SOFTSKILLS – I**  
**(Business and Spoken English)**

**Objective:**

To train students in English language to improve their oral and written business communication

**Unit-I:**

Business Correspondence: Meaning, Scope and Significance - Formal, informal and semiformal introductions – Describing company activities and structures – Describing job responsibilities – Understanding and writing letters - Differences between formal and informal writing – Use of formal vocabulary and functional language in business letter writing – Planning effective initial business letters and responses – email writing skills, call taking etiquette/skills/

**Unit-II**

Business Information: Completing forms with required details: Asking appropriate questions to gather information – Polite phrases of confirmation and communication breakdown- understanding native speaking accents and dialects; Functional language used in making verbal agreements – Effective techniques of making and accepting offers – Efficient written offer making and accepting.

**Unit-III**

Business Presentations: Basic presentation techniques – Use of information in presenting product features – Explaining technical features for simplification; Giving and interpreting numerical data, common useful business abbreviations and acronyms - Oral and written conventions for expressing numerical information in English – Pronunciation issues in expressing numbers and the alphabet.

**Unit-IV**

Business Reporting: Use of grammar in giving instructions– Effective presentation of oral instructions – effective presentation of written instructions, Presenting and describing company information: Vocabulary of describing graphical and numerical information – Expressing cause and result in English – Summarizing important information concisely.

**Unit-V**

Feedback and Evaluation: Giving feedback to others - Use of questions in self-assessment elicitation – Functional language of agreement/disagreement and opinion giving – Use of tone and intonation in good/bad feedback – Motivating others – Use of emphatic structures in English – Use of conditionals to discuss future possibilities – Discourse strategies for effective relationship – team building skills.

**Suggested Books:**

1. K. Srinivasa Krishna & B. Kuberudu: Business Communication and soft skills, excel, Hyderabad, 2008.
2. Seghal, M.K. Business Communication, Excel Books, New Delhi.
3. Mary Ellen Guffey, Business English.
4. Marie M. Stewart, Business & Communication
5. G.L. Handesson, P.R. Voiles, Business English & Communication.
6. Robert E. Barry, Pat Taylor Ellison, Business English for 21st Century.

## SEMESTER - II

### CP – 201: QUANTITATIVE TECHNIQUES FOR BUSINESS DECISIONS

#### Objective:

To make the students familiar with the statistical and mathematical techniques and their applications in business decision making.

#### Unit – I

Functions, Linear, Quadratic, Logarithmic and Exponential Functions – Permutations and Combinations – Matrices – Solving System of Equations with Matrix Methods – Differentiation and Integration of Simple Functions and their Applications.

#### Unit – II

Measures of Central Tendency – Measures of Dispersion – Simple Correlation and Regression Analysis – Concept and Applications of Multiple Regressions.

#### Unit – III

Concept of Probability – Probability Rules – Joint and Marginal Probability – Baye's Theorem – Probability Distributions – Binomial, Poisson, Normal and Exponential Probability Distributions.

#### Unit – IV

Sampling and Sampling Distributions – Estimation – Point and Interval Estimates of Averages and Proportions of Small and Large Samples – Concepts of Testing Hypothesis – One Sample Test for Testing Mean and Proportion of Large and Small Samples.

#### Unit – V

Tests of Two Samples – Tests of Difference Between Mean and Proportions of Small and Large Samples – Chi-square Test of Independence and Goodness of Fitness – Analysis of Variance.

#### Suggested Books:

1. K.V. Sivayya and K. Satya Rao, Business Mathematics.
2. R. Selvaraj, Quantitative Techniques, Excel Books, New Delhi.
3. Misra: Quantitative Techniques for Management, Excel Publications.
4. Barry Render, Ralph M. Stair Jr. & Michael E. Hanna, Quantitative Analysis for Management, 8<sup>th</sup> ed., Prentice Hall of India.
5. Levin, Krehbiel and Berenson, Business Statistics: A first course, Pearson Education Asia.
6. Nagar, Das – Basic Statistics, Oxford University Press.
7. Shenoy, Sarma and Srivatsava, Quantitative Techniques for Management, New Age (International) Pvt. Ltd.
8. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill, 2001.
9. C.R. Kothari, Quantitative Techniques, Vikas Publishers.
10. Anand Sharma, Quantitative Techniques for Decision Making, Himalaya Publishers, Mumbai.
11. Zameerudding, Khanna and Bhambri, Business Mathematics, Vikas Publishing House.

## CP – 202: IT FOR BUSINESS

### Objective:

To equip students with the basic information technologies available for improving managerial performance.

### Unit-I

Introduction to Computer Concepts – Elements of computer – Characteristics of a Computer – Classification of Computers – Basic Computer Architecture – Input-output Devices

### Unit-II

Software Concepts: Types of software – Software: its nature and qualities — Windows Operating System Functions.

### Unit-III

MS Office- Applications of MS Word in Business Correspondence: letters, tables, mail merge, labels.

Applications of MS Excel: Graphs and Charts – Calculation of various financial functions - Ms Access: Tables and Queries.

### Unit-IV

MS Power Point: Introduction – Toolbar, their Icons and Commands – Navigating in Power point - Creation of slides, animation, and templates - Designing Presentations – Slide show controls – Making notes on Pages and Handouts – Printing Presentations – Customizing Presentations - Auto content Wizard.

### Unit-V

E-COMMERCE – BUSINESS MODELS: Business To Business (B2B); Business To Consumer (B2C); E-payments – E-cash or Digital Cash, E-cheques, Credit Cards, Smart Cards, E-wallets and Debit Cards- Internet and Web Technologies

1. C.S.V. Murthy, E-commerce; Concepts, Models, Strategies, Himalaya Publishing House, 2004.
2. P.T. Joseph, S.J., E-Commerce: An Indian Perspectives; 2<sup>nd</sup> Edition, Prentice Hall of India, New Delhi.
3. Deepak Bharihoke, Fundamentals of IT, Excel Books, New Delhi.
4. Dhiraj Sharma, Foundation of IT, Excel Books New Delhi.

## CP 203: FINANCIAL MANAGEMENT

### Objective:

To develop an understanding of the Finance functions and relevant techniques of financial administration.

### Unit – I:

Introduction: Nature, Scope and Objectives of Financial Management: Finance Function – Profit Goal vs. Wealth Goal Maximization; Techniques of Financial Analysis: Funds Flow Analysis and Ratio Analysis Role of Financial Manager in Modern Environment.

### Unit – II:

INVESTMENT DECISION: Techniques of Appraisal; Process of Capital Budgeting – Risk Vs. Return Traditional and Modern Techniques. (including problems).

### Unit – III:

FINANCING DECISIONS: Capital Structure – Determinants; Leverages – Financial, Operating and Combined: Cost of Capital. (including problems)

### Unit – IV:

DIVIDEND AND RETAINED EARNINGS: Dividend Policy Decisions; Parameters, Dividend Models; Policies Regarding Retained Earnings.

### Unit – V:

WORKING CAPITAL MANAGEMENT: Concept, Need and Determinants of Working Capital - Working Capital Cycle – Working Capital Policy.

### Suggested Books:

1. Brearley, Richard and Myers, Steward: Principles of Corporate Finance, New York, McGraw Hill.
2. Solomon, Ezra, Theory of Financial Management, Columbia Press.
3. James C. Van Horne, Financial Management and Policy, Prentice Hall of India.
4. Weston J. Fred and Brigham, Eugene F., Managerial Finance, Dryden Press.
5. Prasanna Chandra, Financial Management, Tata McGraw Hill.
6. Khan, M.Y. and Jain, Financial Management, Tata McGraw Hill.
7. Pandey, I.M., Financial Management, Delhi, Vikas Publishing House.
8. Ravi M. Kishore: Financial Management, Taxmann.
9. Sudhirbhat, Financial Management, Excel Books.



## CP – 204: HUMAN RESOURCE MANAGEMENT

### Objective:

To enable the students to familiarize with the main aspects of Human Resource Management at the organization level and apply the same in management of Human Resources.

### Unit – I:

Human Resources Management: Concept, Significance and Evolution; Functions of HR Manager, Place of HR Department in Organization.

### Unit – II:

Human Resource Planning: Significance – Methods and Techniques - Job Analysis – Recruitment and Selection Processes - Induction – Placement – Promotion and Transfers.

### Unit – III:

Training and Development: Significance – Identification of Training Needs – Employee Training Methods – Executive Development Methods – Evaluation of Training and Development Programmes.

### Unit – IV:

Wage and Salary Administration: Wage Concepts; Job Evaluation – Methods & Techniques Wage Structure & Policy – Wage Differentials – Wage Payment Methods – Incentives – Fringe Benefits – Performance Appraisal: Scope & Significance – Methods of Appraisal - Limitations of Appraisal.

### Unit – V:

Industrial Relations: Significance, Causes of Disputes and Settlement - Role of State in Industrial Relations - Collective Bargaining - Employee Participation in Management.

### Suggested Books:

1. Venkat Ratnam: C.S., and Srivastava B.K., Personnel / Human Resource Management, Tata McGraw Hill.
2. Cynthia D. Fisher & Lyle F. Schoenfeldt, Human Resource Management, Wiley India, New Delhi.
3. N.K. Singh: Human Resources Management, Excel Publications.
4. Jyothi – Human Resource Management, Oxford University Press.
5. Gary Dessler, Human Resource Management.
6. Edwin B Flippo, Personnel Management.
7. Decenzo / Robbins, Personnel / Human Resource Management, 3<sup>rd</sup> Ed, John Wiley & Sons Pvt. Ltd.
8. P. Subba Rao, Human Resource Management, Himalaya Publishers, Mumbai.
9. Deepak Kumar, B. Human Resource Management, Excel Books.
10. Ghosh, HRD and Management, Vikas.
11. Ian Badwel, Len Holden: Human Resource Management – A Contemporary Perspective, Macmillan India Ltd.

## CP – 205: MARKETING MANAGEMENT ✓

### Objective:

To develop an understanding of the concepts, strategies and issues involved in marketing and its Management.

### Unit – I:

Importance of Marketing – Concepts – Approaches to the Study of Marketing – Marketing Environment. ✓

### Unit – II:

Consumer Behaviour – Market Segmentation – Market Targeting and Positioning – Marketing Information System and Research. ✓

### Unit – III:

Marketing Mix: Product Planning – New Product Development – Product Life Cycle – Branding Packaging – Product Mix Management. ✓

### Unit – IV: ✓

Pricing: Objectives – Methods and Strategies – Distribution – Channel Selection and Management Retail Management. ✓

### Unit – V: ✓

Promotion: Integrated Marketing Communications: Personal Selling – Advertising – Sales Promotion, Publicity and Public Relations – Direct Marketing: Evaluation of Communication Effort.

### Suggested Books: ✓

1. Philip Kotler and Kevin Lane Keller: Marketing Management, Prentice Hall of India / Pearson Education, New Delhi.
2. William J Stanton & Futrell: Fundamentals of Marketing.
3. V. J. Ramaswami and S. Namakumari: Marketing Management, Macmillan Business Books, Delhi.
4. S. Jayachandran: Marketing Management, Text and Cases, Excel Publications.
5. Tapan K. Panda, marketing management, Excel.
6. Zinkota & Kotabe: Marketing Management, Prentice Hall of India.
7. Joel R. Evans & Barry Berman: Marketing, Wiley India, New Delhi.
8. Mukesh Dhunna: Marketing Management, Wisdom Publication.
9. Rajiv Lal, John A. Quelch & V. Kasturi Rangan, Marketing Management, Tata McGraw Hill.

**CP – 206: SOFTSKILLS – II**  
**( Personality Development & GD )**

**Objective:**

to equip students with the most needed personality characteristics of modern professional managers with an emphasis on positive thinking, creativity, goal-setting, time management, self-discipline and interview skills.

**Unit - I:**

CAREER PLANNING: Meaning And Importance – The Process Of Career Planning – Different Dimensions – Factors To Be Considered For Career Planning - Goal Setting - Positive Thinking

**Unit - II :**

PERSONALITY DEVELOPMENT: Intra-personal Skills - Inter-personal Skills - Communication Skills – Spoken, Written, Non-Verbal (Body Language), Listening skills - Time Management – Leadership – Creativity - Problem Solving - Strategic Planning.

**Unit - III:**

INTERVIEW PREPARATION: Art of Facing Interview - Resume Preparation- Preparation for Campus Interviews - Pre-requisites for Campus Interviews - Stress and Anxiety Management - Dress Code & Appearance.

**Unit - IV**

INTERVIEW PROCESS: Written Test - Group Discussion - Role-Play- Response to Oral Questions - Employer's Criteria.

**Unit - V:**

NEGOTIATION WITH PROSPECTIVE EMPLOYER: Terms and Conditions - Compensation Package - Place of Posting - Career, Succession - Multi-Skill Development.

**Suggested Books:**

1. Biswajit Das, Business Communication and Personality Development, Excel Books.
2. Subrahmanyam, et.al., Personality Development, Excel Books, New Delhi.

### SEMESTER - III

(One Core Paper and Four Papers from Specialisation)

#### CP 301 : Insurance Products & Management

##### Unit – I:

Life Insurance Concept – Basic Principles of Life Insurance Utmost Good Faith- Insurance Interest – types of Life Insurance – Variations of Whole Life Insurance – Other types of Life Insurance.

##### Unit – II:

Life Insurance Contractual Provisions – Dividend Options – Non Forfeiture Options – Settlement Options – Additional Life Insurance Benefits – Insurance Pricing – Objectives of Rate Making – Rate Making in Life Insurance.

##### Unit – III:

Health and Disability – Income – Insurance – Types of Individual Health Insurance Coverage's – Individual Medical Expense Contractual – Group Insurance Group Life Insurance Plans – Group Medical Expense Insurance.

##### Unit – IV:

Employee Benefits – Retirement Plans – Fundamentals of Private Retirement Plans – Types of Qualified Retirement Plans – Profit Sharing Plans – Self Retirement Plans for Employed – Single Retirement Plans – Simplified Retirement Pension.

##### Unit – V:

Re-Insurance Reasons For Reinsurance- Types of Reinsurance – Alternatives to Traditional Reinsurance Functions of Reinsurance – Advantage and Disadvantage of Reinsurance.

##### *Suggested Books:*

1. George E. Rejoa, Principles of risk management and insurance, Pearson Education, New Delhi, 2004.
2. Black Jr. Skipper Jr. Health Insurance, Pearson Delhi, 2003.
3. M.N. Mishra, Insurance Principles and Practice, S. Chand, New Delhi, 2003.
4. M.J. Mathew, Insurance Principles and Practice, RBSA publishers, Jaipur 2005.

## SEMESTER – IV

(One Core Paper and Four Papers from Specialisation)

### CP 401: COMPUTER APPLICATIONS IN ACCOUNTING (TALLY)

**Unit – I:** Introduction to Computerised Accounting: Significance of Computerized Accounting – Advantages – Disadvantages – Computerised General Ledger System – Spreadsheet Software and Its Applications – Different Software Available in the Market Advantages – Disadvantages.

**Unit – II:** Accounting Software Tally (Ver. 7.2): Characteristics of the Software – Creation of a Company – Security Control – Configuration – Accounts Information – Creation of Ledgers – Vouchers – Types of Vouchers – Cost Center Budgets – Balance Sheet – Alteration of Vouchers – Audit – Trial – P & L a/c – Ratio Analysis – Security – Limitations of Tally – Short Cut Keys. (Lab – with practicals)

**Unit – III:** Tally's Forte (Reports): Displaying Reports – Characteristics – Objectives – Printing Reports – Display Account Books – Display Statement of Bank Reconciliation of Bank Accounts – Display Inventory Reports – Expert Usage. (Lab – with practicals)

**Unit – IV:** Inventory Handling Using Tally Ver 7.2 – A Practical Approach: Creation of Stock Groups – Creation of Stock Categories – Creation of Stock Items – Creation of Godown – Creation of Units of Measure – Inventory Vouchers. (Lab – with practicals)

**Unit – V:** Accounts of Banking Companies and Departmental Accounting: Objectives – Characteristics – Advantages – Disadvantages – Preparation of Accounts Using Tally in Departmental Accounts – Usefulness in Banks – Ledger Preparation – Guidelines of RBI for Profit & Loss Account – Expert Usage. (Lab – with practicals)

#### **Suggested Books:**

1. Computers and Common Sense, Robert Hunt & John Shelly, Prentice Hall of India, New Delhi.
2. Computers and Information Management, S.C. Bhatnagar, K.V. Ramani, Prentice Hall of India, New Delhi.
3. Management Information Systems and Data Processing, Bently, Holt, Rinehart and Winston.
4. Principles of Data Base Management, Martin, Prentice Hall of India, New Delhi.
5. Introduction of Systems Software, Dhandhere, Tata-Mc Grawhill Publications, New Delhi.
6. Accounting Systems, M. Sulochana, K. Kameswara Rao & R. Kishore Kumar, Kalyani Publishers, Hyderabad.

**SPECIALISATIONS**  
**FINANCE & BANKING**

- 3S-F1: Strategic Financial Management ✓ P
- 3S-F2: Financial Markets and Services ✓ P
- 3S-B1: Advanced Banking
- 3S-B2: Bank Financial Management
- 4S-F1: Security Analysis and Portfolio Management ✓ P
- 4S-F2: Financial Derivatives ✓ P
- 4S-B1: Financial Institutions
- 4S-B2: Banking and Technology

Finance:

SFM

FMBS

SACPM

FD

**ACCOUNTING & TAXATION**

- 3S-A1: Corporate Accounting ✓
- 3S-A2: International Accounting ✓
- 3S-T1: Direct Taxes
- 3S-T2: Indirect Taxes
- 4S-A1: Strategic Cost Management ✓
- 4S-A2: Management Control Systems ✓
- 4S-T1: VAT and Service Tax
- 4S-T2: Tax Planning and Management.

## SEMESTER – III ( FINANCE & BANKING )

### 3S – F1: STRATEGIC FINANCIAL MANAGEMENT

**Unit – I:** Financial Goals and Strategy – Shareholder Value Creation (SCV): Market Value Added (MVA) – Market-to-Book Value (M/BV) – Economic Value Added (EVA) – Managerial Implications of Shareholder Value Creation.

**Unit – II:** Financial Strategy for Capital Structure: Leverage Effect and Shareholders' Risk – Capital Structure Planning and Policy – Financial Options and Value of the Firm – Dividend Policy and Value of the Firm.

**Unit – III:** Investment Strategy – Techniques of Investment Appraisal Under Risk and Uncertainty – Risk Adjusted Net Present Value – Risk Adjusted Internal Rate of Return – Capital Rationing – Decision Tree Approach for Investment Decisions – Evaluation of Lease Vs Borrowing Decision.

**Unit – IV:** Merger Strategy – Theories of Mergers – Horizontal and Conglomerate Mergers – Merger Procedure – Valuation of Firm – Financial Impact of Merger – Merge and Dilution Effect on Earnings Per Share – Merger and Dilution Effect on Business Control.

**Unit –V:** Takeover Strategy – Types of Takeovers – Negotiated and Hostile Bids – Takeover Procedure – Takeover Defences – Takeover Regulations of SEBI – Distress Restructuring Strategy – Sell offs – Spin Offs – Leveraged Buyouts.

#### **Suggested Books:**

1. Coopers & Lybrand, Strategic Financial: Risk Management, Universities Press (India) Ltd.
2. Robichek, A, and Myers, S., Optimal Financing Decisions, Prentice Hall Inc.
3. James T. Gleason, Risk: The New Management Imperative in Finance, A Jaico Book.
4. Van Horn, JC. Financial Management and Policy, Prentice Hall.
5. Prasanna Chandra, Financial Management Theory and Practice, Tata McGraw Hill.
6. Weston JF, Chung KS & Hoag SE., Mergers, Restructuring & Corporate Control, Prentice Hall.
7. Pandey IM, Financial Management, Vikas.
8. Shiva Ramu, S., Corporate Growth through Mergers & Acquisitions, Response Books (A Division of Sage Publications).
9. Khandawalla, PN, Innovative Corporate Turnarounds, Sage Publications.

### 3S – F2: FINANCIAL MARKETS AND SERVICES

**Unit - I:** Structure of Financial System – Role of Financial System in Economic Development- Financial Markets and Financial Instruments- Capital Markets – Money Markets –Primary Market Operations- Role of SEBI – Secondary Market Operations - Regulation – Functions of Stock Exchanges – Listing Formalities -Financial Services Sector Problems and Reforms.

**Unit - II:** Financial Services: Concept, Nature and Scope of Financial Services – Regulatory Frame Work of Financial Services – Growth of Financial Services in India - Merchant Banking – Meaning –Types – Responsibilities of Merchant Bankers – Role of Merchant Bankers in Issue Management – Regulation of Merchant Banking in India.

**Unit - III:** Venture Capital – Growth of Venture Capital in India – Financing Pattern Under Venture Capital – Legal Aspects and Guidelines for Venture Capital. Leasing – Types of Leases – Evaluation of Leasing Option. Vs. Borrowing.

**Unit - IV:** Credit Rating – Meaning, Functions - Debt Rating System of CRISIL, ICRA and CARE. Factoring, Forfeiting and Bill Discounting –Types of Factoring Arrangements- Factoring in the Indian Context.

**Unit - V:** Mutual Funds – Concept and Objectives, Functions and Portfolio Classification, Organization and Management, Guidelines for Mutual Funds, Working of Public and Private Mutual Funds in India. Debt Securitisation - Concept and Application - De-mat Services-need and Operations-role of NSDL and CSDL.

#### **Suggested Books:**

1. I.M. Bhole, Financial Institutions and market, Tata McGraw Hill.
2. V.A. Avadhani, Marketing of Financial Services, Himalayas Publishers, Mumbai.
3. Vasant Desai, Indian financial system, Himalaya Publisher.
4. Benton E.G., Financial Intermediaries An introduction.
5. Edminister R. D, Financial Institution, Markets and Management.
6. Verma J.C A manual of Merchant Banking.
7. West Lake. M, Factoring.
8. N. Vinaykan, A Profile of Indian Capital Market.



### 3S – B1: ADVANCED BANKING

**Unit – I:** Central Banking Concept – Central Banking Policy in Developed and Developing Economics – Functions – Note Issues – Banker to the Government; Banker to Commercial Banks – Credit Control – Techniques – Structure and Organization of RBI – Role of RBI as Central Bank.

**Unit – II:** Structure and Organisation of Central Bank in USA and UK – Objectives and Techniques of Central Banking Policy in Developed and Less Developed Countries – A Critical Study of Theory and Practice of Central Banking in USA and UK.

**Unit – III:** Development of Commercial Banking in UK, USA and India – Study of Nature and Structure of Commercial Banking in India and Abroad – Theories of Asset Management of Commercial Banks, Recent Developments in Commercial Banking in USA, UK and India. A Study of Money and Capital Markets in UK, USA and India.

**Unit – IV:** Economic Stabilization Policy – Objectives of Monetary Policy – Choosing Between Conflicting Objectives – Monetary Policy and Economic Stabilization – Fiscal Policy and Economic Stabilization – Interdependence of Monetary and Fiscal Policies – Debt Management Policy.

**Unit – V:** Financial Sector Reforms in India – Need for Reforms – Major Reforms After 1991 – Issues and Impact of Financial Reforms.

#### **Suggestive Books:**

1. Hawtrey "The art of Central Banking " Augustus M.Kelley Publishers, 1970 – New York.
2. Narendra Kumar – Bank Nationalism of India – A Symposium – Lalvani Publishing House, 1969 – Mumbai.
3. Pai Panandikar & N C Mehra – Rural Banking – National Institute of Bank Management – Mumbai.
4. Vasant Desai – Indian Banking – Nature and Problems – Himalaya Publications House – Mumbai.
5. Benjamin H Bankhurt – Banking Systems – Times of India Press – Mumbai.
6. Charless L Prather – Money & Banking – Richard.D.Irwin Inc. – Illinois
7. Mongia J.N. – Banking Around the world – Allied Publishers Pvt Ltd., Mumbai.
8. Bhole, L.M – Financial Institutions and Markets, Tat McGraw – Hill Publishing Company Limited, New Delhi, 2004.
9. Khan, M.Y – Indian Financial System, Tat McGraw Hill Publishing Company Limited, New Delhi, 2004.

### **3S – B2: BANK FINANCIAL MANAGEMENT**

**Unit – I: CONCEPTUAL FRAMEWORK:** Overview of Financial System – Introduction to Financial Management in Banks – Financial Analysis of Banks.

**Unit – II: MANAGEMENT OF FUNDS: SOURCES:** - Management of Owned Funds – Management of Borrowed Funds – Cost of Funds.

**Unit – III: MANAGEMENT OF FUNDS: INVESTMENTS:** Forms of Bank Investment – Long-term Investment – Short-term Investments – Investments in Bonds and other Financial Securities – Investment in Foreign Exchanges.

**Unit – IV: RISK MANAGEMENT:** Risk Management: An Overview – Estimating/Forecasting of Risks – Measuring Risks – Management of Risks – Asset-Liability Management.

**Unit – V: SPECIAL ISSUES:** Mergers and Acquisitions – Accounting Policies – Pricing of Bank Products & Services.

#### ***Suggested Books: To be typed***

1. Edminister R.D, Financial Institution, Markets and Management.
2. Verma J.C. A manual of Merchant Banking.
3. Hawtrey "The art of Central Banking " Augustus M.Kelley Publishers, 1970 – Newyork.
4. Vasant Desai – Indian Banking – Nature and Problems – Himalaya Publications House – Mumbai.
5. Khan, M.Y – Indian Financial System, Tat McGraw Hill Publishing Company Limited, New Delhi, 2004.
6. Narendra Kumar – Bank Nationalism of India – A Symposium – Lalvani Publishing House, 1969 – Mumbai.
7. A.V. Rajwade, Foreign Exchange, International Finance and Risk Management, Academy of Business Studies, New Delhi.

## SEMESTER – III (ACCOUNTING & TAXATION)

### 3S – A1: CORPORATE ACCOUNTING

**Unit - I:** Corporate Financial Accounting: Objectives-Scope - Role of Corporate Accountant- Analysis and Interpretation of Financial Statements - Inflation Accounting.

**Unit - II:** Valuation of Shares: Need for Valuation of Shares – Factors Effecting Value of Shares – Methods of Valuation – Impact of Earnings on Share Valuation – Role of Fundamental Analysis and Technical Analysis in Share Valuation – Fair Value of a Share – Buy Back of Equity Shares.

**Unit - III:** Consolidated Financial Statements: Definition of Parent or Holding and its Subsidiary – Need for Consolidated Financial Statement – Preparation of Consolidated Balance Sheet of a Holding Company with one Subsidiary – Consolidation of Profit and Loss Account – Consolidated Statement of Changes in Financial Position.

**Unit - IV:** Accounting Standards: Objectives – Advantages and Disadvantages of Accounting Standards – Accounting Standards Board (ASB) – Compliance with Accounting Standards – International Accounting Standards and Linkage with Indian Accounting Standards – Accounting Standards Under US GAAP and Indian GAAP.

**Unit - V:** Financial Reporting: Concept, Objectives – Users Purpose of Financial Reporting and Specific Purpose of Report – Segment Reporting – Difficulties in Segment Reporting– Interim Reporting – Problems in Interim Reporting – Improving Financial Reporting – Value Added Statements – Disclosure of Value Added Statements – Economic Value Added – Human Resource Reporting - Environmental Reporting.

#### *Suggested Books:*

1. Advanced Accounting – Corporate Accounting Vol. 2 – Ashok Sehgal & Deepak Sehgal, Taxmann Allied Services Pvt Ltd, New Delhi.
2. Advanced Accounting – Volume – 2; R.L. Gupta & Radhaswami S. Chand & Co. Delhi.
3. Financial Accounting: A Managerial Perspective, R. Narayana Swamy, Prentice Hall of India.
4. Financial Accounting for Business Managers: Asish K. Bhattacharyya, Prentice Hall of India.
5. Human Resource Accounting – D. Prabhakara Rao.
6. Advanced Accounts – Chakravarthy – Oxford Publishers.
7. Modern Accountancy Vol.2 – A. Mukharjee and M. Hanieff – Tata McGraw hill publishing Company. New Delhi.
8. Financial Accounting – A Managerial Perspective – R. Narayana Swami – Prentice Hall of India, New Delhi.
9. Corporate Accounting – S.N. Maheswari & S.K. Maheswari, Vikas Publishing House, New Delhi.

### 3S – A2: INTERNATIONAL ACCOUNTING

**Unit – I:** International Dimensions of Accounting – Definition and Importance of International Accounting – Scope of International Accounting – Status of International Accounting in India.

**Unit – II:** Internationalisation of Accounting Profession – Harmonization of Accounting Practices – Comparative Analysis Between US GAAP, Indian GAAP and IAS – Models of Uniformity in Accounting.

**Unit – III:** Accounting for Currency Translation – Need – Foreign Exchange and Procedural Issues – Practices.

**Unit – IV:** Transfer Pricing – Definition – Evolution and Approaches to Transfer Pricing in International Business with Special Reference to Multinational Corporations – Indian Experience.

**Unit – V:** International Dimensions of Financial Reporting – Introduction – Transactional Reporting – Considerations Reporting Practices – Recent Changes – Indian Experience.

**Suggested Books:**

1. 'International Accounting' – Dr. Shirin Rathore, Prentice Hall of India Pvt. Ltd., New Delhi.
2. FDC Choi and G.G. Mueller, 'An introduction to multinational Accounting' (Prentice Hall, 1982).
3. 'International Accounting and financial reporting, Rueshoff (Norlin G)
4. 'International Accounting – A User perspective Shahorkh M. Suddagaran, TAXMAN INDIA. 2000.
5. "Advanced Financial Accounting". Richard E Baker, Valdean C. Lembke Thomases King, McGraw-Hill Higher Education, Irwin, 2005.
6. "Comparative International Accounting" Christopher Nobes & Robert Parker, Pearson Education, 2002, New Delhi.

### 3S – T1: DIRECT TAXES

**Unit – I:** Income Tax Act 1961: Basic Concepts, Income, Agriculture Income -Residential Status and Incidence of Tax - Incomes Exempt from Tax.

**Unit – II:** Income from Salaries: Chargeability, Deductions, Perquisites, Computation of Salary Income.

**Unit – III:** Income from House Property, Chargeability, and Computation of Income.

**Unit – IV:** Income from Business & Professions - Capital Gains and Income from Other Sources –Computation of Total Income.

**Unit – V:** Wealth Tax Act, 1957 – Chargeability – Incidence of Tax – Assets – Deemed Assets - Assets Exempt from Wealth Tax - Return of Wealth and Assessment – Rates of Tax - Computation of Net Wealth.

***Suggested Books:***

1. Dr. V.K. Singhania & Dr. Kapil Singhania, Direct Taxes Law and Practice, Taxman Publications Pvt. Ltd., New Delhi.
2. Bhagavati Prasad, Direct Taxes Law and Practice, Wishwa Prakashan, New Delhi.
3. Dinkar Pagare, Income Tax and Practice, Sultan Chand and Sons, New Delhi.

### 3S – T2: INDIRECT TAXES

**Unit – I:** Excise Duty - Introduction – Laws Relating to Excise Duty – Nature of Excise Duty – Basic Concepts – Taxable Event for Excise Duty – Types of Excise Duties – Exempted Goods.

**Unit – II:** Excisable Goods – Classification of Goods – Valuation of Goods.

**Unit – III:** CENVAT – Input Goods and Services for CENVAT – Capital Goods for CENVAT – Exempted Final Products / Output Services.

**Unit – IV:** Customs Duty - Introduction – Basic Concepts – Scope and Coverage of Customs Duty - Nature of Customs Duty – Classification for Customs – Types of Custom Duties. Exemptions from Customs Duty – Valuation for Customs Duty.

**Unit – V:** Customs Procedures: Import Procedures - Export Procedures - Baggage, Courier and Post – Warehousing in Customs – Duty Draw Back.

***Suggested Books:***

1. V.S. Datey, Indirect Taxes Law & Practice, Taxman Publications Pvt. Ltd., New Delhi.
2. V.K.Sareen and Ajay Sharma, Indirect Tax laws, Kalyani Publications, New Delhi.

## SEMESTER – IV (FINANCE & BANKING)

### 4S – F1: SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT

**Unit – I:** Concept of Investment, Investment Vs Speculation, and Security Investment Vs Non-security Forms of Investment. Investment Process; Sources of Investment Information. Security Markets – Primary and Secondary – Market Indices.

**Unit – II:** Return and Risk – Meaning and Measurement of Security Returns. Meaning and Types of Security Risks, Systematic Vs Non-systematic Risk. Measurement of Total Risk.

**Unit – III:** Fundamental Analysis – Economy, Industry and Company Analysis, Intrinsic Value Approach to Valuation of Bonds, Preference Shares and Equity Shares.

**Unit – IV:** Technical Analysis – Concept and Tools of Techniques Analysis – Technical Analysis Vs Fundamental Analysis. Efficient Market Hypothesis; Concept and Forms of Market Efficiency.

**Unit – V:** Elements of Portfolio Management, Portfolio Models – Markowitz Model, Sharpe Single Index Model and Capital Asset Pricing Model. Efficient Frontier and Selection of Optimal Portfolio. Performance Evaluation of Portfolios; Sharpe Model – Jensen's Model for PF Evaluation.

#### *Suggested Books:*

1. Donald E. Fischer, Ronald J. Jordan, Security Analysis and Portfolio Management, Prentice Hall of India.
2. Prasanna Chandra, Investment Analysis and Portfolio Management, Tata McGraw Hill.
3. S. Kevin, Security Analysis and Portfolio Management, Prentice Hall of India.
4. S. Kevin, Portfolio Management, Prentice Hall of India.
5. J.C. Francis, Investments – Analysis and Management, McGraw Hill Int.
6. Elton, EJ & Grober, MJ, Modern Portfolio Theory and Investment Analysis, John Wiley.
7. Avadhani, VA, SAPM, Himalaya Publishers.
8. Bhalla, VK Investment Management, S Chand.
9. Punitavathy Pandian, SAPM, Vikas.
10. Preeti Singh, Investment Management, Himalaya Publishers.

## 4S – F2 FINANCIAL DERIVATIVES

**Unit - I:** Introduction to Financial Derivatives – Meaning and Need – Growth of Financial Derivatives in India – Derivative Markets – Participants- Functions – Types of Derivatives – Forwards – Futures – Options-Swaps – The Regulatory Framework of Derivatives Trading in India.

**Unit - II:** Features of Futures –Differences Between Forwards and Futures – Financial Futures – Trading – Currency Futures – Interest Rate Futures – Pricing of Future Contracts- Value at Risk (VaR)-Hedging Strategies – Hedging with Stock Index Futures – Types of Members and Margining System in India – Futures Trading on BSE & NSE.

**Unit - III:** Options Market – Meaning & Need – Options Vs Futures -Types of Options Contracts – Call Options – Put Options- Trading Strategies Involving Options – Basic Option Positions – Margins – Options on Stock Indices – Option Markets in India on NSE and BSE.

**Unit - IV:** Option Pricing – Intrinsic Value and Time Value- Pricing at Expiration – Factors Affecting Options pricing- Put-Call Parity Pricing Relationship- Pricing Models - Introduction to Binominal Option Pricing Model – Black Scholes Option Pricing Model.

**Unit – V:** Swaps – Meaning – Overview – The Structure of Swaps – Interest Rate Swaps – Currency Swaps – Commodity Swaps – Swap Variant – Swap Dealer Role –Equity Swaps – Economic Functions of Swap Transactions - FRAs and Swaps.

### *Suggested Books:*

1. Hull C. John, "Options, Futures and Other Derivatives", Pearson Educations Publishers,
2. David Thomas. W & Dubofsky Miller. Jr., Derivatives valuation and Risk Management, Oxford University, Indian Edition.
3. ND Vohra & BR Baghi, Futures and Options, Tata McGraw-Hill Publishing Company Ltd.
4. Red Head: Financial Derivatives: An Introduction to Futures, Forward, Options" Prentice Hall of India.
5. David A. Dubofsky, Thomas W. Miller, Jr.: Derivatives: Valuation and Risk Management, Oxford University Press.
6. Sunil K.Pameswaran, "Futures Markets: Theory and Practice" Tata-McGraw-Hill Publishing Company Ltd.
7. D.C. Patwari, Financial Futures and Options, Jaico Publishing House.
8. T.V. Somanathan, Derivatives, Tata McGraw-Hill Publishing Company Ltd.
9. NSE Manual of Indian Futures & Options & www. Sebi.com
10. S.C. Gupta, Financial Derivatives: Theory, Concepts and Problems, Prentice Hall of India.



#### 4S – B1: FINANCIAL INSTITUTIONS

**Unit – I:** Origin – Concept – Definition – Structure – Role of Financial Institutions.

**Unit – II:** Non-Bank Financial Companies – Introduction – Concept – Definition – Scope and Meaning – Role.

**Unit – III:** NBFCs – Structure – Growth – Regulation of NBFCs.- An Overview of the Present Position of NBFCs.

**Unit – IV:** Non – Bank Statutory Financial Organisations – Concept – Structure – Nature, Functions and Role of NBFCs.

**Unit – V:** Financial Performance of Non-Banking Statutory Financial Organisations – Investment Pattern – Strengthening of NBFCs. – Reforms in NBFCs.

*Suggested Books:*

1. Bhole, L.M – Financial Institutions and Markets, Tat McGraw – Hill Publishing Company Limited, New Delhi, 2005.
2. Khan, M.Y – Indian Financial System, Tat McGraw Hill Publishing Company Limited, New Delhi, 2004.
3. Indian Banks Association, Indian Banking Year Book 2004, Mumbai, 2005.
4. RBI, Report on Trends and Progress of Banking in India, various issues, Mumbai.

#### 4S – B2: BANKING AND TECHNOLOGY

**Unit – I:** IT IN BANKING: AN INTRODUCTION: - Information Technology and Its Implications  
– Information Technology – Indian Banking Scenario – Initiatives and Trends.

**Unit – II:** IT APPLICATIONS IN BANKING: Computer-based Information System for Banking  
– Electronic Banking – Electronic Fund Management.

**Unit – III:** ENABLING TECHNOLOGIES OF MODERN BANKING: Electronic Commerce and  
Banking – Supply Chain Management – Customer Relationship Management – Integrated  
Communication Networks for Banks.

**Unit – IV:** SECURITY AND CONTROL SYSTEMS: Computer Security and Disaster  
Management – System Audit and Computer Crime – Security and Control Aspects of Emerging  
Banking Technologies.

**Unit – V:** PLANNING AND IMPLEMENTATION OF INFORMATION SYSTEM: Security and  
Control Aspects of Emerging Banking Technologies – Data Warehousing and Data Mining –  
Designing and Implementing Computerization in Banking Sector.

*Suggested Books:*

1. Hawtrey "The art of Central Banking " Augustus M.Kelley Publishers, 1970 – Newyork.
2. Vasant Desai – Indian Banking – Nature and Problems – Himalaya Publications House – Mumbai.
3. Khan, M.Y – Indian Financial System, Tat McGraw Hill Publishing Company Limited, New Delhi, 2004.
4. R.G. Murdick, J.E. Ross and J. R. clagget, Information systems for modern management, PHI.
5. Charlie Kaufman, Radia Perlman and Mike Speciner, Network Security – Private Communication in a Public World, Pearson / PHI.
6. Steve Hedley – Statutes on IT & E-Commerce, Oxford University Press.

**SEMESTER – IV**  
**( ACCOUNTING & TAXATION )**

**4S – A1: STRATEGIC COST MANAGEMENT**

**Unit – I:** Cost Management – Nature and Scope – Management of Value Chain – Tools of Cost Management. Product Costing Systems – Concepts and Design Issues.

**Unit – II:** Activity Based Costing System – Meaning and Scope – Limitations of Traditional Costing Allocation Methods – Application of ABC System – Activity – Based Management – Concept and Scope – Target Costing – Benchmark Costing.

**Unit – III:** Quality Cost Systems – Meaning and Application – Conflict Between Quality and Cost – Trade-off Between Quality and Price – Value Analysis – Life Cycle Costing – Learning Curve Analysis – JIT.

**Unit – IV:** Cost Estimation – Methods – Costing Engineering – Using Regression Analysis – Evaluating Performance – Variance Analysis – Kaizen Costing.

**Unit – V:** Cost Control and Cost Reduction – Managerial and Technical Aspects – Meeting the Cost Reduction Challenges Role of Cost Accountant.

*Suggested Books:*

1. 'Cost Management' – Strategies for Business Decisions HILTON, MAHER and SELT, Tata McGraw Hill, II ed. 2002.
2. 'Cost Accounting' – Principles and Practice, B.M.Lall Nigam, Prentice Hall of India.
3. Cost Accounting: Theory and Practice, Bhabatosh Banerjee, Prentice Hall of India.
4. 'Principles of Quality Costs' Principles, Implementation and Use Jack Companella, Prentice Hall of India Pvt. Ltd. 2000 (3rd Ed.)
5. 'Cost Accounting' – Jain and Narang.
6. 'Cost Accounting' – A Managerial Emphasis' Chrles Tn Horngren.
7. 'Cost Accounting' – B. Benerjee, World Press, Calcutta.

## 4S – A2: MANAGEMENT CONTROL SYSTEMS

UNIT-I: Management Control: Objectives- Basic Concepts- The Formula Control Systems, Characteristics of Management Control Systems; Inter Relationship Among Strategic Planning, Management Control and Operational Control – Designing and Introduction of Management Control System –Management Control System and Responsibility Accounting -Informal Management Controls.

UNIT-II: Structure of Management Control : Need for Delegation- Responsibility Centers – Expense Centers -Revenue Centers – Profit Centers- Investment Centers, Research and Development Centers- Administrative and Support Centers – Performance of Expense Centers – Revenue Centers – Profit Centers – Investment centers – Organizational Structure of Responsibility Centers – Transfer Pricing – Objectives – Methods – Pricing Corporate Services and Administration of Transfer Prices.

UNIT-III: Management Control Process: Strategic Planning – Nature, Analysis of New Programmes – Ongoing Programmes – Strategic Planning Process – Programming and Budgeting – Budget Preparation Process; Performance Evaluation – Performance Evaluation Systems Interactive Control – Analysing and Reporting – Types of Reports – Report Preparation – MIS –MIS & Computers.

UNIT-IV: Special Applications: Controls for Differentiated Strategies – Corporate Strategy – Strategic Business Unit Concept – Top Management Style – Management Control in Service Organizations; Professional Services – Financial Services – Healthcare Service Organizations – Management Control in Non-profit Organizations – Characteristics – Measuring Output – Pricing Management Structure – Control in NPOs.

UNIT-V: Management Control in Multinational and Multi project Corporations (MNCs): Objectives, Characteristics, Performance Measurement of Subsidiaries Reporting System – Need for MIS Between Parent and Subsidiary Companies – Structure of Multi Project Organization – Characteristics, Project Planning and Control Techniques, Control Indicators in Multi Project Organizations.

### Suggested Books:

1. Management control Systems – Robert Anthony and Vijay Govindarajan Tata – McGrawhill publishing Company, New Delhi.
2. Management Control Systems, N. Ghosh, Prentice Hall of India.
3. Management information and control systems – Dr. Sushila Madan. Taxmann Allied Services Pvt. Ltd., New Delhi.
4. Management Control systems Text and Cases – Subhash Sharma Tata-McGrawhill publishing Company, New Delhi.

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#### **4S – T1: VAT AND SERVICE TAX**

**Unit – I:** A.P. VAT Act, 2005 – Basic Concepts – Salient Features of VAT – Incidence of VAT – Exempted Goods.

**Unit – II:** Registration of Dealers – Determination of Taxable Value – Calculation of VAT Payable.

**Unit – III:** Procedure and Administration of the Act - Maintenance of Books of Accounts by Dealers – Assessment Procedure.

**Unit – IV:** Service Tax: Nature of Service Tax - Service Provider and Service Receiver, Individual Service, CENVAT Vs. Service Tax – Exemptions.

**Unit – V:** Procedures of Service Tax: Registration, Maintenance of Records, Payment of Service Tax, Taxable Services – Computation of Service Tax.

*Suggested Books:*

1. Kul Bhushan, How to deal with VAT, Pearson Education, Pvt. Ltd., New Delhi.
2. A.P. VAT Bill 2005, Govt. of A.P. Commercial Taxes Department.
3. V.S. Datey, Indirect Taxes Law and Practice, Taxman Publications Pvt. Ltd., New Delhi.

## 4S – T2: TAX PLANING AND MANAGEMENT

Unit – I: Introduction: Tax Planning and Management – Tax Avoidance, Tax Planning, Tax Evasion - Tax Evasion in India - Measures of the State for Tax Evasion.

Unit – II: Tax Planning for Salaried Persons.

Unit – III: Tax Planning for Firms and HUF.

Unit – IV: Tax Planning for Companies.

Unit – V: Tax Planning for Small Business.

### Suggested Books:

1. Dr. V.K. Singhania & Dr. Kapil Singhania, Direct Taxes Law and Practice, Taxman Publications Pvt. Ltd., New Delhi.
2. Bhagavati Prasad, Direct Taxes Law and Practice, Wishwa Prakashan, New Delhi.

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**Adikavi Nannaya University, Rajamahendravaram**  
**Department of Commerce**  
**(M. Com)**  
**(With effect from 2016 – 2017)**

<b>M. COM- COURSE STRUCTURE</b>								
				Intrl	Extrl	Total	Periods/ Week	Credits
<b>SEMESTER-I</b>								
1	CP	101	Principles of Management	25	75	100	6	4
2	CP	102	Business Environment	25	75	100	6	4
3	CP	103	Business Economics	25	75	100	6	4
4	CP	104	Business Communication & Soft skills	25	75	100	6	4
5	CP	105	Advanced Management Accounting	25	75	100	6	4
<b>SEMESTER-II</b>								
1	CP	201	Financial Management	25	75	100	6	4
2	CP	202	Human Resource Management	25	75	100	6	4
3	CP	203	Marketing Management	25	75	100	6	4
4	CP	204	Research Methodology & Quantitative Techniques	25	75	100	6	4
5	CP	205	Computer Application in Business	25	75	100	6	4
<b>SEMESTER-III</b>								
1	CP	301	Micro Finance	25	75	100	6	4
2	CP	302	Entrepreneurship	25	75	100	6	4
4	AT1	303	Corporate Accounting	25	75	100	6	4
5	AT2	304	Strategic Cost Management	25	75	100	6	4
6	AT3	305	Management Control Systems	25	75	100	6	4
7	FB1	303	Security Analysis and Portfolio Management	25	75	100	6	4
8	FB2	304	International Financial Management	25	75	100	6	4
9	FB3	305	Financial Derivatives	25	75	100	6	4
<b>SEMESTER - IV</b>								
1	CP	401	Financial Markets and Services	25	75	100	6	4
2	CP	402	Insurance Products & Management	25	75	100	6	4
3	AT1	403	Direct Taxes	25	75	100	6	4
4	AT2	404	Indirect Taxes	25	75	100	6	4
5	AT3	405	Tax Planning and Management	25	75	100	6	4
6	FB1	403	Advanced Banking	25	75	100	6	4
7	FB2	404	Rural Banking	25	75	100	6	4
8	FB3	405	Financial Institutions	25	75	100	6	4
			Project Report			50		4
			Comprehensive Viva Voce			50		4
<b>GRAND TOTAL</b>						<b>2100</b>		

## **M. Com SPECIALIZATIONS**

### **M. COM III SEMESTER**

#### **ACCOUNTING & TAXATION SPECIALIZATION**

303 AT 1	Corporate Accounting
304 AT 2	Strategic Cost Management
305 AT 3	Management Control Systems

#### **FINANCE & BANKING**

303 FB 1	Security Analysis & Portfolio Management
304 FB 2	International Financial Management
305 FB 3	Financial Derivatives

### **M. COM IV SEMESTER**

#### **ACCOUNTING & TAXATION SPECIALIZATION**

403 AT 1	Direct Taxes
404 AT 2	Indirect Taxes
405 AT 3	Tax Planning & Management

#### **FINANCE & BANKING**

403 FB 1	Advanced Banking
404 FB 2	Rural Banking
405 FB 3	Financial Institutions



**ADIKAVI NANNAYA UNIVERSITY**  
**M. COM - SEMESTER I**  
**CP – 101: PRINCIPLES OF MANAGEMENT**

**Objectives:** to familiarize the students with basic management concepts and the process of organization.

**Unit – I:** Introduction: Concept of Management: Definition, Nature, Purpose, Scope and Significance – Evolution of Management Thought – Approaches to Management – Process of Management – External Environment Functions of Management.

**Unit – II:** Planning: Types of Plans – Objectives, Management by Objectives, Planning Premises Decision Making: Decision Making Process – Decision Tree Analysis.

**Unit – III:** Organization: Principles of Organization: Formal and Informal Organization – Span of Control – Delegation of Authority – Centralization and Decentralization – Line and Staff Conflict and Cooperation. Staffing Process: Nature and purpose of staffing – Executive Development Programme (EDPs).

**Unit – IV:** Directing: Elements of Directing - Motivation – Leadership – Concept, Styles, Theories – Managerial Grid: Likerts Four Systems of Leadership.

**Unit – V:** Process of Control, Techniques of control, PERT and CPM.

***Suggested Books:***

1. James A. F. Stoner, R. Edward Freeman and Daniel R. Gilbirth Jr. – Management, Prentice Hall of India.
2. Heinz Wehrich and Harold Koontz, Essentials of Management – Tata McGraw Hill International.
3. Stephen Robbins and Mary Coulter, Management, Prentice Hall of India.
4. Bajaj: Management Processing and Organization, Excel Publications.
5. Tripathy and Reddy – Principles of Management – Tata McGraw Hill.
6. John F. Wilson – The Making of Modern Management, Oxford University Press.
7. Heiny Wehrich and Harold Koontz – Management, A Global Perspective – McGraw Hill International.
8. R.K. Suri, Organizational Behaviour, Wisdom Publication.
9. A. Pardhasaradhy & R. Satya Raju: Management Text and Cases, Prentice Hall of India.

## CP – 102: BUSINESS ENVIRONMENT

**Objective:** To familiarize the students with the business environment prevailing in India and international and understand its implications to business.

**Unit-I:** Business Environment: Nature and scope - Significance – Cultural, Political, Technological and External Factors Influencing Business Environment – Dimensions of International Business Environment – Challenges.

**Unit-II:** Structure of Indian Economy: Economic systems- Economic planning with special reference to last three plans, public, private joint and cooperative sectors - Industrial Policy of the Government - Policy Resolutions of 1956, 1991 Industrial Policy and Economic Policy - Subsequent policy Statements.

**Unit-III:** Indian Companies -Competitiveness, Changes and Challenges, Sustainable Development, Social Responsibilities, Ethics in Business- Competition Act 2002 - Emerging Trends in Indian Business Environment.

**Unit – IV:** International Trade Theories, Balance of Payments – Concepts, Disequilibrium in BOP Structural, Cyclical and Monetary Disequilibrium, Methods, Trade Barriers and Trade Strategy - Free Trade vs. Protection- Foreign Exchange Market.

**Unit – V:** Globalization: International Economic Integration, Country Evaluation and Selection, Foreign Market Entry Methods, International Trade Stocks – Objectives; WTO Origin, Objectives, Organization Structure and Functioning – WTO and India.

### ***Suggested Books:***

1. K.V.Sivayya and VBM Das: Indian Industrial Economy, Sultan Chand Publishers, Delhi.
2. Suresh Bedi: Business Environment, Excel, New Delhi.
3. Francis Cherunilam: Business Environment - Text & Cases.
4. M.Adhikari, Economic Environment of Business.
5. Pandey G.N., Environmental Management, Vikas Publishing House.
6. Raj Agarwal: Business Environment, Excel Publications.
7. Govt. of India, Latest Economic Survey.
8. Chari, S. N: International Business, Wiley India
9. Francis Cherunilam: International Business: Text and Cases, Prentice Hall of India.
10. E. Bhattacharya: International Business, Excel Publications.
11. Sundaram & Black: International Business Environment Text and Cases, PHI.
12. Sajahan: International Business, Mac-Milan India. New Delhi.

## CP – 103: BUSINESS ECONOMICS

**Objective:** To enable the students to understand economic concepts and theories and their application in management decision-making.

**Unit - I:** Introduction: Nature and Scope of Business Economics; Objectives of the Firm – Traditional Theory, Sales and Revenue Maximizing Theories, Managerial Theories and Behavioral Theories; Profit Maximization Vs. Wealth Maximization; Demand Forecasting – Methods of forecasting demand for Existing and New Products, Criteria for Good Forecasting Method.

**Unit - II:** Production Analysis and Cost Analysis: Production Function – Law of Variable Proportions, Isoquant and Isocost Curves, Least Cost Combination, and Returns to Scale; Economies of Large Scale; Cobb-Douglas Production Function and C.E.S. Production Function; Cost-Output Relationships – Short and Long Run; Cost Oriented Pricing Methods – Full Cost Pricing, Marginal Cost and Differential Cost Pricing.

**Unit - III:** Market Analysis: Price and Output Determination under Perfect Competition, Monopoly, Monopolistic Competition, Oligopoly and Duopoly.

**Unit - IV:** Profit Analysis: Meaning of Profit, Limiting Factors of Profit, Criteria for Standard Profit: Theories of Profit; Business Forecasting – Nature and Scope of Forecasting and Different Methods of Business Forecasting and their Advantages and Disadvantages.

**Unit - V:** Macro Economic Concepts: National Income, Trade Cycles, Inflation, Monetary and Fiscal Policies.

### ***Suggested Books:***

1. Mukherjee Sampat: Business and Managerial Economics (In the Global Context), Third Edition, New Central Book Agency (P) Ltd., Kolkatta, 1996.
2. Dwivedi, D.N.: Managerial Economics, Vikas Publishing House Pvt. Ltd., 2003.
3. Dhingra, I.C., Essentials of Managerial Economics; Theory, Applications and Cases, Sultan Chand, New Delhi, 2003.
4. Mithani, D.M.: Managerial Economics; Theory and Applications, Himalaya Publishing House, 2003.
5. Mehta, P.L.: Managerial Economics, Text and Cases, S.Chand & Co., Delhi.
6. Varshney, R.L. and Maheswari, K.L.: Managerial Economics, S.Chand & Co, Delhi.
7. Dwivedi, D.N.: Macroeconomics; Theory and Policy, Tata McGraw Hill Publishing Company, 2002.
8. Gupta, G.S.: Macroeconomics; Theory and Applications, Tata McGraw Hill Publishing Company Ltd.
9. Yogesh Maheswari, Managerial Economics, 2<sup>nd</sup> Edition, Prentice Hall of India.

## CP – 104: BUSINESS COMMUNICATION & SOFT SKILLS

**Objective:** To equip the students with the necessary techniques and skills of communication to inform others, inspire them enlist their activity and willing cooperation in the performance of their jobs.

**Unit – I:** Importance of Communication in Business Organizations – Communication Objectives –Types of Communication - Communication Barriers – Communication Gateways – Developing Listening Skills – Influence of Culture on Communication – Media of Communication: Written, Oral, Visual – Audio Visual Communication- Use of Electronic Media in Business Communication.

**Unit – II:** Interpersonal Communication – Intrapersonal Communication – Communication Models: Exchange Theory – Johari Window – Transactional Analysis, Communication Styles – Completing Job Application forms with required details – Effective techniques of making and accepting offers – Efficient written offer making and accepting.

**Unit – III:** Business Correspondence – Meaning, Scope and Significance – Formal, Informal and Semiformal introductions – Understanding and writing letters –Planning effective initial business letters and responses – email writing skills, call taking skills.

Report Writing – Meaning and Significance; Structure of Reports – Formal Reports – Informal Reports.

**Unit – IV:** Meetings and Oral Presentations – Presentations of oral instructions – effective presentation of written instructions - Basic presentation techniques – Use of information in presenting product features – Oral and written conventions for expressing numerical information in English.

**Unit – V:** Feedback and Evaluation – Giving feedback to others – Use of questions in self-assessment elicitation – Functional language of agreement and opinion giving – Use of tone and intonation in good/bad feedback – Use of emphatic structures in English- Use of conditionals to discuss future possibilities – Discourage strategies for effective relationship – Team building skills.

### ***Suggested Books:***

1. Jerry C. Wofford, Edwin A. Gerloff and Robert C. Cummins, Organisational Communication – The Key stone of Managerial Effectiveness.
2. McGrath, Basic Managerial Skills for All, 5<sup>th</sup> ed., Prentice Hall of India.
3. Urmila Rai & S.M. Rai, Business Communication, Himalaya Publishers, Mumbai.
4. Meenakshi Raman – Business Communication, Oxford University Press.
5. Bovee, Thill and Schatzman: Business Communication Today: Pearson Education.
6. Biswajit Das: Business Communication personality Development, Excel Publications.
7. Parag Diwan: Business Communication, Excel Publications.
8. Lesikar I Flatley, Basic Business Communication, Tata McGraw Hill.
9. Dalmar Fisher, Communication in Organizations, A Jaico Book.
10. Scot Ober, Contemporary Business Communication, Wiley India, New Delhi.

## CP 105: ADVANCED MANAGEMENT ACCOUNTING

**Objective:** To develop an insight of postulates, principles and techniques of accounting and utilization of financial and accounting information for planning, decision-making and control.

**Unit – I:** Management Accounting – Nature and Scope – Management Accounting Vs Financial Accounting and Cost Accounting – Role of Management Accountant in a Modern Organization.

**Unit – II:** Cost Concepts for Decision Making - Cost – Volume – Profit Analysis – Behaviour of Variable Cost – Behaviour of Fixed Cost – Relationships among Cost and Profits at Various Levels of Activity – Break-Even Point – Margin of Safety.

**Unit – III:** Cost Analysis for Pricing Decisions – Evaluating the cost Effects of Price – Quantity Relationships Price Elasticity of Demand and Optimal Pricing Decisions – Cost Analysis for Pricing during Recession Conditions – Flexible Cost Data for Pricing Decisions – Special Order Pricing – Impact of Special Order Pricing on Regular Sales and Overall Profits – Make or Buy Decisions.

**Unit – IV:** Cost Analysis for Product Decisions – Breakeven Analysis of Multi-Product Firms – Differential Costs for Product – Mix Alterations Decisions – Product Additions Decision – Adding New Products Combining Pricing Decisions with Product Addition Decision and Selecting Profitable Product-Price Strategies – Produce Deletion – Sell or Process further Decision of Joint and By-Products.

**Unit – V:** Budgeting – Types of Budgets – Financial Budgets – Operating Budgets – Cash Budget – Production Budget – Flexible Budget – Concepts of Performance Budgeting and Zero Based Budgeting.

### ***Suggested Books:***

1. I.M. Pandey: Management Accounting, Vikas Publishing House.
2. N.M. Singhvi, Management Accounting: Text and Cases, Prentice Hall of India.
3. T.P. Ghosh: Fundamentals of Management Accounting, Excel Publications.
4. Ravi M. Kishore, Management Accounting, Taxman Publications.
5. Chakraborty, Hrishikesh – Management Accountancy, Oxford University Press.
6. Horngren, C.T., Introduction to Management Accounting, Prentice Hall of India.
7. Khan and Jain, Management Accounting, Tata McGraw Hill, Delhi.
8. J.C. Varshney: Financial and Management Accounting, Wisdom Publication.
9. Horngren Sundem Stratton, Management Accounting, Prentice Hall of India.
10. Pares P. Shah, Management Accounting, Wiley India, New Delhi.

**ADIKAVI NANNAYA UNIVERSITY, RAJAMAHENDRAVARAM**  
**M.COM. - SEMESTER II**  
**CP – 201: FINANCIAL MANAGEMENT**

**Objective:** to develop an understanding of the Finance functions and relevant techniques of financial administration.

**Unit – I: INTRODUCTION:** Nature, Scope and Objectives of Financial Management: Finance Function – Profit Goal vs. Wealth Goal Maximization; Techniques of Financial Analysis: Funds Flow Analysis and Ratio Analysis Role of Financial Manager in Modern Environment.

**Unit – II: INVESTMENT DECISION:** Techniques of Appraisal; Process of Capital Budgeting – Risk Vs. Return Traditional and Modern Techniques. (including problems).

**Unit – III: FINANCING DECISIONS:** Capital Structure – Determinants; Leverages – Financial, Operating and Combined: Cost of Capital. (including problems)

**Unit – IV: DIVIDEND AND RETAINED EARNINGS:** Dividend Policy Decisions; Parameters, Dividend Models; Policies Regarding Retained Earnings.

**Unit – V: WORKING CAPITAL MANAGEMENT:** Concept, Need and Determinants of Working Capital - Working Capital Cycle – Working Capital Policy.

***Suggested Books:***

1. Brearley, Richard and Myers, Steward: Principles of Corporate Finance, New York, McGraw Hill.
2. Soloman, Ezra, Theory of Financial Management, Columbia Press.
3. James C. Van Horne, Financial Management and Policy, Prentice Hall of India.
4. Weston J. Fred and Brigham, Eugne F., Managerial Finance, Dryden Press.
5. Prasanna Chandra, Financial Management, Tata McGraw Hill.
6. Khan, M.Y. and Jain, Financial Management, Tata McGraw Hill.
7. Pandey, 1M, Financial Management, Delhi, Vikas Publishing House.
8. Ravi M. Kishore: Financial Management, Taxman.
9. Sudhirbhat, Financial Management, Excel Books.

## CP – 202: HUMAN RESOURCE MANAGEMENT

**Objective:** to enable the students to familiarize with the main aspects of Human Resource Management at the organization level and apply the same in management of Human Resources.

**Unit – I:** Human Resources Management: Concept, Significance and Evolution; Functions of HR Manager, Place of HR Department in Organization.

**Unit – II:** Human Resource Planning: Significance – Methods and Techniques - Job Analysis – Recruitment and Selection Processes - Induction – Placement – Promotion and Transfers.

**Unit – III:** Training and Development: Significance – Identification of Training Needs – Employee Training Methods – Executive Development Methods – Evaluation of Training and Development Programmes.

**Unit – IV:** Wage and Salary Administration: Wage Concepts; Job Evaluation – Methods & Techniques Wage Structure & Policy – Wage Differentials – Wage Payment Methods – Incentives – Fringe Benefits – Performance Appraisal: Scope & Significance – Methods of Appraisal - Limitations of Appraisal.

**Unit – V:** Industrial Relations: Significance, Causes of Disputes and Settlement - Collective Bargaining - Employee Participation in Management.

### ***Suggested Books:***

1. Venkat Ratnam C.S., and Srivastava B.K., Personnel / Human Resource Management, Tata McGraw Hill.
2. Cynthia D. Fisher & Lyle F. Schoenfeldt, Human Resource Management, Wiley India, New Delhi.
3. N.K. Singh: Human Resources Management, Excel Publications.
4. Jyothi – Human Resource Management, Oxford University Press.
5. Gary Dessler, Human Resource Management.
6. Edwin B Flippo, Personnel Management.
7. Decenzo / Robbins, Personnel / Human Resource Management, 3rd Ed, John Wiley & Sons Pvt. Ltd.
8. P. Subba Rao, Human Resource Management, Himalaya Publishers, Mumbai.
9. Deepak Kumar, B. Human Resource Management, Excel Books.
10. Ghosh, HRD and Management, Vikas.
11. Ian Badwel, Len Holden: Human Resource Management – A Contemporary Perspective, Macmillan India Ltd.

## CP – 203: MARKETING MANAGEMENT

**Objective:** to develop an understanding of the concepts, strategies and issues involved in marketing and management.

**Unit – I:** Importance of Marketing – Concepts – Approaches to the Study of Marketing – Marketing Environment.

**Unit – II:** Consumer Behaviour – Market Segmentation – Market Targeting and Positioning – Marketing Information System and Research.

**Unit – III:** Marketing Mix: Product Planning – New Product Development – Product Life Cycle – Branding Packaging – Product Mix Management.

**Unit – IV:** Pricing: Objectives – Methods and Strategies – Distribution – Channel Selection and Management Retail Management.

**Unit – V:** Promotion: Integrated Marketing Communications: Personal Selling – Advertising – Sales Promotion, Publicity and Public Relations – Direct Marketing: Evaluation of Communication Effort.

### ***Suggested Books:***

1. Philip Kotler and Kevin Lane Keller: Marketing Management, Prentice Hall of India / Pearson Education, New Delhi.
2. William J Stanton & Futrell: Fundamentals of Marketing.
3. V. J. Ramaswami and S. Namakumari: Marketing Management, Macmillan Business Books, Delhi.
4. S. Jayachandran: Marketing Management, Text and Cases, Excel Publications.
5. Tapan K. Panda, marketing management, Excel.
6. Zinkota & Kotabe: Marketing Management, Prentice Hall of India.
7. Joel R. Evans & Barry Berman: Marketing, Wiley India, New Delhi.
8. Mukesh Dhunna: Marketing Management, Wisdom Publication.
9. Rajiv Lal, John A. Quelch & V. Kasturi Rangan, Marketing Management, Tata McGraw Hill.



## **CP – 204: RESEARCH METHODOLOGY & QUANTITATIVE TECHNIQUES**

**Objective:** To equip the students with the basic understanding of research methodology and to provide insight into the application of modern analytical tools and techniques for the purpose of management decision making.

**Unit – I:** Meaning and Importance of Research – Research Process – Types of Research – Defining Research Problem – Formulation of Hypothesis – Testing of Hypothesis.

**Unit – II:** Research Design – Exploratory Research – Descriptive Research – Casual Research – Sampling and Sampling Design – Sampling Methods – Simple Random Sampling – Stratified Sampling – Systematic Sampling – Cluster Sampling – Multistage Sampling, Non-Probability Sampling – Convenience Sampling – Judgement Sampling – Quota Sampling.

**Unit – III:** Data Collection – Primary and Secondary Data – Designing of Questionnaire – Measurement and Scaling – Nominal Scale – Ordinal Scale – Interval Scale – Ratio Scale – Guttman Scale – Likert Scale – Schematic Differential Scale.

**Unit – IV:** Quantitative Techniques – Meaning – Nature and Scope – Importance in Research.

**Unit – V:** Measures of Central Tendency – Measures of Dispersion – Simple Correlation and Regression Analysis.

### **Suggested Books:**

1. Mark Saunders, Philip Lewis, Adrian Thornbill, Research Methods for Business Students, Pearson, ND
2. Churchill, Iacobucci & Israel, Marketing Research: A South Asian Perspective, Cengage, New Delhi
3. C.R. Kothari, Research Methodology, New Age International.
4. Carver & Nash, Data Analysis with SPSS, Cengage, New Delhi
5. Alan Bryman & Emma Bell, Business Research Methods, Oxford University Press.
6. Donald R. Cooper & Pamela S. Schindler, Business Research Methods 8<sup>th</sup> Edition, Tata McGraw Hill.
7. K.V.S. Sarma, Statistics made simple, do it yourself on PC, Prentice Hall.
8. V P Michael, Research Methodology in Management, Himalaya, Mumbai

## **CP 205 : COMPUTER APPLICATION IN BUSINESS**

**Objective:** The objective of this course is to provide an insight into basic features of Computer Systems and their Applications in Business Decision Making.

**Unit-I:** Introduction to Computer Concepts – Elements of computer – Characteristics of a Computer – Classification of Computers – Basic Computer Architecture – Input-output Devices.

**Unit-II** Software Concepts: Types of software – Software: its nature and qualities — Windows Operating System Functions.

**Unit-III:** MS Office- Applications of MS Word in Business Correspondence: letters, tables, mail merge, labels.

Computer Networks - Overview of a Network – Communication processors – Communications Media – Types of Network – Network Topologies.

**Unit-IV:** E-commerce - Meaning, Advantages and Disadvantages of E-Commerce – Conducting Business On-line – Issues in implementing in E-Commerce – Comparison between Traditional Commerce and E-Commerce – Incentives for engaging E-commerce.

**Unit-V:** Electronic Data Interchange (EDI) – Concept – History of EDI – Phases of EDI – Business Models – Major types of E- Commerce models.

### **Suggested Books:**

1. Sanjay Saxena and Prathpreet Chopra, Computer Applications in Management, Vikas, New Delhi
2. Aksoy, Introduction to Information Technology, Cengage, ND
3. Parameswaran: Computer Application in Business – S Chand, New Delhi.
4. Management Information Systems by Mahadeo Jaiswal, Monika Mittal, Oxford University Press.
5. Sudalaimuthu & Anthony Raj, Computer Applications in Business, Himalaya, Mumbai
6. David Whitley “E-Commerce – Strategy, Technologies and Application” Tata Mc Graw Hill
7. Parag Diwan and Sunil Sharma “E-Commerce”, Excel Books

**M.COM. - SEMESTER III  
CP 301 : MICRO FINANCE**

**M.COM. - SEMESTER III  
CP 301 : MICRO FINANCE**

**Unit I : Overview of Microfinance:** Indian rural financial system, introduction to microfinance, concepts, products (savings, credit, insurance, pension, equity, leasing, hire purchase service. Micro finance in kind, Micro-remittances. Micro-securitization, franchising etc.,). Micro finance models (Generic models viz., SHG, Grameen and Co-operative, variants SHG NABARD model, SIDBI model, SGSY model, Grameen model, NMDFC model.

**Unit II : Catalyst Role of NGOs:** Educating and formation of SHGs, Linkages with Banks & Markets, Liasoning with Government Dept. Capacity building of SHGs members about value additions, record keeping etc.

**Pricing of Micro Finance Products:** Purpose base, Activity base, Economic class base open bidding etc. Pricing saving products, Amount of savings base, Attendance at periodical meeting adding to corpus.

**Unit III :** Gender Issues in Micro finance and Conflict Resolution in Microfinance – Client impact studies measuring impact of microfinance and microenterprises.

**Micro enterprise:** Characteristics, merits and demerits.

**Unit IV: Commercial Microfinance:** MFIs: Evaluating MFIs – Social and Performance Metrics, Fund structure, Value added Services. The rise of commercial Microfinance – Transforming NGOs, Structure of Microfinance Industry and Constraints on MFI Growth. The partnership model – MFI as the servicer.

**Credit Rating of MFIs:** Need and basic criteria/indicators for rating MFIs-Credit rating agencies in India and abroad-CAMEL – ACCION rating tools: An introduction.

**Unit V: Micro insurance:** Products, eligibility, insurance premium and claim administration systems, regulatory guidelines, relevant cases. Micro-securitization. Financial inclusion and micro-finance. Role of NABARD in Microfinance promotion.

**Field visits and field surveys are recommended.**

**Suggested Books**

1. S. Teki and R.K. Mishra, “Microfinance & Financial Inclusion”, Academic foundation, New Delhi, 2012.
2. Beatiz Armendariz and Jonathan Morduch, “The Economics of Microfinance”, Prentice Hall of India Pvt. Ltd., Delhi, 2005.
3. Joanna Ledgerwood, “Microfinance Handbook”: An Institutional and Financial Perspective, The World Bank, Washington, D.C.
4. Malcolm Harper, “Practical Microfinance” A Training guide for South Asia, Vistaar Publication, New Delhi, 2003.
5. C.K. Prahalad, “The Market at the Bottom of the Pyramid, 2006”, The Fortune at the Bottom of the Pyramid, Wharton School Publishing.
6. Jorritt De Jong, et al Edited, ‘Microfinance in Access to Government’, Cambridge, 2008.

## **CP 302 : ENTREPRENEURSHIP**

**Objective:** The objective of this course is to expose the students to the subject of entrepreneurship and small business management, so as to prepare them to establish and a new enterprise and effectively manage the same.

**Unit – I:** Entrepreneurship: Importance, Characteristics and Qualities of Entrepreneurship; Entrepreneurial; Role of Entrepreneurship, Ethics and Social Responsibilities.

**Unit – II:** Role of Government; Role of IDBI, NIESBUD, SISI, DIC Financial Institutions Commercial Banks, Entrepreneurial Development Institutes, Universities and other Educational Institutions Offering Entrepreneurial Development Programme.

**Unit – III:** Training: Designing Appropriate Training Programme to Inculcate Entrepreneurial Spirit, Training for New and Existing Entrepreneurs, Feedback and Performance of Trainees.

**Unit – IV:** Women Entrepreneurship – Role & Importance, Profile Women Entrepreneur, Problems of Women Entrepreneurs, Women Entrepreneurship Development in India.

**Unit – V:** Creativity and Entrepreneurship Sources and Methods of Ideas Planning and Development of Programmes - E-Business Ventures; New Venture Management.

### **Suggested Books:**

1. NVR Naidu and T. Krishna Rao, Management and Entrepreneurship, IK Int Pub House, New Delhi
2. S Anil Kumar, Small Business and Entrepreneurship, IK Int Pub House, New Delhi
3. Balraj Singh, Entrepreneurship Development, Wisdom, Delhi
4. Timmons and Spinelli, New Venture Creation :Entrepreneurship for 21<sup>st</sup> Century, TMH, ND
5. Tabarrok – Entrepreneurial Economics, Oxford University Press.
6. C.V. Bakshi, Entrepreneurship Development, Excel Publications.
7. Jain, Hand Book of Entrepreneurs, Oxford University Press.
8. Vasant Desai, Small Business in Entrepreneurship, Himalaya Publishing House.

### 303 – AT 1: CORPORATE ACCOUNTING

**Objective:** The Objective of this course is to expose students to advanced accounting issues and practices such as maintenance of company accounts, valuation of goodwill and shares, and handling accounting adjustments.

**Unit - I:** Corporate Financial Accounting: Objectives-Scope - Role of Corporate Accountant-Analysis and Interpretation of Financial Statements - Inflation Accounting.

**Unit - II:** Valuation of Shares: Need for Valuation of Shares – Factors Effecting Value of Shares – Methods of Valuation – Impact of Earnings on Share Valuation – Role of Fundamental Analysis and Technical Analysis in Share Valuation – Fair Value of a Share – Buy Back of Equity Shares.

**Unit - III:** Consolidated Financial Statements: Definition of Parent or Holding and its Subsidiary – Need for Consolidated Financial Statement – Preparation of Consolidated Balance Sheet of a Holding Company with one Subsidiary – Consolidation of Profit and Loss Account – Consolidated Statement of Changes in Financial Position.

**Unit - IV:** Accounting Standards: Objectives – Advantages and Disadvantages of Accounting Standards – Accounting Standards Board (ASB) – International Accounting Standards and Linkage with Indian Accounting Standards – Accounting Standards under US GAAP and Indian GAAP.

**Unit - V:** Financial Reporting: Concept, Objectives – Purpose of Financial Reporting and Specific Purpose of Report – Segment Reporting – Difficulties in Segment Reporting– Interim Reporting – Problems in Interim Reporting – Improving Financial Reporting – Value Added Statements – Disclosure of Value Added Statements – Economic Value Added – Human Resource Reporting - Environmental Reporting.

#### ***Suggested Books:***

1. Advanced Accounting – Corporate Accounting Vol. 2 – Ashok Sehgal & Deepak Sehgal, Taxmann Allied Services Pvt Ltd, New Delhi.
2. Advanced Accounting – Volume – 2; R.L. Gupta & Radhaswami S. Chand & Co. Delhi.
3. Financial Accounting: A Managerial Perspective, R. Narayana Swamy, Prentice Hall of India.
4. Financial Accounting for Business Managers: Asish K. Bhattacharyya, Prentice Hall of India.
5. Human Resource Accounting – D. Prabhakara Rao.
6. Advanced Accounts – Chakravarthy – Oxford Publishers.
7. Modern Accountancy Vol.2 – A. Mukharjee and M. Hanieff – Tata McGraw Hill Publishing Company. New Delhi.
8. Financial Accounting – A Managerial Perspective – R. Narayana Swami – Prentice Hall of India, New Delhi.
9. Corporate Accounting – S.N. Maheswari & S.K. Maheswari, Vikas Publishing House, New Delhi.

## 304 AT 2: STRATEGIC COST MANAGEMENT

**Objectives:** The course aims at to impart and inculcate the knowledge of controlling and effective management of cost among the students.

**Unit – I:** Cost Management – Nature and Scope – Management of Value Chain – Tools of Cost Management. Product Costing Systems – Concepts and Design Issues.

**Unit – II:** Activity Based Costing System – Meaning and Scope – Limitations of Traditional Costing Allocation Methods – Application of ABC System – Activity – Based Management – Concept and Scope – Target Costing – Benchmark Costing.

**Unit – III:** Quality Cost Systems – Meaning and Application – Conflict Between Quality and Cost – Trade-off Between Quality and Price – Value Analysis – Life Cycle Costing – Learning Curve Analysis – JIT.

**Unit – IV:** Cost Estimation – Methods – Costing Engineering – Using Regression Analysis – Evaluating Performance – Variance Analysis – Kaizen Costing.

**Unit – V:** Cost Control and Cost Reduction – Managerial and Technical Aspects – Meeting the Cost Reduction Challenges Role of Cost Accountant.

### ***Suggested Books:***

1. ‘Cost Management’ – Strategies for Business Decisions HILTON, MAHER and SELT, Tata McGraw Hill, II ed. 2002.
  2. ‘Cost Accounting’ – Principles and Practice, B. M.Lall Nigam, Prentice Hall of India.
  3. Cost Accounting: Theory and Practice, Bhabatosh Benarjee, Prentice Hall of India.
  4. ‘Principles of Quality Costs’ Principles, Implementation and Use Jack Companella, Prentice Hall of India Pvt. Ltd. 2000 (3rd Ed.) ‘Cost Accounting’ – Jain and Narang.
- ‘Cost Accounting’ – A Managerial Emphasis’ Chrles Tn Horngren.
- ‘Cost Accounting’ – B. Benerjee, World Press, Calcutta.

### 305 AT 3: MANAGEMENT CONTROL SYSTEMS

**Objective:** The course aims at to impart and inculcate the knowledge of controlling and effective strategic systems of management among the students.

**Unit -I:** Management Control: Objectives- Basic Concepts- The Formula Control Systems, Characteristics of Management Control Systems- Inter Relationship Among Strategic Planning, Management Control and Operational Control – Designing and Introduction of Management Control System – Management Control System and Responsibility Accounting -Informal Management Controls.

**Unit -II:** Structure of Management Control : Need for Delegation- Responsibility Centers – Expense Centers -Revenue Centers – Profit Centers- Investment Centers, Research and Development Centers – Administrative and Support Centers – Performance of Expense Centers – Revenue Centers – Profit Centers – Investment centers – Organizational Structure of Responsibility Centers – Transfer Pricing – Objectives – Methods – Pricing Corporate Services and Administration of Transfer Prices.

**Unit -III:** Management Control Process: Strategic Planning – Nature, Analysis of New Programmes – Ongoing Programmes – Strategic Planning Process – Programming and Budgeting – Budget Preparation Process; Performance Evaluation – Performance Evaluation Systems Interactive Control – Analyzing and Reporting – Types of Reports.

**Unit -IV:** Special Applications: Controls for Differentiated Strategies – Corporate Strategy – Strategic Business Unit Concept – Top Management Style – Management Control in Service Organizations; Professional Services – Financial Services – Healthcare Service Organizations – Management Control in Non-profit Organizations – Characteristics – Measuring Output – Pricing Management Structure.

**Unit -V:** Management Control in Multinational and Multi project Corporations (MNCs): Objectives, Characteristics, Performance Measurement of Subsidiaries Reporting System – Need for MIS between Parent and Subsidiary Companies – Structure of Multi Project Organization – Characteristics, Project Planning and Control Techniques, Control Indicators in Multi Project Organizations.

***Suggested Books:***

1. Management control Systems – Robert Anthony and Vijay Govindarajan Tata – McGrawhill publishing Company, New Delhi.
2. Management Control Systems, N. Ghosh, Prentice Hall of India.
3. Management information and control systems – Dr. Sushila Madan. Taxmann Allied Services Pvt. Ltd., New Delhi.
4. Management Control systems Text and Cases – Subhash Sharma Tata- McGrawhill publishing Company, New Delhi.

### **303 FB 1: SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT**

**Objective:** to enlighten the students with the Concepts and Practical applications of Security Analysis and Portfolio Management

**Unit – I:** Concept of Investment, Investment Vs Speculation, and Security Investment Vs Non-security Forms of Investment. Investment Process; Sources of Investment Information. Security Markets – Primary and Secondary.

**Unit – II:** Return and Risk – Meaning and Measurement of Security Returns. Meaning and Types of Security Risks, Systematic Vs Non-systematic Risk. Measurement of total risk.

**Unit – III:** Fundamental Analysis – Economy, Industry and Company Analysis, Intrinsic Value Approach to Valuation of Bonds and Equity Shares.

**Unit – IV:** Technical Analysis – Concept and Tools of Techniques Analysis – Technical Analysis Vs Fundamental Analysis. Efficient Market Hypothesis; Concept and Forms of Market Efficiency.

**Unit – V:** Elements of Portfolio Management, Portfolio Models – Markowitz Model, Sharpe Single Index Model and Capital Asset Pricing Model. Efficient Frontier and Selection of Optimal Portfolio. Performance Evaluation of Portfolios; Sharpe Model, Treynor's Model, Jensen's Model for Portfolio Evaluation.

***Suggested Books:***

1. Donald E. Fischer, Ronald J. Jordan, Security Analysis and Portfolio Management; Prentice Hall of India.
2. Prasanna Chandra, Investment Analysis and Portfolio Management, Tata McGraw Hill.
3. S. Kevin, Security Analysis and Portfolio Management, Prentice Hall of India.
4. S. Kevin, Portfolio Management, Prentice Hall of India.
5. J.C. Francis, Investments – Analysis and Management, McGraw Hill Int.
6. Elton, EJ & Grober, MJ, Modern Portfolio Theory and Investment Analysis, John Wiley.
7. Avadhani, VA, SAPM, Himalaya Publishers.
8. Bhalla, VK Investment Management, S Chand.
9. Punitavathy Pandian, SAPM, Vikas.
10. Preeti Singh, Investment Management, Himalaya Publishers.



## **304 FB 2: INTERNATIONAL FINANCIAL MANAGEMENT**

**Objective:** to enlighten the students with the Concepts and Practical applications of International Financial Management.

**Unit I:** International Monetary and Financial System: Evolution; Breton Woods Conference and Other Exchange Rate Regimes; European Monetary System, South East Asia Crisis and Subprime crisis-2008.

**Unit II:** Foreign Exchange Risk: Transaction Exposure; Accounting Exposure and Operating Exposure – Management of Exposures – Internal Techniques, Management of Risk in Foreign Exchange Markets.

**Unit III:** Features of Different International Markets: Euro Loans, CPs, Floating Rate Instruments, Loan Syndication, Euro Deposits, International Bonds, Euro Bonds and Process of Issue of GDRs and ADRs.

**Unit IV:** Foreign Investment Decisions: Corporate Strategy and Foreign Direct Investment; Multinational Capital Budgeting; International Acquisition and Valuation, Adjusting for Risk in Foreign Investment.

**Unit V:** International Accounting and Reporting; Foreign Currency Transactions, Multinational Transfer Pricing and Performance Measurement; Consolidated Financial Reporting.

### **Suggested Books:**

1. Buckley Adrin, Multinational Finance, 3rd Edition, Engle Wood Cliffs, Prentice Hall of India.
2. S.P.Srinivasan, B.Janakiram, International Financial Management, Wiley India, New Delhi.
3. Clark, International Financial Management, Cengage, ND
4. V.Sharan, International Financial Management, 3rd Edition, Prentice Hall of India.
5. A.K.Seth, International Financial Management, Galgothia Publishing Company.
6. P.G.Apte, International Financial Management, Tata Mc Grw Hill, 3rd Edition.
7. Bhalla, V.K., International Financial Management, 2nd Edition, New Delhi, Anmol, 2001.
8. V.A.Avadhani, International Financial Management, Himalaya Publishing House.
9. Bhalla, V.K., Managing International Investment and Finance, New Delhi, Anmol, 1997.

### 305 FB 3: FINANCIAL DERIVATIVES

**Objective:** to enlighten the students with the concepts and practical applications of derivatives in the security markets.

**Unit - I:** Introduction to Financial Derivatives – Meaning and Need – Growth of Financial Derivatives in India – Derivative Markets – Participants- Functions – Types of Derivatives – Forwards – Futures – Options-Swaps – The Regulatory Framework of Derivatives Trading in India.

**Unit - II:** Features of Futures –Differences Between Forwards and Futures – Financial Futures – Trading – Currency Futures – Interest Rate Futures – Pricing of Future Contracts- Value at Risk (VaR)-Hedging Strategies – Hedging with Stock Index Futures – Types of Members and Margining System in India – Futures Trading on BSE & NSE.

**Unit - III:** Options Market – Meaning & Need – Options Vs Futures -Types of Options Contracts – Call Options – Put Options- Trading Strategies Involving Options – Basic Option Positions – Margins – Options on Stock Indices – Option Markets in India on NSE and BSE.

**Unit - IV:** Option Pricing – Intrinsic Value and Time Value- Pricing at Expiration – Factors Affecting Options pricing- Put-Call Parity Pricing Relationship- Pricing Models - Introduction to Binominal Option Pricing Model – Black Scholes Option Pricing Model.

**Unit – V:** Swaps – Meaning – Overview – The Structure of Swaps – Interest Rate Swaps – Currency Swaps – Commodity Swaps – Swap Variant – Swap Dealer Role –Equity Swaps – Economic Functions of Swap Transactions - FRAs and Swaps.

#### ***Suggested Books:***

1. Hull C. John, “Options, Futures and Other Derivatives”, Pearson Educations Publishers,
2. David Thomas. W & Dubofsky Miller. Jr., Derivatives valuation and Risk Management, Oxford University, Indian Edition.
3. ND Vohra & BR Baghi, Futures and Options, Tata McGraw-Hill Publishing Company Ltd.
4. Red Head: Financial Derivatives: An Introduction to Futures, Forward, Options” Prentice Hall of India.
5. David A. Dubofsky, Thomas W. Miller, Jr.: Derivatives: Valuation and Risk Management, Oxford University Press.
6. Sunil K.Parameswaran, “Futures Markets: Theory and Practice” Tata-McGraw-Hill Publishing Company Ltd.
7. D.C. Patwari, Financial Futures and Options, Jaico Publishing House.
8. T.V. Somanathan, Derivatives, Tata McGraw-Hill Publishing Company Ltd.
9. NSE Manual of Indian Futures & Options & www. Sebi.com
10. S.C. Gupta, Financial Derivatives: Theory, Concepts and Problems, Prentice Hall of India.

**M.COM. - SEMESTER IV**  
**CP 401: FINANCIAL MARKETS AND SERVICES**

**Objective:** to enlighten the students with the concepts and practical dynamics of financial markets and financial services.

**Unit - I:** Structure of Financial System – Role of Financial System in Economic Development- Financial Markets and Financial Instruments- Capital Markets – Money Markets –Primary Market Operations- Role of SEBI – Secondary Market Operations - Regulation – Functions of Stock Exchanges – Listing - Formalities -Financial Services Sector Problems and Reforms.

**Unit - II:** Financial Services: Concept, Nature and Scope of Financial Services – Regulatory Frame Work of Financial Services – Growth of Financial Services in India – Merchant Banking – Meaning –Types – Responsibilities of Merchant Bankers – Role of Merchant Bankers in Issue Management – Regulation of Merchant Banking in India.

**Unit - III:** Venture Capital – Growth of Venture Capital in India – Financing Pattern Under Venture Capital – Legal Aspects and Guidelines for Venture Capital. Leasing – Types of Leases – Evaluation of Leasing Option. Vs. Borrowing.

**Unit - IV:** Credit Rating – Meaning, Functions - Debt Rating System of CRISIL, ICRA and CARE. Factoring, Forfeiting and Bill Discounting –Types of Factoring Arrangements- Factoring in the Indian Context.

**Unit - V:** Mutual Funds – Concept and Objectives, Functions and types, Working of Public and Private Mutual Funds in India. Debt Securitization - Concept and Application - De-mat Services need and Operations-role of NSDL and CSDL.

***Suggested Books:***

1. I.M. Bhole, Financial Institutions and market, Tata McGraw Hill.
2. V.A. Avadhani, Marketing of Financial Services, Himalayas Publishers, Mumbai.
3. Vasant Desai, Indian financial system, Himalaya Publisher.
4. Benton E.G., Financial Intermediaries An introduction.
5. Edminister R. D, Financial Institution, Markets and Management.
6. Verma J.C A manual of Merchant Banking.
7. West Lake. M, Factoring.
8. N. Vinaykan, A Profile of Indian Capital Market.

## CP 402 : INSURANCE PRODUCTS & MANAGEMENT

**Objective:** to enlight the students with the concepts and practical dynamics of insurance products and management.

**Unit – I** Risk and Insurance : Concept of Risk – Types of risk – Risk management – Objectives – Importance – Tools of risk management – Concept of insurance – fundamental principles – Indian insurance sector –Insurance Regulatory and Development Authority (IRDA) – Challenges and recent developments in insurance sector in India. (Theory only)

**Unit – II** Types of Insurance: Life insurance – Essentials of life insurance contract – Insurance pricing – Classification of life insurance policies – Re-insurance – Double insurance – Assignments – Surrender value – Computation of premium – Settlement of Claims – Progress of life insurance business in India – Role of LIC (Theory only)

**Unit – III** Non-Life Insurance: Marine insurance – Marine losses – Types of marine insurance – Settlement of claims – Progress of marine insurance – Fire insurance – Objectives – Types and uses – Settlement of claims – Progress of fire insurance. (Theory only)

**Unit – IV** Miscellaneous Insurance: Health insurance – objectives – Importance – Types of health insurance policies – Settlement of claims – Employee benefits – Retirement plans – Crop insurance – salient features – Importance – Problems of crop insurance (Theory only)

**Unit – V** Investment of funds: Investment of funds – Principles –Types of investment – Factors influencing investment decisions – Legal restrictions on investments by LIC and GIC – Prospects of insurance business in India (Theory only)

### ***Suggested books:***

1. George E.Rejda, Principles of Risk management and Insurance (Ninth Ed.,) Pearson education, Inc. and Dorling Kindersley Publishing Inc. Delhi.
2. Gupta, P.K., Insurance and Risk Management, Himalaya Publishing House, Hyderabad.
3. Mathew, J.J., Insurance: Principles and Practice, RBSA Publishers, Jaipur.
4. Mishra, M.N., and Mishra, S.B., Insurance Principles and practice, S.Chand& Co., Ltd., New Delhi.
5. Nalini Prava Tiripathy and Prabir pal, Insurance: Theory and practice, PHI Learning Pvt., Ltd., New Delhi.
6. Periasamy, P., and Veera Selvam, Risk and Insurance Management, Vijay Nicole Imprints Ltd., Chennai.
7. Periasamy, P., Principles and practice of Insurance, Himalaya Publishing House, New Delhi.
7. Periasamy, P., Principles and practice of Insurance, Himalaya Publishing House, New Delhi.

## 403 – AT 1: DIRECT TAXES

**Objective:** to acquaint the students with the theoretical and practical aspects of direct taxes including wealth taxes.

**Unit – I:** Income Tax Act 1961: Basic Concepts, Income, Agriculture Income –Residential Status and Incidence of Tax - Incomes Exempt from Tax.

**Unit – II:** Income from Salaries: Chargeability, Deductions, Perquisites, Computation of Salary Income.

**Unit – III:** Income from House Property, Chargeability, and Computation of Income.

**Unit – IV:** Income from Business or Profession - Capital Gains and Income from Other Sources –Computation of Total Income.

**Unit – V:** Wealth Tax Act, 1957 – Chargeability – Incidence of Tax – Assets – Deemed Assets - Assets Exempt from Wealth Tax - Return of Wealth and Assessment – Rates of Tax - Computation of Net Wealth.

### *Suggested Books:*

1. Dr. V.K. Singhania & Dr. Kapil Singhania, Direct Taxes Law and Practice, Taxman Publications Pvt. Ltd., New Delhi.
2. Bhagavati Prasad, Direct Taxes Law and Practice, Wishwa Prakashan, New Delhi.
3. Dinkar Pagare, Income Tax and Practice, Sultan Chand and Sons, New Delhi.

## 404 – AT 2: INDIRECT TAXES

**Objective:** to acquaint the students with the basics and latest developments in the areas of Indirect taxes.

**Unit – I:** Excise Duty - Introduction – Laws Relating to Excise Duty – Nature of Excise Duty – Basic Concepts – Taxable Event for Excise Duty – Types of Excise Duties – Exempted Goods.

**Unit – II:** Excisable Goods – Classification of Goods – Valuation of Goods.(Simple problems on Excise Duty)

**Unit – III:** CENVAT Credit – Input Goods and Services for CENVAT Credit – Capital Goods for CENVAT Credit – Exempted Final Products / Output Services.

**Unit – IV:** Customs Duty - Introduction – Basic Concepts – Scope and Coverage of Customs Duty - Nature of Customs Duty – Classification for Customs – Types of Custom Duties. Exemptions from Customs Duty – Valuation for Customs Duty.(Simple problems on Custom Duty)

**Unit – V:** Customs Procedures: Import Procedures - Export Procedures - Baggage, Courier and Post – Warehousing in Customs – Duty Draw Back.

### ***Suggested Books:***

1. V.S. Datey, Indirect Taxes Law & Practice, Taxman Publications Pvt. Ltd., New Delhi.
2. V.K.Sareen and Ajay Sharma, Indirect Tax laws, Kalyani Publications, New Delhi.

### 405 – AT 3: TAX PLANING AND MANAGEMENT

**Objective:** to acquaint the students with the theoretical and practical aspects of tax planning and management.

**Unit – I:** Introduction: Tax Planning and Management – Tax Avoidance, Tax Planning, Tax Evasion – Tax Evasion in India – Measures of the State for Tax Evasion.

**Unit – II:** Tax Planning for Salaried Persons – Application of Sec 80C in reducing the tax bill of Salaried Persons – Choice between Perquisites and Allowances.

**Unit – III:** Tax Planning for Firms and HUF- Meaning-Different Schools of HUF-Assessment of HUF and Firms – Partition of a HUF- Scheme of taxation of firms – Allowance and Disallowance for remunerations paid to partners.

**Unit – IV:** Tax Planning for Companies – Meaning – Types of Companies and Tax rates – Provisions relating to Company assessment – Dividend distribution tax – Deemed Dividend – Minimum alternative tax.

**Unit – V:** Tax Planning for Small Business – Provision relating to SEZs, Software Parks, SSI – Exemptions on Central Excise on SEZs, Software Parks, SSIs.

***Suggested Books:***

1. Dr. V.K. Singhnia & Dr. Kapil Singhania, Direct Taxes Law and Practice, Taxman Publications Pvt. Ltd., New Delhi.
2. Bhagavati Prasad, Direct Taxes Law and Practice, WishwaPrakashan, New Delhi.

## 403 FB 1: ADVANCED BANKING

**Objective:** The course aims at to impart and inculcate the knowledge of development and financial sector reforms among the students.

**Unit – I:** Central Banking Concept – Central Banking Policy in Developed and Developing Economics – Functions – Note Issues – Banker to the Government; Banker to Commercial Banks – Credit Control – Techniques – Structure and Organization of RBI – Role of RBI as Central Bank.

**Unit – II:** Structure and Organization of Central Bank in USA and UK – Objectives and Techniques of Central Banking Policy in Developed and Less Developed Countries – A Critical Study of Theory and Practice of Central Banking in USA and UK.

**Unit – III:** Development of Commercial Banking in UK, USA and India – Study of Nature and Structure of Commercial Banking in India and Abroad – Theories of Asset Management of Commercial Banks, Recent Developments in Commercial Banking in USA, UK and India. A Study of Money and Capital Markets in UK, USA and India.

**Unit – IV:** Economic Stabilization Policy – Objectives of Monetary Policy – Choosing Between Conflicting Objectives – Monetary Policy and Economic Stabilization – Fiscal Policy and Economic Stabilization – Interdependence of Monetary and Fiscal Policies – Debt Management Policy.

**Unit –V:** Financial Sector Reforms in India – Need for Reforms – Major Reforms After 1991 – Issues and Impact of Financial Reforms.

### ***Suggestive Books:***

1. Hawtrey “The art of Central Banking “ Augustus M.Kelley Publishers, 1970 – New York.
2. Narendra Kumar – Bank Nationalism of India – A Symposium – Lalvani Publishing House, 1969 – Mumbai.
3. Pai Panandikar & N C Mehra – Rural Banking – National Institute of Bank Management – Mumabi.
4. Vasant Desai – Indian Banking – Nature and Problems – Himalaya Publications House – Mumbai.
5. Benjamin H Bankhurt – Banking Systems – Times of India Press – Mumbai.
6. Charless L Prather – Money & Banking – Richard.D.Irwin Inc. – Illinois
7. Mongia J.N. – Banking Around the world – Allied Publishers Pvt Ltd., Mumbai.
8. Bhole, L.M – Financial Institutions and Markets, Tat McGraw – Hill Publishing Company Limited, New Delhi, 2004.
9. Khan, M.Y – Indian Financial System, Tat McGraw Hill Publishing Company Limited, New Delhi, 2004.



## **404 FB 2: RURAL BANKING**

**Objective:** To expose the students with the functioning of rural credit institutions in India along with the prospects and problems of financial inclusion including priority sector.

**Unit I – Rural India:** Demographic features-Economic features-Rural poverty-main causes and methods of measuring rural poverty-Rural Infrastructure-Rural Development Policy- Govt. policies and programmes-Economic Reforms and its impact on rural economy.

**Unit II-Financing Rural Development:** Functions and policies of RBI and NABARD ;Rural Credit Institutions-Role and functions -Role of Information and Communication Technologies in rural banking- Regulation of Rural Financial Services.

**Unit III-Financial inclusion:** Concept and its role in inclusive growth- Micro credit, micro insurance scheme - Business Facilitators and Business Correspondents in rural financing-SHG/NGOs, linkages with banking, latest guidelines of GOI and RBI.

**Unit IV-Priority Sector Financing and Govt. initiatives:** Components of priority sector-RBI Guidelines; Government initiatives: Poverty alleviation programmes/Employment programmes/Production oriented programmes-Rural housing and Urban housing schemes under priority sector-Educational loans.

**Unit V-Problems and prospects of Rural Banking:** Problems of rural branches of commercial banks and regional rural banks-emerging trends in rural banking-financing poor as bankable opportunity.

### **Suggested Books:**

1. Vasantha Desai, Indian Banking-Nature and Problems, Himalaya Publishing House, Mumbai
2. Khan, M.Y., Indian Financial System, Tata McGraw Hill Publishing Company Ltd., New Delhi
3. Pai Panandikar & NC Mehra, Rural Banking, National Institute of Bank Management, Pune
4. Guruswamy, S., Banking in the New Millenium, New Century Publications, New Delhi
5. Uppal RK, & Rimpi Kaur, Banking Sector Reforms in India, New Century Publications, New Delhi
6. Indian Institute of Banking & Finance, Rural Banking, Mumbai
7. Uppal RK & Pooja, Transformation in Indian Banks-Search for better tomorrow, Sarup Book Publisher Private Ltd., New Delhi
8. Shyam Ji Mehrotra, New Dimensions of Bank Management, Skylark Publications, New Delhi.

### **405 FB 3: FINANCIAL INSTITUTIONS**

**Objective:** To acquaint the student with the different types of NBFCs and their contribution to the overall development of the Indian financial system.

**Unit – I:** Origin – Concept – Definition – Structure – Role of Financial Institutions.

**Unit – II:** Non-Bank Financial Companies – Introduction – Concept – Definition – Scope and Meaning – Role.

**Unit – III:** NBFCs – Structure – Growth – Regulation of NBFCs.- An Overview of the Present Position of NBFCs.

**Unit – IV:** Non – Bank Statutory Financial Organizations – Concept – Structure – Nature, Functions and Role of NBSFOs.

**Unit – V:** Financial Performance of Non-Banking Statutory Financial Organizations – Investment Pattern – Strengthening of NBFCs. – Reforms in NBSFOs.

***Suggested Books:***

1. Bhole, L.M – Financial Institutions and Markets, Tat McGraw – Hill Publishing Company Limited, New Delhi, 2005.
2. Khan, M.Y – Indian Financial System, Tat McGraw Hill Publishing Company Limited, New Delhi, 2004.
3. Indian Banks Association, Indian Banking Year Book 2004, Mumbai, 2005.
4. RBI, Report on Trends and Progress of Banking in India, various issues, Mumbai.

## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు సిలబస్ & మాదిరి ప్రశ్నాప్రతాలు  
2016-17 ప్రథమ సంవత్సరం (1వ, 2వ సెమిస్టర్లు)  
2017-18 ద్వితీయ సంవత్సరం (3వ, 4వ సెమిస్టర్లు)

Sl. No.	Paper Code	Title	Credits	Internal	Semester End Examination	Total Marks
1.	101	తెలుగు భాషాచరిత్ర	5	25	75	100
2.	102	తెలుగు సాహిత్యచరిత్ర	5	25	75	100
3.	103	ఆంధ్రుల చరిత్ర-సంస్కృతి	5	25	75	100
4.	104	కావ్య నాటకాలు	5	25	75	100
5.	105	జానపద విజ్ఞానం	5	25	75	100
1.	201	తెలుగు భాషాచరిత్ర	5	25	75	100
2.	202	తెలుగు సాహిత్యచరిత్ర	5	25	75	100
3.	203	ఛందోవ్యాకరణాలంకారాలు	5	25	75	100
4.	204	కావ్యనాటకాలు	5	25	75	100
5.	205	ఐచ్ఛికం: 1. స్త్రీవాద సాహిత్యం 2. హేతువాద సాహిత్యం	5	25	75	100
1.	301	ప్రాచీనసాహిత్యవిమర్శ సిద్ధాంతాలు-సూత్రాలు	5	25	75	100
2.	302	నవ్యాంధ్రకవిత్వం-దళితసాహిత్యం	5	25	75	100
3.	303	సామాన్య భాషాశాస్త్రం	5	25	75	100
4.	304	జర్నలిజం - అనువాదం	5	25	75	100
5.	305	ఐచ్ఛికం: 1. నన్నయ 2. కందుకూరి వీరేశలింగం	5	25	75	100
1.	401	ఆధునికసాహిత్యవిమర్శ సిద్ధాంతాలు-సూత్రాలు	5	25	75	100
2.	402	నవ్యాంధ్ర వచన సాహిత్యం	5	25	75	100
3.	403	సామాన్య భాషాశాస్త్రం	5	25	75	100
4.	404	సంస్కృత సాహిత్య పరిచయం	5	25	75	100
5.	405	ఐచ్ఛికం: 1. ప్రబంధ సాహిత్యం 2. మాండలిక విజ్ఞానం	5	25	75	100

\* ప్రాజెక్ట్ వర్క్ 2వ సెమిస్టర్ తర్వాత మొదలై, 4వ సెమిస్టర్లో సమర్పణ, ప్రెజెంటేషన్, వైవా (మౌఖిక పరీక్ష) ఉంటుంది. మొత్తం 100 మార్కులు

ఆదికవి నన్నయ విశ్వవిద్యాలయం, ఎం.ఏ. తెలుగు పాఠ్యప్రణాళిక, మాదిరి ప్రశ్న పత్రాలు

**Minutes of meeting of the Board of Studies in Telugu held on 8-7-2016 at 10.00 AM at Department of Telugu, Adikavi Nannaya University Campus, Rajamahendravaram.**

1.	<b>Prof. V. Simmanna</b> Department of Telugu Andhra University Visakhapatnam	–	Convenor
2.	<b>Prof. S. Raghunadha Sarma</b> Rajamahendravaram	–	Honorary Member
3.	<b>Dr. A. Narayana Rao</b> Rajamahendravaram	–	Honorary Member
4.	<b>Dr. T. Vasu</b> Course Co-ordinator Department of Telugu Adikavi Nannaya University	–	Special Invitee
5.	<b>Dr. KVND Vara Prasad</b> Department of Telugu Adikavi Nannaya University	–	Special Invitee
6.	<b>Dr. T. Satyanarayana</b> Department of Telugu Adikavi Nannaya University	–	Special Invitee
7.	<b>Dr. D. Lakshmi Narasamma</b> Department of Telugu Adikavi Nannaya University	–	Special Invitee

ఆదికవి నన్నయ విశ్వవిద్యాలయం తెలుగు విభాగంలో ది. 8-7-2016న ఉదయం 10 గంటలకు జరిగిన సమావేశంలో BOS కన్వీనర్ మరియు సభ్యులు తీసుకున్న నిర్ణయాలు :

1. ఎం.ఏ. తెలుగు 4 సెమిస్టర్లు  $4 \times 5 = 20$  సబ్జెక్టులు.
2. విశ్వవిద్యాలయం నిర్ణయం-ప్రాజెక్టు వర్క్ (100 మార్కులు) 2వ సెమిస్టర్ తరువాత.
3. ప్రతి పేపర్లోను సిలబస్ 4 యూనిట్లుగా నిర్ణయించడమైంది.
4. ఈ పాఠ్యాంశాలు 2016-2017 విద్యాసంవత్సరం నుండి అమలౌతాయి.
5. ప్రతి పేపర్కి బోధన సమయం వారానికి 6 గంటలు.
6. ప్రతి పేపర్కి 5 క్రెడిట్లు కోర్సు మొత్తం 100 క్రెడిట్లు మరియు ప్రాజెక్ట్ 5 క్రెడిట్లు.
7. సెమిస్టర్ పరీక్షలకు 75 మార్కులు.  
ఇంటర్మీడియట్ 25 మార్కులు : 15 ఇంటర్మీడియట్ పరీక్షలు, 5 ఎసైన్మెంట్స్,  
5 ప్రజెంటేషన్.
8. ఎం.ఏ. తెలుగు ప్రవేశ పరీక్ష రాయడానికి అర్హతలు.
  1. B.A, B.Com, B.Sc. డిగ్రీలలో సాధారణ తెలుగు ఒక పేపర్ చదువుకున్న విద్యార్థులు.
  2. B.A. (స్పెషల్ తెలుగు), B.A.(OL) చదువుకున్న విద్యార్థులు.
9. సిలబస్ UGC-NET, AP-SET, JL, DL పరీక్షలకు అనుగుణంగా తయారుచేయబడింది.
10. ప్రాజెక్ట్ వర్క్ డిజర్టేషన్ 50 మార్కులు, ప్రజెంటేషన్ 25 మార్కులు, మౌఖిక పరీక్ష 25 మార్కులు,  
మొత్తం : 100 మార్కులు. ఇది విశ్వవిద్యాలయ ఆచార్యుని/అధ్యాపకుని సమక్షంలో జరుగుతుంది.
11. ఈ సిలబస్ ఉభయ గోదావరి జిల్లాలలోని విశ్వవిద్యాలయ అనుబంధ సెంటర్లకు 2016-17 విద్యాసంవత్సరం నుండి వర్తింపవుతుంది.



## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

### ఎం.ఏ. తెలుగు సిలబస్

ఎం.ఏ. తెలుగు (ప్రీవియస్) మొదటి సెమిస్టర్ :

- పేపర్ : 1 - తెలుగు భాషాచరిత్ర  
 పేపర్ : 2 - తెలుగు సాహిత్యచరిత్ర  
 పేపర్ : 3 - ఆంధ్రులచరిత్ర - సంస్కృతి  
 పేపర్ : 4 - కావ్య నాటకాలు  
 పేపర్ : 5 - జానపద విజ్ఞానం

ఎం.ఏ. తెలుగు (ప్రీవియస్) రెండవ సెమిస్టర్ :

- పేపర్ : 1 - తెలుగు భాషాచరిత్ర  
 పేపర్ : 2 - తెలుగు సాహిత్యచరిత్ర  
 పేపర్ : 3 - ఛందోవ్యాకరణాలంకారాలు  
 పేపర్ : 4 - కావ్య నాటకాలు  
 పేపర్ : 5 - ఐచ్ఛికం 1. స్త్రీవాద సాహిత్యం, 2. హేతువాద సాహిత్యం

ఎం.ఏ. తెలుగు (ఫైనల్) మూడవ సెమిస్టర్ :

- పేపర్ : 1 - ప్రాచీన సాహిత్య విమర్శ సిద్ధాంతాలు - సూత్రాలు  
 పేపర్ : 2 - నవ్యాంధ్ర కవిత్వం - దళిత సాహిత్యం  
 పేపర్ : 3 - సామాన్య భాషాశాస్త్రం  
 పేపర్ : 4 - జర్నలిజం - అనువాదం  
 పేపర్ : 5 - ఐచ్ఛికం : 1. నన్నయ, 2. కందుకూరి వీరేశలింగం

ఎం.ఏ. తెలుగు (ఫైనల్) నాల్గవ సెమిస్టర్ :

- పేపర్ : 1 - ఆధునిక సాహిత్య విమర్శ సిద్ధాంతాలు - సూత్రాలు  
 పేపర్ : 2 - నవ్యాంధ్ర వచన సాహిత్యం  
 పేపర్ : 3 - సామాన్య భాషాశాస్త్రం  
 పేపర్ : 4 - సంస్కృత సాహిత్య పరిచయం  
 పేపర్ : 5 - ఐచ్ఛికం : 1. ప్రబంధ సాహిత్యం, 2. మాండలిక విజ్ఞానం

## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ప్రథమ) మొదటి సెమిస్టర్

పేపర్-1 : తెలుగు భాషాచరిత్ర

యూనిట్ 1. (ఎ) భారతదేశంలో భాషలు - హింద్వార్య, ద్రావిడ, ముండా, సినో, టిబెటీన్ భాషా కుటుంబాలు.

(బి) హింద్వార్య ద్రావిడ భాషలు - పరస్పర ప్రభావం

యూనిట్ 2. (ఎ) ద్రావిడ భాషలు, తద్వ్యవహారాలు - వారి ప్రాంతాలు, ద్రావిడ భాషలలో తెలుగుస్థానం భౌగోళికంగా సరిహద్దు భాషలు

(బి) ద్రావిడ భాషా లక్షణాలు, ఆంధ్రము, తెలుగు, తెనుగు, పదాల పుట్టుపూర్వోత్తరాలు వాటి వ్యాప్తి.

యూనిట్ 3. (ఎ) ప్రాజున్నయ యుగాంధ్ర భాష, నన్నయ యుగాంధ్ర భాష, మధ్యయుగాంధ్ర భాష, ఆధునిక భాష.

(బి) చారిత్రకంగా తెలుగులో సంధి - ఆగమ సంధి, ఆదేశ సంధి, లోప సంధి, కళ, ద్రుత ప్రకృతికం - పదాల వర్గీకరణ - ప్రాచీన ఆధునిక తెలుగుభాషలో సంధి.

యూనిట్ 4. (ఎ) తెలుగు పద నిర్మాణం - నామవాచకం - లింగం - వచనం, ప్రాచీనాంధ్రం నుండి ఆధునిక ఆంధ్రం వరకూ వచ్చిన మార్పు, సర్వనామాలు - సంఖ్యావాచకాలు.

(బి) మాండలిక విజ్ఞానం, మాండలికాల ఆవిర్భావం - లక్షణాలు, భేదాలు, వ్యాప్తి, మాండలిక భూగోళం.

సంప్రదించవలసిన గ్రంథాలు :

1. తెలుగు భాషా వికాసం - ఆచార్య గంటి జోగిసోమయాజి.
2. తెలుగు భాషా చరిత్ర - ఆచార్య భద్రరాజు కృష్ణమూర్తి.
3. ద్రావిడ భాషలు - ఆచార్య పి.యస్. సుబ్రహ్మణ్యం.
4. తెలుగువాక్యం - ఆచార్య చేకూరి రామారావు.
5. సంధి - ఆచార్య కోరాడ రామకృష్ణయ్య.
6. ద్రావిడ భాషలు చరిత్ర - డా॥ కరెవరపు వెంకట్రామయ్య.
7. తెలుగు భాషాచరిత్ర - డా॥ వెలమల సిమ్మన్న.

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పేపర్-2 : తెలుగు సాహిత్యచరిత్ర

- యూనిట్ 1.** (ఎ) వాఙ్మయ, సారస్వత, సాహిత్య శబ్దార్థాలు - సాహిత్య చరిత్ర స్వరూప స్వభావాలు (అధ్యయన పద్ధతులు) 1.కాలానుసరణ, 2.చారిత్రక, 3.తులనాత్మక పద్ధతులు.
- (బి) ఆంధ్ర సాహిత్యచరిత్రకు అనువైన యుగవిభాగం-యుగకర్త నిర్దేశం ప్రాబ్లన్నయ యుగం-శాసనాలు-ఛందోవిశేషాలు-కావ్య సంభాష్యత.

- యూనిట్ 2.** (ఎ) నన్నయయుగం (1000-1100) భారతాంధ్రీకరణకు చారిత్రక నేపథ్యం, నన్నయ భారతాంధ్రీకరణ పద్ధతి-నన్నయ కవితారీతులు-ఆత్మీయత-యుగప్రాముఖ్యం.
- (బి) శివకవియుగం(1101-1245) పాల్కురికి సోమనాథుని కృతుల సమీక్ష- మార్గ, దేశి, వస్తుకవితల స్వరూపం- జానుతెనుగు స్వభావం.
- ఇతర కవులు : 1. నన్నెచోడుడు, 2. శివదేవయ్య, 3. చక్రపాణి రంగనాథుడు, 4. యుధావాక్కుల అన్నమయ్య - శివకవి యుగ ప్రత్యేకత.

- యూనిట్ 3.** (ఎ) తిక్కన యుగం (1245-1301) తిక్కన (సమన్వయ దృష్టి) హరిహరనాథ తత్వం - తిక్కన కృతుల సమీక్ష - కవితా రీతులు - ఆత్మీయత.
- ఇతర కవులు : 1. కేతన, 2. మారన, 3. మంచెన, 4. గోన బుద్ధారెడ్డి.
- (బి) ఎఱ్ఱన యుగం (1301-1350) - ఎఱ్ఱన కృతుల పౌర్యాపర్యం -కృతుల సమీక్ష - నాచన సోమనాథుని కృతి సమీక్ష-ఎఱ్ఱన, సోమనల కవితా తారతమ్యం.

- యూనిట్ 4.** (ఎ) భాస్కరరామాయణ కృతి సమీక్ష.
- ఇతర కవులు : 1. మేములవాడ భీమకవి, 2. కృష్ణమాచార్యులు.
- శ్రీనాథయుగం (1361-1500) శ్రీనాథుని కృతుల సమీక్ష - నైషధాంధ్రీకరణ పద్ధతి - కవితారీతులు - ఆత్మీయత.
- (బి) పోతన కృతులు - సమీక్ష.
- ఇతర కవులు : 1. పినవీరన (శృంగార శాకుంతలం), 2. గౌరన (హరిశ్చంద్రోపాఖ్యానం) 3. జక్కన(విక్రమార్క చరిత్రం), 4. అనంతామాత్యుడు (భోజరాజీయం), 5.అన్నమయ్య - వేమనల సామాజిక సంస్కరణ దృక్పథం.

సంప్రదించవలసిన గ్రంథాలు :

1. ఆంధ్ర సాహిత్య చరిత్ర - పింగళి లక్ష్మీకాంతం.
2. తెలుగు సాహిత్య చరిత్ర (సంపుటం 1-2) - ఆచార్య కొర్లపాటి శ్రీరామమూర్తి.
3. తెలుగు సాహిత్య సమీక్ష - ఆచార్య జి. నాగయ్య.
4. ఆరుద్ర - సమగ్రాంధ్ర సాహిత్యం - (1,2,3,4 సంపుటాలు)



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పేపర్-3 : ఆంధ్రుల చరిత్ర - సంస్కృతి

యూనిట్ 1. (ఎ) సంస్కృతి - నిర్వచనం; ఆంధ్రజాతి వ్యాప్తి - తెలుగు ప్రాదేశికత్వం - (ఆంధ్రదేశం పూర్వకాలపు పేర్లు) - తెలుగుభాష ప్రాచీనత - ఊళ్లపేర్లు - ఇళ్లపేర్లు.

(బి) తెలుగు పండుగలు - సంస్కృతి, తెలుగు నృత్యకళ కూచిపూడి - ఇతరనృత్యాలు.

యూనిట్ 2. (ఎ) ఆంధ్ర రాజ్య స్థాపనం - శాతవాహనులు - ప్రజల సంఘజీవనం - ఇక్ష్వాకులు - పల్లవులు - బృహత్పలాయనులు - శాలంకాయన రాజ్యాల సంస్కృతి - సాహిత్యసేవ.

(బి) చాళుక్య, చోడులు వెలనాటి - తెలుగుచోడుల సాహిత్యసేవ.

యూనిట్ 3. (ఎ) కాకతీయులు - రెడ్డిరాజ్యాల పాలనా వైభవం - సాహిత్య సేవ.

(బి) విజయనగర సామ్రాజ్యం - నాయక, గోల్కొండ రాజ్యాల సాహిత్య సేవ.

యూనిట్ 4. (ఎ) ఆధునిక యుగం-స్వాతంత్ర్యోద్యమం-భాషా ప్రాతిపదిక రాష్ట్రాలు - ప్రత్యేక రాష్ట్ర ఉద్యమాలు.

(బి) నవీనాంధ్ర నిర్మాతలు: కందుకూరి, గురజాడ, చిలకమర్తి, రఘుపతి వెంకటరత్నం నాయుడు, న్యాపతి సుబ్బారావు, దుగ్గిరాల, కాశీనాథుని, పట్టాభి సీతారామయ్య, టంగుటూరి, పొట్టి శ్రీరాములు, గాడిచర్ల, కట్టమంచి, మోక్షగుండం, దుర్గాబాయి దేశ్ముఖ్, ఎన్.జి.రంగా, నందమూరి తారక రామారావు.

సంప్రదించవలసిన గ్రంథాలు :

1. ఆంధ్రుల చరిత్ర - సంస్కృతి - ఖండవల్లి లక్ష్మీరంజనం, బాలేందు శేఖరం
2. ఆంధ్రుల సాంఘిక చరిత్ర - సురవరం ప్రతాపరెడ్డి.
3. ఆంధ్రుల సంస్కృతి - చరిత్ర - కంభంపాటి సత్యనారాయణ.
4. ఆంధ్రు సంక్షిప్త చరిత్ర - ఏటుకూరి బలరామమూర్తి.
5. ఆధునిక ఆంధ్రప్రదేశ్ చరిత్ర - పి. రాఘనాథరావు.
6. సమగ్రాంధ్రదేశచరిత్ర (5 సంపుటాలు) - ముప్పాళ్ళ హనుమంతరావు.

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పేపర్-4 : కావ్యనాటకాలు

యూనిట్ 1. నన్నయ - మహాభారతం - ఆదిపర్వం - ద్వితీయాశ్వాసం - సౌపర్ణాఖ్యానం, 26వ పద్యం “అమృతముతోనుద్భవమై ..... ” నుండి 56వ పద్యం “అనిలుడు పక్షయుగ్మ....” పద్యం వరకు.

యూనిట్ 2. ఎఱ్ఱన - మహాభారతం - అరణ్యపర్వం - పంచమాశ్వాసం - ధర్మవ్యాధోపాఖ్యానం 27వ వచనం “అక్షణంబు.... ” నుండి 112 ‘నీవడిగిన....’ వచనం వరకు.

యూనిట్ 3. జాషువ - గబ్బిలం (మొదటి భాగం)

యూనిట్ 4. (ఎ) శ్రీశ్రీ - మహాప్రస్థానం (సంకలనం)  
(బి) ఆత్రేయ - ఎన్.జి.ఓ. నాటకం.

సంప్రదించవలసిన గ్రంథాలు :

1. ఆంధ్రమహాభారత వ్యాఖ్యాన గ్రంథాలు - టి.టి.డి. ప్రచురణ.
2. జాషువా సాహిత్యం.
3. శ్రీశ్రీ కవిత్వం - మిరియాల రామకృష్ణ.
4. ఆత్రేయ సాహితీ - నాటకాలు.



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పేపర్-5 : జానపద విజ్ఞానం

యూనిట్ 1. (ఎ) జానపద విజ్ఞానం నిర్వచనం-లక్షణాలు, వర్గీకరణ ఆటవిక, గ్రామీణ, నాగరిక విజ్ఞానాలు తారతమ్యాలు.

(బి) పాశ్చాత్యుల జానపద విజ్ఞాన కృషి, ఆంధ్రుల జానపద విజ్ఞాన కృషి.

యూనిట్ 2. (ఎ) జానపద కళలు - ప్రదర్శక, అప్రదర్శక కళలు

(బి) జ్ఞానపద భాష : మాండలికాలు, సంధులు, జాతీయాలు, నామ విజ్ఞానం - ధ్వనుల మార్పు, పదజాలం, అన్యదేశాలు, మారుమూల పదాలు, జానపద నిరుక్తి.

యూనిట్ 3. (ఎ) జానపద సాహిత్యం - లక్షణాలు, వర్గీకరణ, జానపద గేయం - నిర్వచనం లక్షణాలు

(బి) జానపద గేయాల్లోని రకాలు : శ్రామిక-స్త్రీల-పిల్లల-కౌటుంబిక-శృంగార-హాస్య-కరుణ పారమార్థిక గేయాలు.

యూనిట్ 4. (ఎ) సామెత, పొడుపు కథ - నిర్వచనం, లక్షణాలు, వర్గీకరణ

(బి) నీతి కథలు, అద్భుత కథలు, జానపద పురాణాలు, జానపద సాహిత్యం - సాంఘిక విశేషాలు.

సంప్రదించవలసిన గ్రంథాలు :

1. జానపద విజ్ఞానాధ్యయనం - డా॥ జి.ఎస్. మోహన్.
2. ఆంధ్రుల జానపద విజ్ఞానం - ఆచార్య ఆర్పీయస్ సుందరం.
3. తెలుగు జానపద గేయ సాహిత్య - డా॥ బి. రామరాజు.
4. పొడుపు కథ - ఆచార్య కసిరెడ్డి వెంకటరెడ్డి.
5. జానపద గేయగాథలు - నాయని కృష్ణకుమారి.

## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

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పేపర్-1 : తెలుగు భాషాచరిత్ర

యూనిట్ 1. (ఎ) తెలుగులో గ్రాంథిక, వ్యావహారిక శైలులు - నిర్వచనం, ఉత్పత్తి వికాసాలు.  
(బి) ఆధునిక ప్రామాణిక తెలుగుభాష - ఆవశ్యకం.

యూనిట్ 2. (ఎ) క్రియ : క్రియాధాతు నిర్మాణం - ప్రాథమికం, ద్వితీయం - సకర్మకం - ఆకర్మకం  
(బి) సమాపక క్రియలు - అసమాపక క్రియలు, భూత, భవిష్యద్వర్తమాన కాలాలు - చరిత్ర, సంయుక్తక్రియా నిర్మాణం.

యూనిట్ 3. (ఎ) పదజాలం : దేశ్యం, దేశ్యేతరం.  
(బి) హింద్యార్య, మధ్య ప్రాచ్య, పాశ్చాత్య, ద్రావిడ భాషల నుండి తెలుగులోకి వచ్చి చేరిన సమీకృత పదాలు - అసమీకృత పదాలు.  
(సి) ధ్వని పరిణామం

యూనిట్ 4. (ఎ) అర్థ పరిణామం  
(బి) వాక్య నిర్మాణం - పురుష బోధక ప్రత్యయాలు  
(సి) ఔపవిభక్తికాలు - విభక్తి ప్రత్యయాలు

సంప్రదించవలసిన గ్రంథాలు :

1. ఆంధ్రభాషా వికాసం - ఆచార్య గంటిజోగి సోమయాజి.
2. తెలుగుభాషా చరిత్ర - ఆచార్య భద్రరాజు కృష్ణమూర్తి.
3. ద్రావిడ భాషలు - ఆచార్య పి.ఎన్. సుబ్రహ్మణ్యం.
4. తెలుగు వాక్యం - ఆచార్య చేకూరి రామారావు.
5. సంధి - ఆచార్య కోరాడ రామకృష్ణయ్య.
6. ఎ స్టడీ ఆఫ్ తెలుగు సెమాన్టిక్స్ - ఆచార్య జి.ఎన్. రెడ్డి.
7. ద్రావిడ భాషలు చరిత్ర - డా॥ కఠవరపు వెంకట్రామయ్య.
8. ఆంధ్ర విశ్వకళా పరిషత్తు - వ్యావహారిక తెలుగు భాషా వ్యాప్తి - డా॥ బి.వి. రమణారెడ్డి.
9. తెలుగు భాషా చరిత్ర - డా॥ వెలమల సిమ్మన్న.

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పేపర్-2 : తెలుగు సాహిత్యచరిత్ర

యూనిట్ 1. (ఎ) రాయలయుగం (1501-1600)-ప్రబంధయుగం-ప్రబంధలక్షణాలు, అష్టదిగ్గజకవుల పరిచయం.

- (బి) కవులు : శ్రీకృష్ణదేవరాయలు (అముక్తమాల్యద), 1. అల్లసాని పెద్దన (మనుచరిత్ర)  
2.నంది తిమ్మన (పారిజాతాపహరణం), 3. ధూర్జటి (శ్రీకాళహస్తీశ్వర మాహాత్మ్యం),  
4.మాదయ్యగారి మల్లన (రాజశేఖర చరిత్ర), 5. అయ్యలరాజు రామభద్రుడు (రామాభ్యుదం),  
6. రామరాజభూషణుడు (వసుచరిత్ర), 7. పింగళి సూరన (కళాపూర్ణోదయం, ప్రభావతీ ప్రద్యుమ్నం), 8. తెనాలి రామకృష్ణుడు (పాండురంగ మాహాత్మ్యం).

యూనిట్ 2. (ఎ) రాయలయుగం - ఇతర కవులు : 1. కందుకూరి రుద్రకవి (నిరంకుశోపాఖ్యానం)

2. చింతలపూడి ఎల్లనార్యుడు (రాధామాధవీయం), 3. చెదలవాడ మల్లన (విప్రనారాయణచరిత్రం).

- (బి) 1. నాదెండ్ల గోపనమంత్రి (కృష్ణార్జున సంవాదం), 2. అద్దంకి గంగాధరుడు (తపతీ సంవరణోపాఖ్యానం), 3. సంకుసాల సృసింహకవి (కవి కర్ణరసాయనం), 4. పొన్నికంటి తెలగన (యయాతి చరిత్ర), 5. కంకంటి పాపరాజు (ఉత్తర రామాయణం).

యూనిట్ 3. (ఎ) దక్షిణాంధ్ర యుగం (1601-1855) తంజావూరు, మధుర, పుదుక్కోట, మైసూరు పాలకుల వాఙ్మయసేవ, చేమకూర వేంకటకవి.

రఘునాథ నాయకుల కృతుల సమీక్ష, యక్షగాన, వచన కావ్య ప్రక్రియల పుట్టుక - వికాసం.

- (బి) ఈ యుగంలోని ఇతర కవులు : 1. రంగాజమ్మ (మన్నారుదాస విలాస నాటకం),  
2. మద్దుపళని (రాధికా సాంత్వనం), 3. సముఖం వెంకటకృష్ణనాయకుడు (జైమినీభారతం-వచన ప్రబంధం), 4. శేషం వేంకటపతి (తారాశశాంకం), 5. కలువె వీర్రాజు (ఆంధ్రవచన భారతం), దక్షిణాంధ్రయుగం వైశిష్ట్యం.

యూనిట్ 4. (ఎ) క్షీణయుగం-క్షీణయుగం కవితాలక్షణాలు: వివిధ సంస్థానాలు, (1. విజయనగరం, 2. పెద్దాపురం, 3. వెంకటగిరి, 4. గద్వాల) వాఙ్మయసేవలు సంక్షిప్తంగా, కూచిమంచి తిమ్మన కృతుల సమీక్ష.

- (బి) ఇతర కవులు : 1. పాలవేకరి కదరీపతి (శుకసప్తతి), 2. ఏనుగు లక్ష్మణకవి (సుభాషిత రత్నావళి), 3. ఆడిదం సూరన (కవిజనరంజనం), 4. పిండిప్రోలు లక్ష్మణకవి (రావణదమ్మీయం), 5. గోగులపాటి కూర్మనాథకవి (నారసింహశతకం), 6. కాసుల పురుషోత్తమకవి (ఆంధ్ర నాయక శతకం) - పాశ్చాత్యుల వాఙ్మయసేవ, ప్రత్యేకించి సి.పి. బ్రౌన్.

సంప్రదించవలసిన గ్రంథాలు :

1. ఆంధ్ర సాహిత్య చరిత్ర - పింగళి లక్ష్మీకాంతం.
2. తెలుగు సాహిత్య చరిత్ర (సంపుటం 3,4,5) - ఆచార్య కొల్లపాటి శ్రీరామమూర్తి.
3. తెలుగు సాహిత్య సమీక్ష - ఆచార్య జి. నాగయ్య.
4. ఆంధ్ర ప్రబంధము - అవతరణ వికాసములు - కె.వి.ఆర్. నరసింహం.
5. దక్షిణాంధ్రయుగ వాఙ్మయచరిత్ర - కె.వి.ఆర్. నరసింహం.
6. తంజావూరాంధ్ర సాహిత్యచరిత్ర - కొక్కొండ సత్యవతి.
7. ఉష:కిరణాలు - యండమూరి సత్యనారాయణ
8. ఆంధ్ర సంస్థానములు - సాహిత్య పోషణములు - తూమాటి దొణప్ప.

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పేపర్-3 : ఛందోవ్యాకరణాలంకాలు

- యూనిట్ 1. (ఎ) బాలవ్యాకరణం - సంజ్ఞా పరిచ్ఛేదం.  
(బి) బాలవ్యాకరణం - సంధి పరిచ్ఛేదం.

యూనిట్ 2. బాల వ్యాకరణం - తత్సమ పరిచ్ఛేదం.

- యూనిట్ 3. (ఎ) బాల వ్యాకరణం - సమాస పరిచ్ఛేదం.  
(బి) ప్రాధవ్యాకరణం - వాక్య పరిచ్ఛేదం.

- యూనిట్ 4. (ఎ) అప్పకవీయం - యతులు. 1. యతి నిర్వచనం, 2. స్వరవళులు అన్నీ, 3. వ్యంజనాక్షర విరతులు :- 1. ప్రాణి విరామములు, 2. వర్గజ యతులు, 3. బిందు యతులు, 4. మువిభక్తి యతులు, 5. ముకారయతి, 6. మ వర్గ విరామములు, 7. ఋజు యతులు, 8. ప్రత్యేక యతులు, 9. సరస వళులు, 10. భిన్న యతులు.  
అప్పకవీయం: ప్రాసలు: 1. రేఫయుత ప్రాస, 2. వికల్ప ప్రాస, 3. ఉభయ ప్రాస, 4. అనునాసిక ప్రాస, 5. అభేద ప్రాస, 6. అంత్య ప్రాస.  
(బి) అర్థాలంకారాలు : 1. ఉపమ, 2. రూపక, 3. ఉత్పేక్ష, 4. దీపక, 5. సమాసోక్తి, 6. శ్లేష, 7. వ్యాజస్తుతి, 8. కావ్య లింగ, 9. అర్థాంతరన్యాస, 10. వక్రోక్తి, 11. అతిశయోక్తి, 12. నిదర్శన, 13. దృష్టాంత, 14. సద్యోక్తి, 15. పరికర.  
శబ్దాలంకారాలు : అంత్యానుప్రాస, ఛేకాను ప్రాస, లాటాను ప్రాస, యమకం, ముక్త పదగ్రంథం.

సంప్రదించవలసిన గ్రంథాలు :

1. బాలవ్యాకరణం - చిన్నయసూరి.
2. బాలవ్యాకరణం - వ్యాఖ్యానం - వంతరాం రామకృష్ణారావు.
3. రమణీయం - దువ్వూరి వెంకటరమణశాస్త్రి.
4. అప్పకవీయం - కాకుసూరి అప్పకవి.
5. అప్పకవీయ భావ ప్రకాశిక - రావూరి దొరసామిశర్మ.
6. చంద్రాలోక సమున్మేషం - స్ఫూర్తిశ్రీ.

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పేపర్-4 : కావ్యనాటకాలు

యూనిట్ 1. తిక్కన - మహాభారతం - ఉద్యోగపర్వం - ద్వితీయాశ్వాసం - విదురసీతి, 30వ వచనం “నీవు ధర్మాధర్మ విదుండవు.....” నుండి 27 వ పద్యం “ అనుడు ముదంబు...” వరకు.

యూనిట్ 2. పోతన - భాగవతం - దశమస్కంధం - ఉత్తరభాగం - కుచేలోపాఖ్యానం. 963వ పద్యం ‘హరిభజియించు.....’ నుండి 1031వ వచనం ‘అట్టి పురుషోత్తముండు....’ వరకు.

యూనిట్ 3. (ఎ) విశ్వనాథ సత్యనారాయణ - ఆంధ్రప్రశస్తి నుండి ‘వేంగిక్షేత్రము’ ఖండిక  
(బి) తిలక్ - అమృతం కురిసిన రాత్రి (సంకలనం)

యూనిట్ 4. కాళ్ళకూరి నారాయణరావు ‘వరవిక్రయం’ నాటకం

సంప్రదించవలసిన గ్రంథాలు :

1. మహాభారత వ్యాఖ్యానాలు - టి.టి.డి. ప్రచురణ.
2. తిక్కన కావ్య శిల్పం - కేతవరపు రామకోటీశ్వరరావు.
3. పోతన - నిడదవోలు వేంకటరావు.
4. పోతన భాగవతం.
5. ఆంధ్రప్రశస్తి - విశ్వనాథ సత్యనారాయణ.
6. ‘అమృతం కురిసిన రాత్రి’ - తిలక్.
7. వరవిక్రయం నాటకం - కాళ్ళకూరి నారాయణరావు.



## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

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పేపర్-5 : ఐచ్ఛికాంశం - 1. స్త్రీవాద సాహిత్యం

- యూనిట్ 1. (ఎ) స్త్రీవాద నిర్వచనం - లక్షణాలు - నేపథ్యం  
(బి) భారతదేశంలో స్త్రీవాద ఉద్యమాలు - పుట్టుపూర్వోత్తరాలు
- 

- యూనిట్ 2. (ఎ) స్త్రీవాదం వివిధ ధోరణులు  
(బి) తెలుగులో స్త్రీవాద సాహిత్యం - పరిణామ వికాసం
- 

- యూనిట్ 3. స్త్రీవాద కవిత్వం - నీలిమేఘాలు (సంకలనం)
- 

- యూనిట్ 4. (ఎ) స్త్రీవాద నవల - సహజ - ఓల్గా.  
(బి) స్త్రీవాద కథలు - ఇల్లలకగానే - పి.సత్యవతి.
- 

సంప్రదించవలసిన గ్రంథాలు :

1. మాకు గోడలు లేవు (స్త్రీవాద సిద్ధాంత పరిచయం) - అస్మిత.
2. సరిహద్దులు లేని సంధ్యలు - అస్మిత.
3. స్త్రీవాద విచారాలు - ఆచార్య యస్వీ సత్యనారాయణ.
4. మనకు తెలియని మన చరిత్ర - అస్మిత.

పాఠ్య గ్రంథాలు :

1. నీలి మేఘాలు (కవితలు) - ఓల్గా.
2. సహజ - ఓల్గా.
3. ఇల్లలకగానే - పి. సత్యవతి.





## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

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పేపర్-5 : ఐచ్ఛికాంశం - 2. హేతువాద సాహిత్యం

- యూనిట్ 1. (ఎ) హేతువాద నిర్వచనం - లక్షణాలు - ఉద్యమం  
(బి) హేతువాదం ఇతర వాదాలతో గల సంబంధం - చార్వాకం, నాస్తికవాదం, మానవవాదం, సామ్యవాదం.

- యూనిట్ 2. (ఎ) హేతువాద నిర్వచనం - ఆంగ్ల భాషా ప్రభావం.  
(బి) ప్రముఖ హేతువాద రచయితలు - సాహిత్యం - సంక్షిప్త పరిచయం.

- యూనిట్ 3. (ఎ) హేతువాద కవిత్వం - శతకాలు  
(బి) ఖానీ - త్రిపురనేని రామస్వామి చౌదరి

- యూనిట్ 4. (ఎ) సీత అగ్నిప్రవేశం - చలం  
(బి) హేతువాదంలో వ్యాసం - పరిశోధనా వ్యాసం

పాఠ్య గ్రంథాలు :

1. ఖానీ - త్రిపురనేని రామస్వామి చౌదరి
2. సీత అగ్ని ప్రవేశం - చలం

సంప్రదించవలసిన గ్రంథాలు :

1. ఆంధ్రప్రదేశ్ లో హేతువాద ఉద్యమం - రావిపూడి వెంకటాద్రి.
2. తెలుగు పౌరాణిక నాటకాలు - హేతువాదం - డా॥ జి. ప్రభాకర్.
3. నాస్తికవాదం - హేతువాదం - మానవవాదం - రంగనాయకమ్మ.
4. పౌరాణిక రూపకాలు - భావ విప్లవం - ఆచార్య కొండపల్లి సుదర్శనరాజు
5. హేతువాదం - రావిపూడి వెంకటాద్రి.
6. ఆంధ్రప్రదేశ్ లో హేతువాద మానవవాద ఉద్యమాలు (సం.) - డా॥ ఆవుల మంజులత.
7. హేతువాద వ్యాసావళి - ఆచార్య కొండపల్లి సుదర్శనరాజు.

## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

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### పేపర్-1 : ప్రాచీన సాహిత్య విమర్శ సిద్ధాంతాలు - సూత్రాలు

యూనిట్ 1. (ఎ) 1. విమర్శ-నిర్వచనం, అవశ్యకం, ప్రయోజనం, 2. సహృదయుడు-వివిధ అభిప్రాయాలు.

(బి) 1. ఉత్తమ విమర్శకుని లక్షణాలు, బాధ్యతలు, 2. విమర్శ భేదాలు, పద్ధతులు.

యూనిట్ 2. (ఎ) 1. కావ్యం, కవిత్వం - ప్రాచ్య, పాశ్చాత్య నిర్వచనాలు, భేద సాదృశ్యాలు.

2. కావ్యభేదాలు - ప్రాచ్య, పాశ్చాత్య ఆలంకారికులు విశ్లేషణ.

(బి) 1. కావ్యహేతువులు-వివిధ అభిప్రాయాలు, 2. కావ్యాత్మ-వివిధ ఆలంకారికుల అభిప్రాయాలు.

యూనిట్ 3. (ఎ) 1. రస సిద్ధాంతం - విభిన్న ఆలంకారికులమతం, 2. రసం-కెథార్సిస్-భేద సాదృశ్యాలు.

(బి) 1. రసనిష్ఠ - వివిధ అభిప్రాయాలు, 2. రస సంఖ్య - నవరస, ఏకరస వాదాలు,

3. ధ్వని-నిర్వచనం, భేదాలు, ధ్వనిభావ వాదాలు, 4. త్రివిధ శబ్ద వృత్తులు స్వరూపస్వభావాలు

యూనిట్ 4. (ఎ) 1. ప్రాచ్య, పాశ్చాత్య నాటకోత్పత్తి వాదాలు, 2. నాటక లక్షణాలు, 3. కావ్యావతారికలు - విమర్శ స్వరూప స్వభావాలు, 4. చాటు పద్యాలు - విమర్శ స్వరూప స్వభావాలు.

(బి) 1. ప్రాచీన సాహిత్య ప్రక్రియలు - ఇతిహాసం, పురాణం, వాటి విమర్శ.

2. ప్రాచీన సాహిత్య ప్రక్రియలు - కావ్యం, శతకం, వాటి విమర్శ.

సంప్రదించవలసిన గ్రంథాలు :

1. సాహిత్యదర్శనం - కె.వి.ఆర్. నరసింహం.
2. కావ్యాలంకారసంగ్రహం - సన్నిధానం సూర్యనారాయణ శాస్త్రి వ్యాఖ్య.
3. సాహిత్య శిల్పసమీక్ష - పింగళి లక్ష్మీకాంతం.
4. తెలుగు కావ్యావతారికలు - జి. నాగయ్య.
5. సాహిత్యభావాలహరి - ఎస్వీ. జోగారావు.
6. తెలుగు సాహిత్య విమర్శ సిద్ధాంతాలు - సూత్రాలు - వెలమల సిమ్మన్న.
7. ప్రాచీనాంధ్రకవుల సాహిత్యాభిప్రాయాలు - అభిరుచులు - రాచపాలెం చంద్రశేఖరరెడ్డి.
8. విమర్శాశిల్పం - వల్లంపాటి వెంకటసుబ్బయ్య.
9. తెలుగులో సాహిత్య విమర్శ - అవతరణ - వికాసములు - ఎస్వీ రామారావు.
10. తెలుగులో సాహిత్య విమర్శ - పాటిబండ మాధవ శర్మ.
11. పట్నది - అప్పజోడు వెంకటసుబ్బయ్య.
12. కవితాకళ - ఆచార్య తిరుమల.
13. విమర్శ మౌళికలక్షణాలు - ముదిగొండ వీరభద్రయ్య.
14. అనుశీలన - వడలి మందేశ్వరరావు.
15. సాహిత్యం - విమర్శ - వడలి మందేశ్వరరావు.

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పేపర్-2 : నవ్యాంధ్ర కవిత్వం - దళిత సాహిత్యం

యూనిట్ 1. (ఎ) నవ్యాంధ్ర కవిత్వ హేతువులు - లక్షణాలు - యుగకర్త, సంఘ సంస్కరణోద్యమ కవిత్వం - లక్షణాలు

(బి) భావకవిత్వం నిర్వచనం - వివిధ శాఖలు, అభ్యుదయ కవిత్వ స్వరూప స్వభావాలు.

యూనిట్ 2. (ఎ) దిగంబర కవిత్వం సమీక్ష, విష్ణవ కవిత్వం సమీక్ష

(బి) స్త్రీవాద కవిత్వ స్వరూప స్వభావాలు, మైనారిటీ కవిత్వం.

యూనిట్ 3. (ఎ) దళిత సాహిత్యం పరిధి, నిర్వచనం, నేపథ్యం - దళిత సాహిత్య ఆవిర్భావ వికాసాలు

(బి) దళిత సాహిత్యం - ఉద్యమాల, వ్యక్తుల ప్రభావం

యూనిట్ 4. (ఎ) దళిత కవిత్వ లక్షణాలు - స్వరూప స్వభావాలు - సంకలనాలు

(బి) దళిత కథ, నవల, నాటక సాహిత్యం - తాత్విక దృక్పథం.

సంప్రదించవలసిన గ్రంథాలు :

1. ఆధునికాంధ్ర కవిత్వం - సంప్రదాయాలు - ప్రయోగాలు - డా॥ సి. నారాయణరెడ్డి.
2. తెలుగులో కవితా విష్ణవాల స్వరూపం - డా॥ వెల్చేరు నారాయణరావు.
3. తెలుగులో కవితా వికాసం - డా॥ కడియాల రామమోహనరావు.
4. స్త్రీవాద వివాదాలు (సం.) - డా॥ యస్వీ సత్యనారాయణ.
5. 20వ శతాబ్దపు తెలుగు కవిత్వం - డా॥ కడియాల రామమోహనరావు.
6. తెలుగు సాహిత్య విమర్శ సిద్ధాంతాలు - సూత్రాలు - ఆచార్య వెలమల సిమ్మన్న.
7. తెలుగులో కవితోద్యమాలు (సం.) - డా॥ ఆవుల మంజులత.
8. మైనారిటీ కవిత్వం - తాత్విక నేపథ్యం - డా॥ ఎస్. షమీ ఉల్లా.
9. దళిత సాహిత్యం - తాత్విక దృక్పథం - జి. లక్ష్మీనరసయ్య.
10. దళిత సాహిత్య తత్వం - శిఖామణి.
11. దళిత సాహిత్య దర్శనం - ఆచార్య కొండపల్లి సుదర్శనరాజు, ఆచార్య వెలమల సిమ్మన్న.

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పేపర్-3 : సామాన్య భాషాశాస్త్రం

యూనిట్ 1. (ఎ) భాష - నిర్వచనం, స్వభావం, పుట్టుక, వికాసం - వివిధ సిద్ధాంతాలు - మానవ భాషకున్న ప్రత్యేకతలు.

(బి) భాషా విజ్ఞాన శాస్త్రం - ప్రాచ్య పాశ్చాత్య దేశాలలో భాషా శాస్త్రాభివృద్ధి, చరిత్ర.

యూనిట్ 2. (ఎ) వర్ణనాత్మక, చారిత్రక, తులనాత్మక భాషాశాస్త్రం - భాషాశాస్త్రంలోని వివిధ సంప్రదాయాలు (Schools).

(బి) భాషల వర్గీకరణ - భౌగోళిక, వంశానుగుణ, పదాంశానుగుణ విభజన - ప్రధాన ప్రపంచభాషా కుటుంబాలు.

యూనిట్ 3. (ఎ) ధ్వని మార్పు - భాషా పరిణామం - హేతువులు, మార్పులు రకాలు.

ధ్వని సూత్రం, స్వభావం, ధ్వని సూత్రాలకు అపవాదాలు, అర్థవిపరిణామం.

(బి) తులనాత్మక పద్ధతి - మూల భాష పునర్నిర్మాణం - లాభాలు.

అంతరంగిక పునర్నిర్మాణం - పరిమితులు.

యూనిట్ 4. (ఎ) భాషలోని ఆదానాలు-ఆదానాలలోని రకాలు - భౌగోళిక, సాంస్కృతిక, సన్నిహిత ఆదానాలు

(బి) తెలుగు భాషలోని అన్యదేశాలు.

సంప్రదించవలసిన గ్రంథాలు :

1. Bloomfield, L – Language.
2. Hocket, C.F. – Course in Modern Linguistics.
3. H.A. Gleason, J – An Introduction to Descriptive Linguistics.
4. Lahmann, W.P. – Historical Linguistics – An Introduction.
5. S.K. Varma – General Linguistics.
6. Cruse – Semantics.
7. సుబ్రహ్మణ్యం, పి.ఎస్. - అధునిక భాషాశాస్త్ర సిద్ధాంతాలు.
8. చక్రధరరావు, ఎల్. - భాషాశాస్త్ర వ్యాసాలు.
9. దొణప్ప, టి. - భాషా చారిత్రక వ్యాసావళి.
10. వెలమల సిమ్మన్న - ప్రపంచ భాషలు.
11. చేకూరి రామారావు - భాషాపరివేషం.
12. బూదరాజు రాధాకృష్ణ - భాషాశాస్త్ర వ్యాసాలు.
13. భద్రరాజు కృష్ణమూర్తి - భాష - సమాజం - సంస్కృతి.
14. బూదరాజు రాధాకృష్ణ - ఆధునికాంధ్రభాష సంగ్రహం.

## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ద్వితీయ) మూడవ సెమిస్టర్

పేపర్-4 : జర్నలిజం - అనువాదం

- యూనిట్ 1. (ఎ) కమ్యూనికేషన్ నిర్వచనం, స్వభావం, అంశాలు, విధులు, రకాలు, మాస్ కమ్యూనికేషన్ - సహజ పాత్ర.
- (బి) పత్రికారచన - పుట్టుక - పరిణామం, తొలి తెలుగు పత్రిక, తెలుగు ముద్రణ - పుట్టుపూర్వోత్తరాలు.
- 
- యూనిట్ 2. (ఎ) వార్త - నిర్వచన, లక్షణాలు, వార్తాంశాలు, వార్తా విలువలు, రకాలు, వనరులు, వార్తా సేకరణ విధానాలు - బీట్లు, ఇంటర్వ్యూలు, పత్రికా ప్రకటనలు, సభలు - సమావేశాలు.
- (బి) వార్తా సేకర్త (విలేకరి) - అర్హతలు, లక్షణాలు, విలేకర్ల రకాలు, వార్తా సేకరణలో పాటించదగ్గ మెళుకువలు - జాగ్రత్తలు.
- 
- యూనిట్ 3. (ఎ) వార్తా రచన సూత్రాలు - నియమాలు, ప్రత్యేక సందర్భాల్లో వార్తరచన.
- (బి) సంపాదకుని విధులు - సంపాదకీయం - ప్రముఖ సంపాదకీయాలు, ఉపసంపాదకుడు - అర్హతలు, లక్షణాలు, విధులు - బాధ్యతలు - వార్తా రచనలో తీసుకోవలసిన జాగ్రత్తలు.
- 
- యూనిట్ 4. (ఎ) తొలితరం పత్రికలు - వృత్తాంతి, హితవాది, వివేకవర్ధిని.  
తొలితరం పాత్రికేయులు - కందుకూరి, గాడిచర్ల, తాపీ, కాశీనాథుని.
- (బి) ఎలక్ట్రానిక్ మీడియా - టి.వి. రేడియో, అంతర్జాలం.  
అనువాదం - నిర్వచనం - అనువాద పద్ధతులు - అనువాదంలో రకాలు.
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సంప్రదించవలసిన గ్రంథాలు :

1. తెలుగు జర్నలిజం - డా॥ వి. లక్ష్మణరెడ్డి.
2. వార్తా రచన - కె. శ్రీరామచంద్రమూర్తి.
3. తెలుగు జర్నలిజం - పరిచయం - డా॥ బూదరాజు రాధాకృష్ణ.
4. పత్రికారచన - పరిచయాంశాలు - డా॥ గజ్జా యోహాన్ బాబు.
5. ఎ.బి.కె. సంపాదకీయాలు.
6. భారతీయ పత్రికారంగచరిత్ర - మాడభూషి కృష్ణప్రసాద్.



## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ద్వితీయ) మూడవ సెమిస్టర్

పేపర్-5 : ఐచ్ఛికాంశం - 1. నన్నయ

- యూనిట్ 1. (ఎ) నన్నయకు పూర్వందేశకాల పరిస్థితులు - భాషా సాహిత్యాల స్థితి  
(బి) వేంగీ తూర్పుచాళుక్యులు - తూర్పు చాళుక్యుల భాషాభిమానం  
మార్గదేశి కవిత్వాలు - తమిళ, కన్నడ భాషలలో భారతాలు.

- యూనిట్ 2. (ఎ) నన్నయ - రాజరాజనరేంద్రుడు - నారాయణభట్టు. తెలుగు భారత రచనానేపథ్యం -  
మహాభారత అవతారిక - మహాభారత వైశిష్ట్యం.  
(బి) నన్నయ కవితారీతులు - ప్రసన్న కథాకలితార్థయుక్తి - అక్షర రమ్యత - నారారుచిరార్థ  
సూక్తి నిధిత్వం.

- యూనిట్ 3. (ఎ) భారతాంధ్రీకరణ విధానం - కవితాశిల్పం - శైలి - వర్ణనలు - నాటకీయత.  
(బి) రసపోషణ - ఔచిత్యం - ధ్వని - అలంకార ప్రయోగాలు - భాషావిశేషాలు -  
ఛందోవిశేషాలు.

- యూనిట్ 4. (ఎ) నన్నయ వచన రచనా విధానం - శాస్త్ర విశేషాలు - ఉపఖ్యానాలు - ఉదంకోపాఖ్యానం -  
కచోపాఖ్యానం - శకుంతలోపాఖ్యానం - తపతీ సంవరణోపాఖ్యానం.  
(బి) నన్నయ సమకాలికులు - అలభ్యరచనలు - నన్నయ భారతంపై పరిశోధనలు - నన్నయ  
పేరిట వచ్చిన గ్రంథాలు - సారస్వత కేంద్రాలు.

సంప్రదించవలసిన గ్రంథాలు :

1. నన్నయ భారతి : 3 సంపుటాలు - తెలుగు విశ్వవిద్యాలయం.
2. నన్నయ భట్టారకుడు - ఆచార్య దివాకర్ల వేంకటాచార్యులు.
3. ఆంధ్రదేశ చరిత్ర సంగ్రహం - డా॥ మల్లంపల్లి సోమశేఖరశర్మ.
4. ప్రసన్న కథా కలితార్థయుక్తి - డా॥ విశ్వనాథ సత్యనారాయణ.
5. ఆంధ్ర సాహిత్య చరిత్ర - ఆచార్య పింగళి లక్ష్మీకాంతం.
6. తెలుగు సాహిత్య సమీక్ష - ఆచార్య జి. నాగయ్య.
7. సారమతి నన్నయ - ఇంద్రగంటి హనుమచ్ఛాస్త్రి.
8. నన్నయ - భారత రచన - డా॥ తలారి వాసు.

## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ద్వితీయ) మూడవ సెమిస్టర్

పేపర్-5 : ఐచ్ఛికాంశం - 2. కందుకూరి వీరేశలింగం

- యూనిట్ 1. (ఎ) 19వ శతాబ్దపు ఆంధ్రదేశ పరిస్థితి - ఇతర ప్రాంతాలలో సామాజిక, రాజకీయ, సాంస్కృతిక స్థితిగతులు - నేపథ్యం - వీరేశలింగం బాల్యజీవితం - విద్యాభ్యాసం - ఉద్యోగప్రయత్నాలు - తొలి రచనలు - ప్రేరకులు (ఈశ్వరచంద్ర, రాజారామమోహనరావు)
- (బి) వీరేశలింగం - చైతన్యస్వరూపం - భావాలు - భాషాసాహిత్య విషయకం, సంఘసంస్కరణ, స్త్రీజనోద్ధరణలపై ఆయన భావన, మూఢాచారాల నిర్మూలనప్రయత్నం - ఎన్నుకొన్న మార్గాలు

యూనిట్ 2. (ఎ) వీరేశలింగం రచనలు - స్వీయచరిత్ర.

(బి) నవల, నాటకం, ప్రహసనాలు.

యూనిట్ 3. (ఎ) జీవితచరిత్రలు - ఇతర రచనలు.

(బి) పత్రికారచనకు మూలపురుషుడు.

యూనిట్ 4. (ఎ) బహుముఖ ప్రజ్ఞా తత్వం - భాష - సమాజం - స్త్రీవిద్య గురించి ఆయన చేసిన సేవ - సాధించిన ఘనకార్యాలు.

(బి) వీరేశలింగం రచనా శైలి - ఆధునిక సామాజిక, సాహిత్య, సాంస్కృతిక రంగాలలో ఆయన స్థానం - తదనంతర కవులకు, రచయితలకు మార్గదర్శకత్వం.

సంప్రదించవలసిన గ్రంథాలు :

1. వీరేశలింగం - వి.ఆర్. నార్ల.
2. సమగ్రాంధ్ర సాహిత్యచరిత్ర - ఆరుద్ర.
3. వీరేశలింగం సమస్త సాహిత్యం.
4. వీరేశలింగం - స్వీయచరిత్రం.

## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ద్వితీయ) నాల్గవ సెమిస్టర్

పేపర్-1 : ఆధునిక సాహిత్య విమర్శ సిద్ధాంతాలు - సూత్రాలు

యూనిట్ 1. (ఎ) సమాజం - సాహిత్యం - సాహిత్య విమర్శ - పరస్పర సంబంధం

(బి) రచయిత : సామాజిక స్పృహ - సమాజ విశ్లేషణ

(సి) 1. ఆధునిక సాహిత్యవిమర్శ లక్షణాలు, 2. ఆధునిక సాహిత్య విమర్శ పద్ధతులు.

యూనిట్ 2. (ఎ) 1. సంస్కరణ సాహిత్య విమర్శ, 2. కాల्పనిక సాహిత్య విమర్శ.

(బి) 1. హేతువాద సాహిత్య విమర్శ, 2. అభ్యుదయ సాహిత్య విమర్శ.

(సి) 1. దిగంబర కవిత్వ విమర్శ, 2. విప్లవ సాహిత్య విమర్శ.

యూనిట్ 3. (ఎ) 1. దళిత సాహిత్య విమర్శ, 2. స్త్రీవాద సాహిత్య విమర్శ.

(బి) 1. మైనారిటీ సాహిత్య విమర్శ, 2. నవల - విమర్శ.

(సి) 1. కథానిక - విమర్శ, 2. నాటకం - విమర్శ.

యూనిట్ 4. (ఎ) 1. వ్యాసం విమర్శ, 2. హైకు, నానీల విమర్శ.

(బి) 1. ఆధునిక సాహిత్య విమర్శకారులు - కట్టమంచి, కందుకూరి, రాళ్ళపల్లి, శ్రీశ్రీ.

2. అత్యాధునిక సాహిత్య విమర్శకారులు - రాచమల్లు రామచంద్రారెడ్డి, సుదర్శనం, కత్తి పద్మారావు, కాత్యాయనీ విద్యుహే.

సంప్రదించవలసిన గ్రంథాలు :

1. సాహిత్య దర్శనం - కె.వి.ఆర్. నరసింహం.
2. సాహిత్యం - మౌళిక భావనలు - పాపినేని శివశంకర్.
3. భ్రమ - వాస్తవం - కాడ్వెల్ క్రిష్టోఫర్ (పొట్లూరి వెంకటేశ్వరరావు అనువాదం)
4. తెలుగు నాటక వికాసం - పి.యస్.ఆర్. అప్పారావు.
5. తెలుగు సాహిత్య విమర్శ - సిద్ధాంతాలు - సూత్రాలు - వి. సిమ్మన్న.
6. ఆధునికాంధ్ర కవిత్వము - సంప్రదాయములు - ప్రయోగములు - సి. నారాయణరెడ్డి.
7. సాహిత్యం - సౌందర్యం - బి. సూర్యసాగర్.
8. ఆధునిక తెలుగు సాహిత్య విమర్శ - సంప్రదాయరీతి - కోవెల సుప్రసన్నాచార్య
9. ఆధునిక సాహిత్య విమర్శ సూత్రం - కొలకలూరి ఇనాక్.
10. ఆధునిక సాహిత్య విమర్శ - ఆంగ్ల ప్రభావం - జి.వి. సుబ్రహ్మణ్యం.
11. విమర్శ మౌళిక లక్షణాలు - ముదిగొండ వీరభద్రయ్య
12. వల్లంపాటి సాహిత్య వ్యాసాలు - వల్లంపాటి వెంకట సుబ్బయ్య
13. సాహిత్య నేపథ్యం - ఆర్.ఎస్. సుదర్శనం.



## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

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పేపర్-2 : నవ్యాంధ్ర వచన సాహిత్యం

యూనిట్ 1. (ఎ) నవల - నిర్వచనాలు - లక్షణాలు - ప్రపంచ భాషలో నవల - తొలి తెలుగు నవల - వాదవివాదాలు

(బి) తెలుగు నవల వర్గీకరణ - వికాసం - సాంఘిక నవలలు - మనో వైజ్ఞానిక నవలలు

యూనిట్ 2. (ఎ) 1. కథానిక - నిర్వచనం - లక్షణాలు, 2. కథానిక - ఆరంభ వికాసాలు

(బి) 1. కథానికల వర్గీకరణ, 2. తెలుగు కథానికలు - వస్తువు.

యూనిట్ 3. (ఎ) 1. తెలుగు నాటకం - లక్షణాలు, 2. తెలుగు నాటకం - ఆరంభ వికాసాలు

(బి) 1. నాటకాలు - వర్గీకరణ, 2. ప్రయోగాత్మక నాటకరంగం

యూనిట్ 4. (ఎ) 1. నాటిక - నిర్వచనం, లక్షణాలు, 2. నాటిక - ఆరంభ వికాసాలు

(బి) 1. వ్యాసం - నిర్వచనం, లక్షణాలు, 2. వ్యాస పరిణామం.

సంప్రదించవలసిన గ్రంథాలు :

1. తెలుగు నవలా వికాసం - డా॥ మొదలి నాగభూషణశర్మ.
2. తెలుగు నవలా సాహిత్య వికాసం - పుల్లారాజు వెంకటేశ్వర్లు.
3. కథానిక స్వరూప స్వభావాలు - డా॥ పోరంకి దక్షిణామూర్తి.
4. తెలుగు నాటక వికాసం - పోణంకి శ్రీరామ అప్పారావు.
5. తెలుగు సాంఘిక నాటకం - డా॥ పి.వి. రమణ.
6. తెలుగు ఏకాంకికా వికాసం - డా॥ వనం మధుసూదన్.
7. తెలుగు నవలా సాహిత్యంలో మనోవిశ్లేషణ - కోడూరి శ్రీరామమూర్తి
8. తెలుగు వ్యాస పరిణామం - డా॥ కొలకలూరి ఇనాక్.
9. వచన వాఙ్మయ వీచిక - జి. యోహాన్ బాబు.



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పేపర్-3 : సామాన్య భాషాశాస్త్రం

యూనిట్ 1. (ఎ) ధ్వని విజ్ఞానశాస్త్రం - ధ్వని విజ్ఞాన శాస్త్రాధ్యయనంలో ప్రధాన మార్గాలు - శ్రవణాత్మక, ఉచ్ఛారణాత్మక, ధ్వనితరంగాత్మక, వాగింద్రియాలు - ఉత్పత్తి, ధ్వనులు వర్గీకరణ - ధ్వని ప్రతిలేఖనం.

(బి) అంతర్జాతీయ ధ్వని పట్టిక, చరిత్ర - ప్రామాణిక ధ్వని పట్టిక తయారీ

(సి) వర్ణ విజ్ఞాన శాస్త్రం - ధ్వని విజ్ఞానశాస్త్రం, వర్ణ ధ్వని విజ్ఞాన శాస్త్రాలకున్న భేదం నిర్వచనం.

యూనిట్ 2. (ఎ) వర్ణాల రకాలు - వర్ణ విశ్లేషణ - ప్రయోగాత్మక ధ్వని లేఖనం, లేఖనం, ధ్వని - వర్ణం - సవర్ణం.

(బి) పద విజ్ఞానశాస్త్రం - పదాంశం - సపదాంశం - నిర్వచనం - పదాంశాల గుర్తింపు పదాంశ రకాలు - నైడా సూత్రాలు.

యూనిట్ 3. (ఎ) వాక్య విజ్ఞాన శాస్త్రం - పదాంశం వాక్య నిర్మాణ పరిమితుల్ని స్థాపించడానికి పద్ధతులు - సన్నిహిత సంబంధాల విశ్లేషణ.

(బి) సంగ్రహంగా తెలుగు వాక్య నిర్మాణం.

యూనిట్ 4. (ఎ) సామాజిక భాషాశాస్త్రం - సమాజం, భాషా సంబంధం - వైయక్తిక మాండలికం, మాండలికం, భాషా - నిర్వచనం, భాషలో మాండలికాలు ఏర్పడే విధానం, కారణాలు.

(బి) మాండలికాల వర్గీకరణ - ప్రాంతీయ, సాంఘిక, వృత్తిసంబంధి - వ్యవహారభేదక రేఖాపటాల తయారీ-మాండలిక సరిహద్దుల్ని గుర్తించటం - భాషా ప్రామాణీకరణ ప్రత్యేకించి తెలుగు.

సంప్రదించవలసిన గ్రంథాలు :

1. Chomsky. N. : Aspects Theory of Syntax.
2. Chomsky. N. : Theoretical Linguistics.
3. Pike, K.L. : Phonetics.
4. Nida, L.A. : Morphology.
5. Seminar Papers on Socio - Linguistics, Telugu Academy, Hyd, 1977.
6. సుబ్రహ్మణ్యం, పి.ఎస్. - ఆధునిక భాషా శాస్త్ర సిద్ధాంతాలు.
7. మాండలిక వృత్తిపదకోశం - (వ్యవసాయం) సం. భద్రరాజు కృష్ణమూర్తి
8. ప్రపంచ భాషలు - డా॥ వెలమల సిమ్మన్న.
9. తెలుగుభాషా చరిత్ర - డా॥ వెలమల సిమ్మన్న.

## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

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పేపర్-4 : సంస్కృత సాహిత్య పరిచయం

- యూనిట్ 1. (ఎ) సంస్కృత భాషా ప్రాముఖ్యం - భారతీయ సాంస్కృతిక భాషగా సంస్కృతం.  
(బి) వైదిక వాఙ్మయరీతులు - భారత రామాయణాల పరిచయం (ఇతిహాసాలు)
- 

- యూనిట్ 2. (ఎ) పురాణాల పరిచయం  
(బి) మహాకావ్య, లఘుకావ్యాలు - ఉపదేశాత్మక సాహిత్య పరిచయం.
- 

- యూనిట్ 3. (ఎ) సంస్కృత వ్యాకర్తలు - పాణిని, వరరుచి, పతంజలి, నిఘంటుకర్త యాసుకడు.  
(బి) వాల్మీకి, వ్యాసుడు, భాస, కాళిదాస, భవభూతి, శ్రీహర్ష, మాఘ, భారతి, భర్తృహరి, కల్దణ కవుల సాహిత్య పరిచయం.
- 

- యూనిట్ 4. (ఎ) ప్రతిమా - అభిజ్ఞానశాకుంతలం - నాగానంద - మృచ్చకతిక - వేణీ సంహార - ముద్రారాక్షస నాటకాల పరిచయం, కాదంబరి, దశకుమార చరిత్ర గద్యకావ్యాల పరిచయం.  
(బి) రఘువంశం - పంచమసర్గ - 1 నుండి 30 శ్లోకాలు  
సంస్కృత సంధులు : సవర్ణదీర్ఘ, గుణ, వృద్ధి, యణాదేశ, శ్చుత్వ, జస్త్య, విసర్గ సంధులు.
- 

సంప్రదించవలసిన గ్రంథాలు :

1. సంస్కృత వాఙ్మయ చరిత్ర 2 భాగాలు - మల్లాది సూర్యనారాయణ శాస్త్రి.
2. సంస్కృత సాహిత్య చరిత్ర - ముదిగొండ గోపాలకృష్ణారెడ్డి, సుతాజారెడ్డి.
3. సంస్కృత వ్యాకరణ ప్రకాశిక - కె.ఎ. కృష్ణమాచార్యులు.



## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

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పేపర్-5 : ఐచ్ఛికాంశం - 1. ప్రబంధ సాహిత్యం

- యూనిట్ 1. (ఎ) ప్రబంధ సాహిత్యం - ఆవిర్భావ వికాసాలు, అష్టదిగ్గజ కవులు - రచనలు.  
(బి) ప్రబంధాలు - పాత్రచిత్రణ, వర్ణనలు, రసం, శైలి.
- 

- యూనిట్ 2. (ఎ) మనుచరిత్ర - సమీక్ష  
(బి) పారిజాతాపహరణం - సమీక్ష.
- 

- యూనిట్ 3. (ఎ) క్షేత్రమాహాత్మ్య ప్రబంధాలు పుట్టుక - పెరుగుదల  
(బి) శ్రీకాళహస్తిమాహాత్మ్యం - సమీక్ష, పాండురంగ మాహాత్మ్యం - సమీక్ష.
- 

- యూనిట్ 4. (ఎ) విజయ విలాసం - సమీక్ష.  
(బి) దక్షిణాంధ్రయుగ కవయిత్రులు  
రంగాజమ్మ, ముద్దుపకని, రామభద్రాంబ, కృష్ణాజి.
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సంప్రదించవలసిన గ్రంథాలు :

1. ఆంధ్ర ప్రబంధాలు - అవతరణ వికాసాలు : కె.వి.ఆర్. నరసింహం.
2. తెలుగు సాహిత్య సమీక్ష (2వ సంపుటం) : జి. నాగయ్య.
3. మనుచరిత్ర వాఖ్యానం : వెంపరాల సూర్యనారాయణశాస్త్రి.
4. పారిజాతాపహరణ సౌందర్యం : వక్కలంక లక్ష్మీపతిరావు.
5. విజయవిలాసం హృదయోల్లాస వ్యాఖ్య : తాపీ ధర్మారావు.
6. కావ్య సమీక్షలు : ఎం.వి. సత్యనారాయణ.
7. ప్రబంధాల్లో ప్రకృతి వర్ణనలు : అంతటి నరసింహం.



## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ద్వితీయ) నాల్గవ సెమిస్టర్

పేపర్-5 : ఐచ్ఛికాంశం - 2. మాండలిక విజ్ఞానం

యూనిట్ 1. (ఎ) మాండలిక నిర్వచనం - లక్ష్యాలు - సమస్యయం.

మాండలిక భాషావిర్భావం - సోదాహరణ నిరూపణ.

(బి) మాండలిక భాషలేర్పడడానికి గల హేతువులు, తెలుగులోని మాండలికాలు.

యూనిట్ 2. (ఎ) పూర్వాంధ్ర, మధ్యాంధ్ర మాండలికాల పరిశీలన, దక్షిణాంధ్ర, ఉత్తరాంధ్ర మాండలికాల పరిశీలన

(బి) మాండలికాలు - సమాజం - భాష పరస్పర సంబంధం, ప్రధాన భాషలో మాండలికాలు ఏర్పడే విధానం.

యూనిట్ 3. (ఎ) ప్రాదేశిక, సాంఘిక, వర్గ మాండలికాలు, తెలుగు మాండలికాలు - సంగ్రహ పరిచయం.

(బి) మాండలికాలు - వర్గీకరణ విధానం, మాండలికాలు - ఆదానపదాలు.

యూనిట్ 4. (ఎ) మాండలికాలపై పరిసరాన్య భాషల ప్రభావం, అన్యదేశ్యాలలోని రకాలు - మాండలికాలు

(బి) మాండలికాలు - వ్యవహారభేదకరేఖ - మాండలిక పటనిర్మాణ విధానం, మాండలిక భాషారచన.

సంప్రదించవలసిన గ్రంథాలు :

1. మాండలిక వృత్తి పదకోశం : భద్రరాజు కృష్ణమూర్తి.
2. భాషాశాస్త్ర పరిచయం - బొడ్డుపల్లి పురుషోత్తం
3. ఆధునిక భాషాశాస్త్ర సిద్ధాంతాలు - పి.ఎస్. సుబ్రహ్మణ్యం.
4. ఆధునిక భాషాశాస్త్రం - వెలమల సిమ్మన్న.
5. భాషాచరిత్రక వ్యాసాలు - కోరాడ రామకృష్ణయ్య.
6. వైకృత పద స్వరూప నిరూపణము - తూమాటి దొణప్ప.



## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

### ఎం.ఏ. తెలుగు - మాదిరి ప్రశ్నాపత్రం వివరణ

ఈ క్రింది ప్రశ్నలలో అన్నింటికి సమాధానాలు రాయండి.

#### పార్ట్ - ఎ

- I. మొదటి యూనిట్ నుండి ఒక ప్రశ్న 15 మార్కులు  
 లేదా  
 మొదటి యూనిట్ నుండి ఒక ప్రశ్న
- II. రెండవ యూనిట్ నుండి ఒక ప్రశ్న 15 మార్కులు  
 లేదా  
 రెండవ యూనిట్ నుండి ఒక ప్రశ్న
- III. మూడవ యూనిట్ నుండి ఒక ప్రశ్న 15 మార్కులు  
 లేదా  
 మూడవ యూనిట్ నుండి ఒక ప్రశ్న
- IV. నాల్గవ యూనిట్ నుండి ఒక ప్రశ్న 15 మార్కులు  
 లేదా  
 నాల్గవ యూనిట్ నుండి ఒక ప్రశ్న

#### పార్ట్-బి

- V. ఈ యూనిట్‌లో ఐదు చిన్న ప్రశ్నలకు సమాధానాలు రాయాలి. 5×3= 15 మార్కులు

(నాలుగు యూనిట్ల నుండి ఒక్కొక్క యూనిట్‌లో రెండు ప్రశ్నలు చొప్పున ఎనిమిది ప్రశ్నలు ఇవ్వాలి)

సూచన : వ్యాకరణం పేపర్ మినహా అన్ని పేపర్లకు ఇదే మాదిరిని అనుసరించాలి.



## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ప్రథమ) మొదటి సెమిస్టర్ మాదిరి ప్రశ్నాపత్రం

పేపర్-1 : తెలుగు భాషాచరిత్ర

Effective from the admitted batch of 2016-17

Time : 3 Hours

Marks: 75

అన్ని ప్రశ్నలకు సమాధానాలు రాయాలి.

- I. (ఎ) ద్రావిడ భాషల ప్రత్యేక లక్షణాలను తెల్పండి. 15 మార్కులు  
లేదా  
(బి) భారతదేశంలోని భాషా కుటుంబాలను వివరించండి.
- II. (ఎ) ద్రావిడ భాషల్లో తెలుగు స్థానాన్ని నిర్ణయించండి. 15 మార్కులు  
లేదా  
(బి) తెలుగు, తెనుగు పదాల చారిత్రక ఆధారాలను, వ్యుత్పత్తులను వివరించండి.
- III. (ఎ) ప్రాజ్ఞన్నయ యుగాంధ్ర భాషా లక్షణాలను తెల్పండి. 15 మార్కులు  
లేదా  
(బి) భాషా చారిత్రక దృక్పథంతో తెలుగులో సంధిని వివరించండి.
- IV. (ఎ) తెలుగులో లింగవచనాల గురించి తెల్పండి. 15 మార్కులు  
లేదా  
(బి) తెలుగులో ప్రాంతీయ, సామాజిక మాండలికాల్ని వివరించండి.
- V. క్రింది వాటిలో ఐదు ప్రశ్నలకు సమాధానాలు రాయండి. 5 × 3 = 15 మార్కులు
- |                                    |                             |
|------------------------------------|-----------------------------|
| (అ) హింద్వార్య భాషాకుటుంబం         | (ఆ) ఆంధ్రము                 |
| (ఇ) మాండలిక లక్షణాలు               | (ఈ) తెలుగులో సంఖ్యా వాచకాలు |
| (ఉ) తెలుగులో మాండలికాల వర్గీకరణ    | (ఊ) తెలుగులో లోపసంధి        |
| (ఎ) తెలుగుపై సరిహద్దు భాషల ప్రభావం | (ఏ) భద్రరాజు కృష్ణమూర్తి.   |

## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ప్రథమ) మొదటి సెమిస్టర్ మాదిరి ప్రశ్నాపత్రం

పేపర్-2 : తెలుగు సాహిత్యచరిత్ర

Effective from the admitted batch of 2016-17

Time : 3 Hours

Marks: 75

అన్ని ప్రశ్నలకు సమాధానాలు రాయాలి.

- I. (ఎ) సాహిత్యచరిత్ర స్వరూప స్వభావాల్ని తెలిపి, ఆంధ్ర సాహిత్య యుగ విభజనను క్రోడీకరించండి. 15 మార్కులు

లేదా

(బి) ప్రాజ్ఞన్నయ యుగపు శాసనాల్లోని ఛందోవిశేషాల్ని రాయండి.

- II. (ఎ) నన్నయ భారతాంధ్రీకరణకు కలిగిన నేపథ్యాన్ని వివరించండి. 15 మార్కులు

లేదా

(బి) పాల్కురికి సోమనాథుని కృతులను సమీక్షించండి.

- III. (ఎ) తిక్కన హరిహరనాథ తత్వాన్ని గూర్చి వివరించండి. 15 మార్కులు

లేదా

(బి) ఎఱ్ఱన కృతుల పౌర్యాపర్యం గూర్చి చర్చించండి.

- IV. (ఎ) శ్రీనాథుని నైషధాంధ్రీకరణ పద్ధతిని వివరించండి. 15 మార్కులు

లేదా

(బి) అన్నమయ్య, వేమనల సామాజిక సంస్కరణ దృక్పథం రాయండి.

- V. క్రింది వాటిలో ఐదుప్రశ్నలకు సమాధానాలు రాయండి. 5 × 3 = 15 మార్కులు

- |                      |                                    |
|----------------------|------------------------------------|
| (1) వాఙ్మయం          | (2) ప్రాజ్ఞన్నయ యుగ కావ్య సంభావ్యత |
| (3) జాను తెనుగు      | (4) నన్నెచోడుడు                    |
| (5) గోన బుద్ధారెడ్డి | (6) నాచన సోమన                      |
| (7) సింహగిరి వచనాలు  | (8) జక్కన                          |



## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ప్రథమ) మొదటి సెమిస్టర్ మాదిరి ప్రశ్నాపత్రం

పేపర్-3 : ఆంధ్రుల చరిత్ర - సంస్కృతి

Effective from the admitted batch of 2016-17

Time : 3 Hours

Marks: 75

అన్ని ప్రశ్నలకు సమాధానాలు రాయాలి.

- I. (ఎ) సంస్కృతిని నిర్వచించి, తెలుగుభాషా ప్రాచీనతను వివరించండి. 15 మార్కులు  
లేదా  
(బి) తెలుగువారి పండుగలను, వాటి ప్రాశస్త్యాన్ని విశదీకరించండి.
- II. (ఎ) శాతవాహనులకాలంనాటి సంస్కృతి విశేషాలను తెలపండి. 15 మార్కులు  
లేదా  
(బి) చాళుక్యుల సాహిత్యసేవను పరిచయం చేయండి.
- III. (ఎ) కాకతీయుల పాలనా విశేషాలను తెలపండి. 15 మార్కులు  
లేదా  
(బి) విజయనగర సామ్రాజ్యంలో విలసిల్లిన తెలుగు సాహిత్యాన్ని వివరించండి.
- IV. (ఎ) స్వాతంత్రోద్యమంలో ఆంధ్రుల పాత్రను విశదీకరించండి. 15 మార్కులు  
లేదా  
(బి) నవీనాంధ్ర నిర్మాతలను పరిచయం చేయండి.
- V. క్రింది వాటిలో ఐదుప్రశ్నలకు సమాధానాలు రాయండి. 5 × 3 = 15 మార్కులు  
(1) ఆంధ్రదేశానికి ఉన్న పేర్లు (2) కూచిపూడి నృత్యం (3) గౌతమీపుత్ర శాతకర్ణి  
(4) రాజరాజనరేంద్రుడు (5) రుద్రమదేవి (6) తంజావూరు సాహిత్యసేవ  
(7) భాషాప్రాతిపదిక రాష్ట్రాలు (8) కందుకూరి వీరేశలింగం

## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ప్రథమ) మొదటి సెమిస్టర్ మాదిరి ప్రశ్నాపత్రం

పేపర్-4 : కావ్య నాటకాలు

Effective from the admitted batch of 2016–17

Time : 3 Hours

Marks: 75

అన్ని ప్రశ్నలకు సమాధానాలు రాయాలి.

I. క్రింది వానిలో రెండింటికి సమగ్ర వ్యాఖ్య రాయండి. 15 మార్కులు

- (అ) వివిధోత్తుంగ తరంగ ఘట్టన చలద్వేలావనైలావీ  
లవలీలుంగలవంగ సంగత లతాలాస్యంబు లీక్షించుచున్  
ధవళాక్షుల్ సని కాంచి రంత నెదురం దత్తీర దేశంబునం  
దవదాతాంబుజ పేనపుంజనిభునయ్యశోత్త ముందవ్వులన్
- (ఆ) ఆతత పక్షమారుత రయ ప్రవికంపిత ఘూర్ణితాచల  
వ్రాత మహోర్ణవండు, బలవన్నిజ దేహసముజ్జ్వల ప్రభా  
ధూత పతంగ తేజుఁడుదితుండయి తార్క్ష్యుడు తల్లికిన్ మనః  
ప్రీతి యొనర్చుచున్ నెగసె భీమజవంబున నభ్రవీధికిన్
- (ఇ) వినయము విస్తరిల్ల గురువృద్ధ జనాతిథి విప్రదేవతా  
ర్చన లొనరింతు సత్యమును శౌచము నేమఱి, నీగి మన్ననం  
దనువుడు భృత్యబంధు తతి, దాల్మి వహింతు, నసూయజేయ, నెం  
దును మదిదృష్ట సొన్న, బరదోష కథా విముఖుండ నెప్పుడున్
- (ఈ) ప్రతిమల పెండ్లి సేయుటకు వందలువేలు వ్యయింతుగానిదు  
ఖిత మతులైన పేదల ఘోరీరుల శూన్యములైన పాత్రలన  
మొతుకు విదల్పదీ భరతమేధిని ముప్పది మూడు కోట్ల దే  
వతలెగవడ్ల దేశమున భాగ్య విహీనుల క్షుత్తులారునే.

II. (ఎ) సౌపర్ణాఖ్యానమాధారంగా నన్నయ కవితారీతుల్ని వివరించండి. 15 మార్కులు

లేదా

- (బి) ధర్మవ్యాధుడు కౌశికునికి బోధించిన ధర్మ సూక్ష్మాల్ని విశదీకరించండి.

III. (ఎ) గబ్బిలం కావ్యంలోని జాషువా కవితాతత్వాన్ని వివరించండి. 15 మార్కులు

లేదా

(బి) కవి మార్గదర్శనంలో గబ్బిలం ప్రయాణ ప్రదేశాల్ని విశ్లేషించండి.

IV. (ఎ) మహాప్రస్థానం కవితా సంకలనంలో శ్రీశ్రీ అభ్యుదయ భావాల్ని తెల్పండి. 15 మార్కులు

లేదా

(బి) అత్రేయ ఎన్.జి.ఓ. నాటక విశేషాల్ని విశ్లేషించండి.

V. క్రింది వాటిలో ఐదింటికి సందర్భవ్యాఖ్యలు రాయండి. 5 × 3 = 15 మార్కులు

(1) ఉరుతర జవమున నరుగుదెంచి తల్లికి మ్రొక్కెన్.

(2) అని సమర్పణ సేసె బ్రభుత్వ మేర్పడన్.

(3) ధర్మమునెడ బ్రీతి వదలదగదు బుధునకున్.

(4) ఇన్నియును శిష్టచరితంబు లిద్ద చరిత !

(5) పల్లెటూళ్లో తల్లికేదో పాడుకలలో పేగు కదిలింది.

(6) మూడు మూర్తులకు గూడ కూడు లేదు.

(7) స్నానమాడుమతిగణ్యంబైన పెన్నానదిన్.

(8) ఘర్మ జలానికి ఖరీదు లేదోయ్.



## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ప్రథమ) మొదటి సెమిస్టర్ మాదిరి ప్రశ్నాపత్రం

పేపర్-5 : జానపద విజ్ఞానం

Effective from the admitted batch of 2016-17

Time : 3 Hours

Marks: 75

అన్ని ప్రశ్నలకు సమాధానాలు రాయాలి.

- I. (ఎ) జానపద విజ్ఞానాన్ని నిర్వచించి, లక్షణాలను రాయండి. 15 మార్కులు  
లేదా  
(బి) ఆంధ్రుల జానపద విజ్ఞాన కృషిని గురించి వివరించండి.
- II. (ఎ) జానపద ప్రదర్శక కళల్ని గురించి రాయండి. 15 మార్కులు  
లేదా  
(బి) జానపద భాషా విశేషాల్ని తెలియజేయండి.
- III. (ఎ) జానపద గేయ లక్షణాల్ని వివరించండి. 15 మార్కులు  
లేదా  
(బి) జానపద గేయాల్లోని రకాల్ని తెలియజేయండి.
- IV. (ఎ) సామెతను నిర్వచించి, వర్గీకరణను తెల్పండి. 15 మార్కులు  
లేదా  
(బి) జానపద సాహిత్యంలోని సాంఘిక విశేషాల్ని విశ్లేషించండి.
- V. క్రింది వాటిలో ఐదుప్రశ్నలకు సమాధానాలు రాయండి. 5 × 3 = 15 మార్కులు
- |                        |                      |
|------------------------|----------------------|
| (1) ఆటవిక విజ్ఞానం     | (2) జానపదుల నమ్మకాలు |
| (3) బిరుదురాజు రామరాజు | (4) నేడునూరి గంగాధరం |
| (5) పిల్లల గేయాలు      | (6) జానపద నిరుక్తి   |
| (7) పొడుపు కథ          | (8) అద్భుత కథలు      |

## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ప్రథమ) రెండవ సెమిస్టర్ మాదిరి ప్రశ్నాపత్రం

పేపర్-1 : తెలుగు భాషాచరిత్ర

Effective from the admitted batch of 2016-17

Time : 3 Hours

Marks: 75

అన్ని ప్రశ్నలకు సమాధానాలు రాయాలి.

- I. (ఎ) గ్రాంథిక వ్యావహారిక భాషావాద ప్రధాన అంశాలను పేర్కొనండి. 15 మార్కులు  
లేదా  
(బి) ఆధునిక తెలుగుభాష ప్రమాణీకరణ అవశ్యకతను తెల్పండి.
- II. (ఎ) తెలుగులో క్రియాధాతు నిర్మాణాన్ని వివరించండి. 15 మార్కులు  
లేదా  
(బి) తెలుగులో సంయుక్త క్రియా నిర్మాణాన్ని వివరించండి.
- III. (ఎ) తెలుగులోకి వచ్చి చేరిన సమీకృత, అసమీకృత పదాల్ని పేర్కొనండి. 15 మార్కులు  
లేదా  
(బి) తెలుగులో వచ్చిన ధ్వని మార్పుల్ని వివరించండి.
- IV. (ఎ) తెలుగులో వాక్య నిర్మాణ బేధాల్ని వివరించండి. 15 మార్కులు  
లేదా  
(బి) అర్థపరిణామాన్ని నిర్వచించి, చారిత్రక అర్థపరిణామ రూపాల్ని పేర్కొనండి.
- V. క్రింది వాటిలో ఐదుప్రశ్నలకు సమాధానాలు రాయండి. 5 × 3 = 15 మార్కులు  
(అ) పత్రికల్లో ప్రామాణిక భాష (ఆ) సమాపక క్రియలు (ఇ) ఔషవిభక్తిక ప్రత్యయాలు  
(ఈ) తెలుగులో దేశ్యతర పదజాలం (ఉ) అకర్మక క్రియలు (ఊ) పురుషబోధక ప్రత్యయాలు  
(ఎ) గిడుగు రామ్మూర్తి పంతులు (ఏ) ఆచార్య చేకూరి రామారావు.

## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ప్రథమ) రెండవ సెమిస్టర్ మాదిరి ప్రశ్నాపత్రం

పేపర్-2 : తెలుగు సాహిత్యచరిత్ర

Effective from the admitted batch of 2016-17

Time : 3 Hours

Marks: 75

అన్ని ప్రశ్నలకు సమాధానాలు రాయాలి.

- I. (ఎ) ప్రబంధ లక్షణాలను పేర్కొని, ప్రబంధ కవులను పరిచయం చేయండి. 15 మార్కులు  
లేదా  
(బి) కళాపూర్ణోదయ కావ్యవైశిష్ట్యం పరిశీలించండి.
- II. (ఎ) కంకంటి పాపరాజు ఉత్తర రామాయణ వైశిష్ట్యం చర్చించండి. 15 మార్కులు  
లేదా  
(బి) రాయల యుగంలోని ఇతర కవులను పరిచయం చేయండి.
- III. (ఎ) తంజావూరు, మధుర, పుదుక్కోట పాలకుల వాఙ్మయ సేవను వివరించండి. 15 మార్కులు  
లేదా  
(బి) దక్షిణాంధ్రయుగ రచయిత్రులైన రంగాజమ్మ ముద్దుపళని రచనలను పరామర్శించండి.
- IV. (ఎ) కూచిమంచి తిమ్మన కృతుల్ని సమీక్షించండి. 15 మార్కులు  
లేదా  
(బి) తెలుగు సాహిత్యానికి సి.పి.బ్రౌను చేసిన సేవను వివరించండి.
- V. క్రింది వాటిలో ఐదుప్రశ్నలకు సమాధానాలు రాయండి. 5 × 3 = 15 మార్కులు
- |                             |                      |                       |
|-----------------------------|----------------------|-----------------------|
| (1) అల్లసాని పెద్దన         | (2) వసుచరిత్ర        | (3) అద్దంకి గంగాధరుడు |
| (4) రాధామాధవీయం             | (5) యక్షగాన ప్రక్రియ | (6) శేషం వేంకటపతి     |
| (7) క్షీణయుగ కవితా లక్షణాలు | (8) ఆంధ్రనాయక శతకం   |                       |

## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ప్రథమ) రెండవ సెమిస్టర్ మాదిరి ప్రశ్నాపత్రం

పేపర్-3 : ఛందోవ్యాకరణాలంకాలు

Effective from the admitted batch of 2016-17

Time : 3 Hours

Marks: 75

- I. ఈ క్రింది వానిలో రెండింటికి సమాధానాలు రాయండి. 2×5=10 మార్కులు
- (1) య ర ల వ లు లఘువులని య లఘువుని ద్వివిధంబులగు.
  - (2) ఆర్య వ్యవహారంబుల దృష్టంబు గ్రాహ్యంబు.
  - (3) అత్తునకు సంధి బహుళముగా నగు.
  - (4) తెనుఁగుల మీఁది సాంస్కృతిక పరుషములకు గనడదవలురావు.
- II. ఈ క్రింది వానిలో రెండింటికి సమాధానాలు రాయండి. 2×5=10 మార్కులు
- (1) వానికి మువర్ణకేతరంబయిన విభక్తి పరంబగునపుడు ముగాగమంబగు.
  - (2) విశ్వకర్మాదులకు స్త్రీత్వంబగు.
  - (3) కద్రువ నాగమాత.
  - (4) ఉకారాంత గోశబ్దంబుల కంతట వువర్ణకంబగు.
- III. ఈ క్రింది వానిలో రెండింటికి సమాధానాలు రాయండి. 2×5=10 మార్కులు
- (1) బాలవ్యాకరణ నామ సార్థక్యమును గురించి రాయండి.
  - (2) వ్యాకరణముల ప్రయోజనాన్ని వివరించండి.
  - (3) సమాసము అనగా ఏమి? సమాసములోని రకాలను వివరించండి.
  - (4) వాక్యప్రయోజనాన్ని వివరించండి.
- IV. క్రింది వాటిలో ఐదింటికి రూపసాధన చేయండి. 5×3=15 మార్కులు
- (1) కందోయి      (2) చిగురుటాకు      (3) క్రొత్తావి      (4) కట్టకడ      (5) ధీరురాలు
  - (6) వృక్షములు      (7) ఋత్విక్కు      (8) తాజదివె      (9) తోచెను జుక్కులు      (10) బాలురు
- V. క్రింది వాటిలో ఐదింటికి పారిభాషిక పదాలను రాయండి. 5×2=10 మార్కులు
- (1) ఉపధ      (2) ద్రతము      (3) తద్భవం      (4) సంధి      (5) ఆమ్రేడితం
  - (6) సంక్షేష      (7) తిర్యక్కు      (8) కర్మధారయ      (9) త్రికము      (10) సమాసము
- VI. క్రింది వాటిలో ఐదింటికి లక్ష్యలక్షణ సమన్వయం చేయండి. 5×2=10 మార్కులు
- (1) ఋవళి      (2) వృద్ధివభి      (3) వర్గజయతి      (4) ముకార యతి      (5) సరసపళాలు
  - (6) రేఫయుత      (7) ఉభయ ప్రాస      (8) అనునాసిక ప్రాస      (9) అభేద ప్రాస      (10) అంత్యప్రాస
- VII. క్రింది వాటిలో ఐదింటికి లక్ష్యలక్షణ సమన్వయం చేయండి. 5×2=10 మార్కులు
- (1) రూపకం      (2) శ్లేష      (3) వ్యాజస్తుతి      (4) అర్థాంతరన్యాస      (5) అతిశయోక్తి
  - (6) నిదర్శన      (7) ఉపమ      (8) అంత్యప్రాస      (9) యమకం      (10) ముక్తపదగ్రస్తం

## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ప్రథమ) రెండవ సెమిస్టర్ మాదిరి ప్రశ్నాపత్రం

పేపర్-4 : కావ్య నాటకాలు

Effective from the admitted batch of 2016–17

Time : 3 Hours

Marks: 75

అన్ని ప్రశ్నలకు సమాధానాలు రాయాలి.

I. క్రింది వానిలో రెండింటికి సమగ్ర వ్యాఖ్య రాయండి. 15 మార్కులు

(అ) నీతి పథంబునన్ బ్రదుక నేర్పుట యుత్తమ భంగి; శౌర్య సం  
జాతములై కరంబలరు సంపదలొందుట మధ్యవృత్తి; య  
స్థీతములైన భారవహజీవనముల్ దలపం గనిష్ఠముల్,  
నీతికి బాహ్యులైన ధరణీవర! మెత్తురె వారి సుత్తముల్.

(ఆ) కరితురగాది ఘట్టనయుగాలియు నొంపదె యొంటి నున్నయ  
త్తరువు? ననేక భూరుహవితానము గుంపయి పేర్చి బాధలం  
బొలయునె? యన్నదమ్ములును బొందిన నేరిక సాధ్యు; లట్లు గా  
కెరవయి నిల్చినం గెలని కెల్లిదమై పఠివోడు రెంతయున్.

(ఇ) తన మృదుతల్పమందు వనితా మణియైన రమాలలామ పొం  
దును నెడగాఁ దలంపక యదు ప్రవరుండెదురేగి మోదముం  
దనుకగ గౌగిలించి యుచితక్రియలం బరితుష్ట జేయుచున్  
వినయమునన్ భజించె; ధరణీ సురుడెంతటి భాగ్యవంతుడో?

(ఈ) నీయతుల ప్రభావ మహనీయత వేగి పురాధి రాజమా!  
ఆయత ధర్మ మూర్తులు మహాత్ములు వారలు బ్రహ్మకోశగో  
పాయితలాంధ్ర పల్లవ నృపాలుర హుంకృతి వ్యాఘ్రగర్జనా  
వైయరిలోక భీకర మహాద్భుత శౌర్యరసాకృతింజనెన్

II. (ఎ) తిక్కన 'విదురనీతి'ని వివరించండి. 15 మార్కులు

లేదా

(బి) కుచేలోపాఖ్యాన సారాంశాన్ని రాయండి.



- III. (ఎ) విశ్వనాథవారి 'వేంగీక్షేత్రం'లోని గతవైభవ స్మరణాన్ని వివరించండి. 15 మార్కులు  
లేదా  
(బి) 'అమృతం కురిసిన రాత్రి' కవితా సంపుటి ద్వారా తిలక్ మనవతా వాదాన్ని విశ్లేషించండి.
- IV. (ఎ) వరవిక్రయ నాటకం సమాజానికిచ్చే సందేశాన్ని వివరించండి. 15 మార్కులు  
లేదా  
(బి) వరవిక్రయం నాటకంలో 'సింగరాజు లింగరాజు' పాత్ర చిత్రణ.
- V. క్రింది వాటిలో ఐదింటికి సందర్భవ్యాఖ్యలు రాయండి. 5 × 3 = 15 మార్కులు
- (1) ఏడు విడిచి వర్తించువాడు వివేకధనుడు.
  - (2) గుణమింక నొండు గలదేయురయన్?
  - (3) విభుడప్పుడయిచ్చు ననూన సంపదల్.
  - (4) చూచి సంభ్రమ విలోలుండై దిగెండల్పమున్.
  - (5) అశ్రువులు జార్తు జీవచ్చవాంధ్ర జనులు.
  - (6) ఇది యెక్కడి పూర్వపు జన్మ వాసనో!
  - (7) ఏ బుద్ధ దేవుడి జన్మభూమికి గర్వస్మృతి?
  - (8) కవిత్వం ఒక అల్యేమీ, దాని రహస్యం కవికే తెలుసును.



## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ప్రథమ) రెండవ సెమిస్టర్ మాదిరి ప్రశ్నాపత్రం

పేపర్-5 : ఐచ్ఛికాంశం-1 స్త్రీవాద సాహిత్యం

Effective from the admitted batch of 2016-17

Time : 3 Hours

Marks: 75

అన్ని ప్రశ్నలకు సమాధానాలు రాయాలి.

- I. (ఎ) స్త్రీవాద ఉద్యమం, నేపథ్యం, భారతదేశంలో స్త్రీవాద ఉద్యమాలు. 15 మార్కులు  
లేదా  
(బి) స్త్రీవాదాన్ని నిర్వచించి లక్షణాలను పేర్కొనండి.
- II. (ఎ) స్త్రీవాదంలో ఉన్న విభిన్న ధోరణులను పరిచయం చేయండి. 15 మార్కులు  
లేదా  
(బి) తెలుగులో స్త్రీవాద సాహిత్య వికాసాన్ని తెల్పండి.
- III. (ఎ) నీలిమేఘాలు కవితా సంకలనంలో పీఠిక సారాంశాన్ని విశ్లేషించండి. 15 మార్కులు  
లేదా  
(బి) నీలిమేఘాలు సంకలనంలో రచయిత్రులు పేర్కొన్న వివక్ష రూపాలను చిత్రించండి.
- IV. (ఎ) స్త్రీవాద దృక్పథంతో సహజ నవలలోని సమాజాన్ని విశ్లేషించండి. 15 మార్కులు  
లేదా  
(బి) ఇల్లలకగానే కథాసంపుటిలో ఉన్న వివక్ష రూపాలను చిత్రించండి.
- V. క్రింది వాటిలో ఐదుప్రశ్నలకు సమాధానాలు రాయండి. 5 × 3 = 15 మార్కులు
- |                              |                                |
|------------------------------|--------------------------------|
| (1) మహిళాభ్యుదయ సాహిత్యం     | (2) స్త్రీవాదం-మహిళాభ్యుదయం    |
| (3) మల్లాది సుబ్బమ్మ         | (4) చలం - స్త్రీవాద ధోరణులు    |
| (5) లైంగికత                  | (6) అస్మిత సంస్థ               |
| (7) స్త్రీవాదం-ఆంగ్ల ప్రభావం | (8) బదిలీ కథలో ఉన్న స్త్రీవాదం |

## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ప్రథమ) రెండవ సెమిస్టర్ మాదిరి ప్రశ్నాపత్రం

పేపర్-5 : ఐచ్ఛికాంశం-2 హేతువాద సాహిత్యం

Effective from the admitted batch of 2016-17

Time : 3 Hours

Marks: 75

అన్ని ప్రశ్నలకు సమాధానాలు రాయాలి.

- I. (ఎ) హేతువాదానికి ఇతరవాదాలతో ఉన్న సంబంధాల్ని, సంఘర్షణల్ని వివరించండి. 15 మార్కులు  
లేదా  
(బి) ఆంధ్రప్రదేశ్‌లో హేతువాద ఉద్యమాల్ని విశ్లేషించండి.
- II. (ఎ) ఆంధ్రదేశంలో హేతువాద రచయితల సాహిత్యాన్ని పరిచయం చేయండి. 15 మార్కులు  
లేదా  
(బి) హేతువాద సాహిత్యంపై ఆంగ్ల భాషా ప్రభావాన్ని వివరించండి.
- III. (ఎ) తెలుగు కవిత్వంలో వ్యక్తమయ్యే హేతువాద భావాల్ని వివరించండి. 15 మార్కులు  
లేదా  
(బి) ఖాసీ నాటకంలో ఉన్న హేతువాద భావాలను చిత్రించండి.
- IV. (ఎ) సీత అగ్నిప్రవేశం నాటకంలో చలం ప్రకటించిన భావాలను విశ్లేషించండి. 15 మార్కులు  
లేదా  
(బి) హేతువాద పరిశోధనా వ్యాసాల్ని గురించి రాయండి.
- V. క్రింది వాటిలో ఐదుప్రశ్నలకు సమాధానాలు రాయండి. 5 × 3 = 15 మార్కులు
- |                                 |                                      |
|---------------------------------|--------------------------------------|
| (1) హేతువాద శతకాలు              | (2) పురోహిత వర్గ వ్యతిరేకత           |
| (3) డా॥ అబ్రహం, టి. కోవూరి      | (4) చార్వాకం, లోకాయుతం               |
| (5) వ్యాస ప్రక్రియలో హేతువాదం   | (6) ఆధునిక తెలుగు కవిత్వంలో హేతువాదం |
| (7) త్రిపురనేని రామస్వామి చౌదరి | (8) వేమన హేతువాద దృష్టి              |

## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ద్వితీయ) మూడవ సెమిస్టర్ మాదిరి ప్రశ్నాపత్రం

పేపర్-1 : ప్రాచీన సాహిత్య విమర్శ సిద్ధాంతాలు - సూత్రాలు

Effective from the admitted batch of 2016-17

Time : 3 Hours

Marks: 75

అన్ని ప్రశ్నలకు సమాధానాలు రాయాలి.

- I. (ఎ) విమర్శను నిర్వచించి, దాని ప్రయోజనాన్ని వివరించండి. 15 మార్కులు  
లేదా  
(బి) వివిధ ఆధునిక విమర్శనా పద్ధతుల్ని పేర్కొనండి.
- II. (ఎ) కావ్యాన్ని గురించి ప్రాచ్య, పాశ్చాత్య నిర్వచనాలలోని భేద, సాదృశ్యాలను తెల్పండి. 15 మార్కులు  
లేదా  
(బి) కావ్య హేతువులు - వివిధ అభిప్రాయాలను విశ్లేషించండి.
- III. (ఎ) రసం-కెథార్సిస్ బేధ సాదృశ్యాలను విశ్లేషించండి. 15 మార్కులు  
లేదా  
(బి) ధ్వనిని నిర్వచించి ధ్వనిభావ వాదాలతో సమీక్షించండి.
- IV. (ఎ) ప్రాచీన, ప్రాచ్య నాటక క్రమ వికాసాన్ని పేర్కొనండి. 15 మార్కులు  
లేదా  
(బి) కావ్యావతారికలు విమర్శ స్వరూప స్వభావాలు తెల్పండి.
- V. క్రింది వాటిలో ఐదు ప్రశ్నలకు సమాధానాలు రాయండి. 5 × 3 = 15 మార్కులు
- |                  |                               |
|------------------|-------------------------------|
| (1) ఇతిహాసం      | (2) ఉత్తమ విమర్శకుని లక్షణాలు |
| (3) కావ్యాత్మ    | (4) కెథార్సిస్                |
| (5) కామెడి       | (6) త్రివిధ శబ్దవృత్తులు      |
| (7) చాటు పద్యాలు | (8) శతకం                      |

## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ద్వితీయ) మూడవ సెమిస్టర్ మాదిరి ప్రశ్నాపత్రం

పేపర్-2 : నవ్యాంధ్ర కవిత్వం - దళిత సాహిత్యం

Effective from the admitted batch of 2016-17

Time : 3 Hours

Marks: 75

అన్ని ప్రశ్నలకు సమాధానాలు రాయాలి.

- I. (ఎ) తెలుగులో వచ్చిన సంఘసంస్కరణ కవిత్వాన్ని పరిచయం చేయండి. 15 మార్కులు  
లేదా  
(బి) భావకవిత్వాన్ని నిర్వచించి, భావకవిత్వంలో శాఖల గురించి తెల్పండి.
- II. (ఎ) తెలుగు సాహిత్యానికి 'షాక్ ట్రీట్ మెంట్' ఇచ్చిన దిగంబరకవిత్వాన్ని సమీక్షించండి. 15 మార్కులు  
లేదా  
(బి) స్త్రీవాద కవిత్వంలోని ఆవేశాన్ని, ఆ కవిత్వంలోని ఉదాహరణలతో వివరించండి.
- III. (ఎ) దళిత సాహిత్య ఆవిర్భావ వికాసాన్ని వివరించండి. 15 మార్కులు  
లేదా  
(బి) దళిత సాహిత్యంపై ఉద్యమాల, వ్యక్తుల ప్రభావాన్ని తెల్పండి.
- IV. (ఎ) దళిత కవిత్వ లక్షణాలను వివరించి కొన్ని దళిత కవితా సంకలనాల్ని పేర్కొనండి. 15 మార్కులు  
లేదా  
(బి) దళిత సాహిత్యంలోని తాత్విక దృక్పథాన్ని వివరించండి.
- V. క్రింది వాటిలో ఐదు ప్రశ్నలకు సమాధానాలు రాయండి. 5 × 3 = 15 మార్కులు
- |                               |                      |
|-------------------------------|----------------------|
| (1) నవ్యాంధ్ర కవిత్వ హేతువులు | (2) అభ్యుదయకవిత్వం   |
| (3) విప్లవ కవిత్వం            | (4) మైనారిటీ కవిత్వం |
| (5) హరిజన శతకం                | (6) చిక్కనాతున్న పాట |
| (7) దళిత నవలలు                | (8) దళిత నాటకాలు     |

## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ద్వితీయ) మూడవ సెమిస్టర్ మాదిరి ప్రశ్నాపత్రం

పేపర్-3 : సామాన్య భాషాశాస్త్రం

Effective from the admitted batch of 2016-17

Time : 3 Hours

Marks: 75

అన్ని ప్రశ్నలకు సమాధానాలు రాయాలి.

- I. (ఎ) భాషను నిర్వచించి, మానవ భాషకున్న ప్రత్యేకతల్ని తెల్పండి. 15 మార్కులు  
లేదా  
(బి) పాశ్చాత్య దేశాల్లో జరిగిన భాషాశాస్త్ర కృషిని వివరించండి.
- II. (ఎ) వర్ణనాత్మక, చారిత్రక భాషా శాస్త్రాల గురించి రాయండి. 15 మార్కులు  
లేదా  
(బి) పదాంశానుగుణ భాషా వర్గీకరణ గురించి రాయండి.
- III. (ఎ) ధ్వని సూత్రాలకు అపవాదాలు లేవు - చర్చించండి. 15 మార్కులు  
లేదా  
(బి) మూల భాషా పునర్నిర్మాణాన్ని గురించి రాయండి.
- IV. (ఎ) ఆదానాన్ని నిర్వచించి, ఆదానాల్లోని రకాలను గూర్చి రాయండి. 15 మార్కులు  
లేదా  
(బి) తెలుగుభాషలోని అన్యదేశాలను సోదాహరణంగా వివరించండి.
- V. క్రింది వాటిలో ఐదుప్రశ్నలకు సమాధానాలు రాయండి. 5 × 3 = 15 మార్కులు
- |                             |                              |
|-----------------------------|------------------------------|
| (1) భౌగోళికంగా భాషావర్గీకరణ | (2) భాషోత్పత్తివాదాలు        |
| (3) ఫాణిని                  | (4) విషయసేకరణ                |
| (5) భాషాపరిణామం-హేతువులు    | (6) అంతరంగిక పునర్నిర్మాణం   |
| (7) సాంస్కృతిక ఆదానాలు      | (8) తెలుగులోని డచ్ భాషాపదాలు |

## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ద్వితీయ) మూడవ సెమిస్టర్ మాదిరి ప్రశ్నాపత్రం

పేపర్-4 : జర్నలిజం - అనువాదం

Effective from the admitted batch of 2016-17

Time : 3 Hours

Marks: 75

అన్ని ప్రశ్నలకు సమాధానాలు రాయాలి.

- I. (ఎ) కమ్యూనికేషన్ నిర్వచనం, స్వభావాన్ని వివరించండి. 15 మార్కులు  
లేదా  
(బి) పత్రికారచన, పరిణామ వికాసాల్ని వివరించండి.
- II. (ఎ) వార్తా లక్షణాలు, విలువల్ని తెల్పండి. 15 మార్కులు  
లేదా  
(బి) విలేకరి లక్షణాలు, విలేకర్లలో రకాలను తెల్పండి.
- III. (ఎ) వార్తా రచన సూత్రాలు, నియమాల్ని వివరించండి. 15 మార్కులు  
లేదా  
(బి) సంపాదకుని విధులు, ప్రముఖ సంపాదకీయాల గురించి రాయండి.
- IV. (ఎ) తొలితరం పత్రికల గురించి రాయండి. 15 మార్కులు  
లేదా  
(బి) అనువాద పద్ధతులు, రకాలు తెలియజేయండి.
- V. క్రింది వాటిలో ఐదు ప్రశ్నలకు సమాధానాలు రాయండి. 5 × 3 = 15 మార్కులు
- |                             |                     |
|-----------------------------|---------------------|
| (1) మాస్ కమ్యూనికేషన్       | (2) సత్యదూత         |
| (3) పత్రికా ప్రకటనలు        | (4) దూరదర్శన్       |
| (5) కాశీనాథుని నాగేశ్వరరావు | (6) తాపీ ధర్మారావు  |
| (7) స్వేచ్ఛానువాదం          | (8) యథామాతృకానువాదం |

## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ద్వితీయ) మూడవ సెమిస్టర్ మాదిరి ప్రశ్నాపత్రం

పేపర్-5 : ఐచ్ఛికాంశం - 1. నన్నయ

Effective from the admitted batch of 2016-17

Time : 3 Hours

Marks: 75

అన్ని ప్రశ్నలకు సమాధానాలు రాయాలి.

- I. (ఎ) నన్నయకు పూర్వం దేశకాల పరిస్థితులు, భాషాసాహిత్యాల స్థితిని వివరించండి. 15 మార్కులు  
లేదా  
(బి) మార్గదేశి కవిత్వాలు, తమిళ-కన్నడ భాషల్లో భారతాలు గురించి రాయండి.
- II. (ఎ) నన్నయ మహాభారత అవతారికను విశ్లేషించండి. 15 మార్కులు  
లేదా  
(బి) నన్నయ కవితారీతుల్ని వివరించండి.
- III. (ఎ) నన్నయ భారతాంధ్రీకరణ విధానాన్ని విశ్లేషించండి. 15 మార్కులు  
లేదా  
(బి) నన్నయ రచనలో రసపోషణ, ఔచిత్యాలను విశ్లేషించండి.
- IV. (ఎ) నన్నయ భారతంలో ఉపాఖ్యానాల్ని వివరించండి. 15 మార్కులు  
లేదా  
(బి) నన్నయ సమకాలికుల్ని గురించి తెల్పండి.
- V. క్రింది వాటిలో ఐదుప్రశ్నలకు సమాధానాలు రాయండి. 5 × 3 = 15 మార్కులు
- |                             |                                      |
|-----------------------------|--------------------------------------|
| (1) రాజరాజనరేంద్రుడు        | (2) నారాయణభట్టు                      |
| (3) తూర్పు చాళుక్యులు       | (4) నన్నయశైలి                        |
| (5) నన్నయ అలభ్యరచనలు        | (6) నన్నయ పేరుతో సారస్వత కేంద్రాలు   |
| (7) నన్నయ సూక్తి (ఒక పద్యం) | (8) భారత ప్రారంభ శ్లోకం - తాత్పర్యం. |



## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ద్వితీయ) మూడవ సెమిస్టర్ మాదిరి ప్రశ్నాపత్రం

పేపర్-5 : ఐచ్ఛికాంశం - 2. కందుకూరి వీరేశలింగం

Effective from the admitted batch of 2016-17

Time : 3 Hours

Marks: 75

అన్ని ప్రశ్నలకు సమాధానాలు రాయాలి.

- I. (ఎ) 19వ శతాబ్ది ఆంధ్రదేశ సామాజిక స్థితిగతుల్ని వివరించండి. 15 మార్కులు  
లేదా  
(బి) వీరేశలింగం సంఘసంస్కరణ, స్త్రీజనోద్ధరణ భావాల్ని వివరించండి.
- II. (ఎ) వీరేశలింగం స్వీయ చరిత్ర విశేషాల్ని విశ్లేషించండి. 15 మార్కులు  
లేదా  
(బి) రాజశేఖర చరిత్ర నవలలోని సంఘసంస్కరణ భావాల్ని వివరించండి.
- III. (ఎ) కందుకూరి రచించిన జీవిత చరిత్రలు, ఇతర రచనల్ని విశ్లేషించండి. 15 మార్కులు  
లేదా  
(బి) పత్రికా రచనకు కందుకూరి మూలపురుషుడని ఎట్లు భావించవచ్చు.
- IV. (ఎ) స్త్రీ విద్యకు, వితంతు వివాహాలకు వీరేశలింగం చేసిన కృషి ఎట్టిది. 15 మార్కులు  
లేదా  
(బి) ఆధునిక సామాజిక, సాహిత్య, సాంస్కృతిక రంగాల్లో వీరేశలింగం స్థానమెట్టిదో వివరించండి.
- V. క్రింది వాటిలో మూడు ప్రశ్నలకు సమాధానాలు రాయండి. 3 × 5 = 15 మార్కులు
- |                              |                            |
|------------------------------|----------------------------|
| (1) సత్యరాజు పూర్వదేశయాత్రలు | (2) బ్రాహ్మ వివాహం ప్రహసనం |
| (3) వివేకవర్ధిని             | (4) రాజారామ్మోహన్‌రాయ్     |
| (5) హితకారిణి సమాజం          | (6) పురమందిరం (టౌన్‌హాల్)  |
| (7) రాజశేఖర చరిత్ర           | (8) ఆస్తికోన్నత పాఠశాల     |

## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ద్వితీయ) నాల్గవ సెమిస్టర్ మాదిరి ప్రశ్నాపత్రం  
పేపర్-1 : ఆధునిక సాహిత్య విమర్శ సిద్ధాంతాలు - సూత్రాలు

Effective from the admitted batch of 2016-17

Time : 3 Hours

Marks: 75

అన్ని ప్రశ్నలకు సమాధానాలు రాయాలి.

- I. (ఎ) సమాజం-సాహిత్యం-సాహిత్య విమర్శల పరస్పర సంబంధాన్ని వివరించండి. 15 మార్కులు  
లేదా  
(బి) రచయిత సామాజిక సమస్యల పరిష్కార బాధ్యత.
- II. (ఎ) కాల्పనిక సాహిత్య విమర్శను పేర్కొనండి. 15 మార్కులు  
లేదా  
(బి) విప్లవ సాహిత్య విమర్శను పరామర్శించండి.
- III. (ఎ) దళితవాద విమర్శలోని కొత్తదనాన్ని తెల్పండి. 15 మార్కులు  
లేదా  
(బి) కథానిక విమర్శనా పద్ధతుల్ని పేర్కొనండి.
- IV. (ఎ) అత్యాధునిక (సమకాలీన) సాహిత్య విమర్శకులను గూర్చి రాయండి. 15 మార్కులు  
లేదా  
(బి) వ్యాస లక్షణం, వ్యాస విమర్శ పద్ధతులు.
- V. క్రింది వాటిలో ఐదు ప్రశ్నలకు సమాధానాలు రాయండి. 5 × 3 = 15 మార్కులు
- |                                   |                              |
|-----------------------------------|------------------------------|
| (1) ఆర్.ఎస్. సుదర్శనం             | (2) సామాజిక స్పృహ            |
| (3) అభ్యుదయ సాహిత్య విమర్శ సూత్రం | (4) రాళ్ళపల్లి అనంతకృష్ణశర్మ |
| (5) స్త్రీవాద సాహిత్యం            | (6) నవల విమర్శ సూత్రం        |
| (7) సాహిత్య విమర్శ పద్ధతులు       | (8) సాహిత్య విమర్శ           |

## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ద్వితీయ) నాల్గవ సెమిస్టర్ మాదిరి ప్రశ్నాపత్రం

పేపర్-2 : నవ్యాంధ్ర వచన సాహిత్యం

Effective from the admitted batch of 2016-17

Time : 3 Hours

Marks: 75

అన్ని ప్రశ్నలకు సమాధానాలు రాయాలి.

- I. (ఎ) ప్రపంచ భాషలలో నవలా వికాస చరిత్రను వివరించండి. 15 మార్కులు  
లేదా  
(బి) తొలి తెలుగు నవలను గుర్తించి, తెలుగు నవలా లక్షణాలను వివరించండి.
- II. (ఎ) తెలుగు కథానిక ఆరంభ వికాసాలను విశదీకరించండి. 15 మార్కులు  
లేదా  
(బి) తెలుగు కథానికలో సామాజిక అంశాలను పరామర్శించండి.
- III. (ఎ) ఆధునిక తెలుగు నాటక ఆరంభవికాసాన్ని వివరించండి. 15 మార్కులు  
లేదా  
(బి) ప్రయోగాత్మక నాటక విశేషాలను తెల్పండి.
- IV. (ఎ) నాటికను నిర్వచించి, దాని లక్షణాలను విశదీకరించండి. 15 మార్కులు  
లేదా  
(బి) వ్యాస నిర్వచనం, లక్షణాలు, వ్యాస వర్గీకరణ పేర్కొనండి.
- V. క్రింది వాటిలో ఐదు ప్రశ్నలకు సమాధానాలు రాయండి. 5 × 3 = 15 మార్కులు
- |                            |                            |
|----------------------------|----------------------------|
| (1) మనోవైజ్ఞానిక నవలలు     | (2) తెలుగులో ఇద్దరు కథకులు |
| (3) ఆధునిక ప్రదర్శన రూపాలు | (4) మాలపల్లి నవల           |
| (5) మీకు నచ్చిన కథా సంకలనం | (6) ఏకాంకికలు              |
| (7) ఆధునిక వచన వాఙ్మయం     | (8) నాటకాలు - వర్గీకరణ     |

## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ద్వితీయ) నాల్గవ సెమిస్టర్ మాదిరి ప్రశ్నాపత్రం

పేపర్-3 : సామాన్య భాషాశాస్త్రం

Effective from the admitted batch of 2016-17

Time : 3 Hours

Marks: 75

అన్ని ప్రశ్నలకు సమాధానాలు రాయాలి.

- I. (ఎ) ధ్వని విజ్ఞాన శాస్త్రాధ్యయనంలోని ప్రధాన మార్గాలను సోదాహరణంగా తెల్పండి. 15 మార్కులు  
లేదా  
(బి) ధ్వని విజ్ఞాన శాస్త్రం-వర్గ విజ్ఞాన శాస్త్రాలకున్న బేధాల్ని వివరించండి.
- II. (ఎ) ధ్వని - వర్గం - సవర్ణాలను సోదాహరణంగా విశదీకరించండి. 15 మార్కులు  
లేదా  
(బి) పదాంశాల రకాలను పేర్కొని, నైదా సూత్రాలను వివరించండి.
- III. (ఎ) సన్నిహిత సంబంధులను గూర్చి విశ్లేషించండి. 15 మార్కులు  
లేదా  
(బి) తెలుగు వాక్య నిర్మాణాన్ని సంగ్రహంగా వివరించండి.
- IV. (ఎ) సమాజం-భాషకున్న సంబంధాన్ని విపులీకరించండి. 15 మార్కులు  
లేదా  
(బి) మాండలికాలను వర్గీకరించి సోదాహరణంగా వివరించండి.
- V. క్రింది వాటిలో ఐదు ప్రశ్నలకు సమాధానాలు రాయండి. 5 × 3 = 15 మార్కులు
- |                       |                            |
|-----------------------|----------------------------|
| (1) వాగింద్రియాలు     | (2) అంతర్జాతీయ ధ్వనిపట్టిక |
| (3) సపదాంశం           | (4) వర్గం                  |
| (5) వాక్య విజ్ఞానం    | (6) వాక్య నిర్మాణ పరిమితి  |
| (7) వైయక్తిక మాండలికం | (8) వ్యవహార భేదకరేఖ        |

## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ద్వితీయ) నాల్గవ సెమిస్టర్ మాదిరి ప్రశ్నాపత్రం

పేపర్-4 : సంస్కృత సాహిత్య పరిచయం

Effective from the admitted batch of 2016–17

Time : 3 Hours

Marks: 75

అన్ని ప్రశ్నలకు సమాధానాలు రాయాలి.

- I. (ఎ) సంస్కృత భాషా ప్రాముఖ్యాన్ని వివరించండి. 15 మార్కులు  
లేదా  
(బి) వైదిక వాఙ్మయ రీతుల్ని విశ్లేషించండి.
- II. (ఎ) పురాణాల్ని గురించి రాయండి. 15 మార్కులు  
లేదా  
(బి) సంస్కృత మహాకావ్య, లఘుకావ్యాలను పేర్కొనండి.
- III. (ఎ) సంస్కృత వ్యాకర్తల గురించి రాయండి. 15 మార్కులు  
లేదా  
(బి) వాల్మీకి, వ్యాసుల రామాయణ, భారత రచనల గురించి వివరించండి.
- IV. (ఎ) సంస్కృత నాటక సాహిత్యాన్ని గురించి రాయండి. 15 మార్కులు  
లేదా  
(బి) రఘుమహారాజు, కౌత్సుల సంభాషణను విశ్లేషించండి.
- V. క్రింది వాటిలో ఐదుప్రశ్నలకు సమాధానాలు రాయండి. 5 × 3 = 15 మార్కులు
- |                 |                      |
|-----------------|----------------------|
| (1) యాస్కుడు    | (2) రాజతరంగిణి       |
| (3) కాదంబరి     | (4) దశకుమార చరిత్రమ్ |
| (5) మృచ్ఛకటికమ్ | (6) వృద్ధి సంధి      |
| (7) జన్మ సంధి   | (8) విసర్గ సంధులు    |

## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ద్వితీయ) నాల్గవ సెమిస్టర్ మాదిరి ప్రశ్నాపత్రం

పేపర్-5 : ఐచ్ఛికాంశం 1. ప్రబంధ సాహిత్యం

Effective from the admitted batch of 2016-17

Time : 3 Hours

Marks: 75

అన్ని ప్రశ్నలకు సమాధానాలు రాయాలి.

- I. (ఎ) ప్రబంధయుగంనాటి సాంఘిక, చారిత్రక, సాంస్కృతిక పరిస్థితుల్ని వివరించండి. 15 మార్కులు  
లేదా  
(బి) అష్టదిగ్గజ కవుల వ్యవస్థ పుట్టుకను, సంప్రదాయాన్ని వివరించండి.
- II. (ఎ) మనుచరిత్ర వైశిష్ట్యాన్ని వివరించండి. 15 మార్కులు  
లేదా  
(బి) పారిజాతాపహరణం కావ్యాన్ని సమీక్ష చేయండి.
- III. (ఎ) ధూర్జటి భక్తి తత్వాన్ని విశ్లేషించండి. 15 మార్కులు  
లేదా  
(బి) పాండురంగ మాహాత్మ్యం కావ్యాన్ని సమీక్షించండి.
- IV. (ఎ) విజయవిలాస కావ్య వైభవాన్ని తెల్పండి. 15 మార్కులు  
లేదా  
(బి) దక్షిణాంధ్రయుగ కవయిత్రుల ప్రబంధాలగురించి రాయండి.
- V. క్రింది వాటిలో ఐదుప్రశ్నలకు సమాధానాలు రాయండి. 5 × 3 = 15 మార్కులు
- |                               |                                 |
|-------------------------------|---------------------------------|
| (1) భువన విజయం                | (2) ఆముక్తమాల్యద                |
| (3) పింగళి సూరన               | (4) వసుచరిత్ర                   |
| (5) రాజశేఖర చరిత్రం           | (6) అయ్యలరాజు రామభద్రుడు        |
| (7) ప్రబంధ వ్యాఖ్యాన గ్రంథాలు | (8) క్షేత్ర మాహాత్మ్య ప్రబంధాలు |

## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ద్వితీయ) నాల్గవ సెమిస్టర్ మాదిరి ప్రశ్నాపత్రం

పేపర్-5 : ఐచ్ఛికాంశం 2. మాండలిక విజ్ఞానం

Effective from the admitted batch of 2016–17

Time : 3 Hours

Marks: 75

అన్ని ప్రశ్నలకు సమాధానాలు రాయాలి.

- I. (ఎ) మాండలిక భాషావిర్భావాన్ని సోదాహరణంగా వివరించండి. 15 మార్కులు  
లేదా  
(బి) మాండలిక భాషలేర్పడటానికి గల హేతువులేవి.
- II. (ఎ) తెలుగు మాండలికాల్ని వివరించండి. 15 మార్కులు  
లేదా  
(బి) దక్షిణాంధ్ర మాండలికాల గురించి రాయండి.
- III. (ఎ) ప్రధాన భాషలో మాండలికాలు ఏర్పడే విధానాన్ని తెల్పండి. 15 మార్కులు  
లేదా  
(బి) ప్రాదేశిక, సాంఘిక మాండలికాల గురించి విశ్లేషించండి.
- IV. (ఎ) మాండలికాలపై పరిసర అన్యభాషల ప్రభావాన్ని వివరించండి. 15 మార్కులు  
లేదా  
(బి) మాండలికాల వ్యవహార భేదక రేఖ, పట నిర్మాణ విధానాన్ని వివరించండి.
- V. క్రింది వాటిలో ఐదుప్రశ్నలకు సమాధానాలు రాయండి. 5 × 3 = 15 మార్కులు
- |                             |                         |
|-----------------------------|-------------------------|
| (1) కుల మాండలికాలు          | (2) మధ్యమండల భాష        |
| (3) పూర్వాంధ్ర మాండలికం     | (4) వైయక్తిక మాండలికాలు |
| (5) మాండలిక వృత్తి పదకోశాలు | (6) ఆదాన విక్షేపం       |
| (7) భద్రరాజు కృష్ణమూర్తి    | (8) అన్యదేశ్యాల పట్టిక  |

**ఎం.వి. తెలుగు (ప్రథమ)**

**మొదటి సెమిస్టర్ సిలబస్**



**ఎం.వి. తెలుగు (ప్రథమ)**

**రెండవ సెమిస్టర్ సిలబస్**

ఎం.వి. తెలుగు (ద్వితీయ)

మూడవ సెమిస్టర్ సిలబస్

**ఎం.వి. తెలుగు (ద్వితీయ)**

**నాల్గవ సెమిస్టర్ సిలబస్**

**ఎం.వి. తెలుగు**  
**మాదిరి ప్రశ్నాపత్రాలు**

**ఎం.ఏ. తెలుగు - పాఠ్యప్రణాళిక**

**మరియు**

**మాదిరి ప్రశ్నా పత్రాలు**

**విశ్వవిద్యాలయం మరియు అనుబంధ కళాశాలలకు**

**( 2016-17 విద్యాసంవత్సరం నుండి అమలు )**



**తెలుగు విభాగం**

**యూనివర్సిటీ కాలేజ్ ఆఫ్ ఆర్ట్స్ & కామర్స్**

**ఆదికవి నన్నయ విశ్వవిద్యాలయం**

**రాజరాజనరేంద్రనగర్, రాజమహేంద్రవరం-533 296**

## తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ప్రథమ) మొదటి సెమిస్టర్

పేపర్-1 : తెలుగు భాషాచరిత్ర

యూనిట్ 1. (ఎ) ధారణదేశంలో భాషలు - హింద్యార్య, ద్రావిడ, ముండా, సిన్, టిబెటీన్ భాషా కుటుంబాలు.

(బి) హింద్యార్య ద్రావిడ భాషలు - వరస్పర వ్రభావం

యూనిట్ 2 (ఎ) ద్రావిడ భాషలు, తద్వ్యవహారాలు - వారి ప్రాంతాలు, ద్రావిడ భాషలలో తెలుగుస్థానం భౌగోళికంగా సరిహద్దు భాషలు

(బి) ద్రావిడ భాషా లక్షణాలు, ఆంధ్రము, తెలుగు, తెనుగు, పదాల వుట్టుపూర్వోత్తరాలు వాటి వ్యాప్తి

యూనిట్ 3. (ఎ) ప్రాబ్లన్నయ యుగాంధ్ర భాష, నన్నయ యుగాంధ్ర భాష, మధ్యయుగాంధ్ర భాష, అధునిక భాష

(బి) చారిత్రకంగా తెలుగులో సంధి - ఆగమ సంధి, ఆదేశ సంధి, లోప సంధి, కళ, ద్రుత ప్రకృతికం - పదాల వర్గీకరణ - ప్రాచీన అధునిక తెలుగుభాషలో సంధి.

యూనిట్ 4. (ఎ) తెలుగు పద నిర్మాణం - నామవాచకం - లింగం - వచనం, ప్రాచీనాంధ్రం నుండి అధునిక అంధ్రం వరకూ వచ్చిన మార్పు, సర్వనామాలు - సంఖ్యావాచకాలు.

(బి) మాండలిక విజ్ఞానం, మాండలికాల ఆవిర్భావం - లక్షణాలు, భేదాలు, వ్యాప్తి, మాండలిక భూగోళం.

సంప్రదించవలసిన గ్రంథాలు :

1. తెలుగు భాషా వికాసం - ఆచార్య గంటి కోగిసోమయాజి.
2. తెలుగు భాషా చరిత్ర - ఆచార్య భద్రరాజు కృష్ణమూర్తి.
3. ద్రావిడ భాషలు - ఆచార్య పి.యస్. సుబ్రహ్మణ్యం.
4. తెలుగువాక్యం - ఆచార్య చేకూరి రామారావు.
5. సంధి - ఆచార్య కోరాడ రామకృష్ణయ్య.
6. ద్రావిడ భాషలు చరిత్ర - డా॥ కవేంద్రు వెంకట్రామయ్య.
7. తెలుగు భాషాచరిత్ర - డా॥ వెలమల సిమ్మన్న.

ఆదికవి నన్నయ విశ్వవిద్యాలయం, ఎం.ఏ. తెలుగు పాఠ్యపూర్వక, మాదిరి ప్రశ్న పత్రాలు

**తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం**  
**ఎం.ఏ. తెలుగు (ప్రథమ) మొదటి సెమిస్టర్ మాదిరి ప్రశ్నాపత్రం**  
**పేపర్-1 : తెలుగు భాషాచరిత్ర**

Effective from the admitted batch of 2016-17

Time : 3 Hours

Marks: 75

అన్ని ప్రశ్నలకు సమాధానాలు రాయాలి.

- I. (ఎ) ద్రావిడ భాషల ప్రత్యేక లక్షణాలను తెల్పండి. 15 మార్కులు  
 లేదా  
 (బి) భారతదేశంలోని భాషా కుటుంబాలను వివరించండి.
- II. (ఎ) ద్రావిడ భాషల్లో తెలుగు స్థానాన్ని నిర్ణయించండి. 15 మార్కులు  
 లేదా  
 (బి) తెలుగు, తెనుగు పదాల చారిత్రక అధారాలను, వ్యుత్పత్తులను వివరించండి.
- III. (ఎ) ప్రాబ్లన్నయ యుగాంధ్ర భాషా లక్షణాలను తెల్పండి. 15 మార్కులు  
 లేదా  
 (బి) భాషా చారిత్రక దృక్పథంతో తెలుగులో సంధిని వివరించండి.
- IV. (ఎ) తెలుగులో లింగపచనాల గురించి తెల్పండి. 15 మార్కులు  
 లేదా  
 (బి) తెలుగులో ప్రాంతీయ, సామాజిక మాండలికాల్ని వివరించండి.
- V. క్రింది వాటిలో ఐదుప్రశ్నలకు సమాధానాలు రాయండి. 5 X 3 = 15 మార్కులు
- |                                  |                             |
|----------------------------------|-----------------------------|
| (అ) హింద్యార్య భాషాకుటుంబం       | (ఆ) ఆంధ్రము                 |
| (ఇ) మాండలిక లక్షణాలు             | (ఉ) తెలుగులో సంఖ్యా వాచకాలు |
| (ఊ) తెలుగులో మాండలికాల వర్గీకరణ  | (ఋ) తెలుగులో లోకనామ         |
| (ఋ) తెలుగులో నిర్దేశనామ వర్గీకరణ | (ౠ) లక్షణాలను వివరించండి    |

# తెలుగుశాఖ, ఆంధ్రవిశ్వ కళాపరిషత్, విశాఖపట్నం

Department of Telugu : Andhra University  
M.A. Telugu (Previous) First Semester Syllabus  
(Effect from the Admitted Batch of 2015-16)

## Paper - 2 : తెలుగు సాహిత్య చరిత్ర

- Unit I**
- (a) వాఙ్మయ, సారస్వత శబ్దార్థాలు - సాహిత్య చరిత్ర స్వరూప స్వభావాలు (అధ్యయన పద్ధతులు) - 1. కాలానుసరణ, 2. చారిత్రక, తులనాత్మక పద్ధతులు.
- (బి) ఆంధ్ర సాహిత్య చరిత్రకు అనువైన యుగ విభాగం - యుగకర్త నిర్దేశం.
- Unit II**
- (a) ప్రాబ్లన్నయ యుగం - శాసనాలు - ఛందో విశేషాలు - కావ్య సంభాష్యత - నన్నయ యుగం (1000-1100) భారతాంధ్రీకరణకు చారిత్రక నేపథ్యం.
- (బి) నన్నయ భారతాంధ్రీకరణ పద్ధతి - నన్నయ కవితా రీతులు - ఆత్మీయత - యుగ ప్రాముఖ్యం.
- Unit III**
- (a) శివకవి యుగం (1001-1245) పాల్కురికి సోమనాథుని కృతుల సమీక్ష - మార్గదేశి, వస్తు కవితల స్వరూపం - జానుతెనుగు స్వభావం. ఇతర కవులు : 1. నన్నెచోడుడు, 2. శివదేవయ్య, 3. చక్రపాణిరంగనాథుడు, 4. యథావాక్కుల అన్నమయ్య - శివకవి యుగ ప్రత్యేకత.
- (బి) తిక్కన యుగం (1245-1301) - తిక్కన (సమన్వయ దృష్టి) హరిహరనాథతత్వం - తిక్కన కృతుల సమీక్ష - కవితా రీతులు - ఆత్మీయత. ఇతర కవులు - 1, కేతన, 2. మారన, 3. మంచెన, 4. గోన బుద్ధారెడ్డి.
- Unit IV**
- (a) ఎర్రన యుగం (1301 -1350) ఎర్రన కృతుల పౌర్వాపర్యం - కృతుల సమీక్ష. నాచన సోమనాథుని కృతి సమీక్ష - ఎర్రన, సోమనల కవితా తారతమ్యం.
- (బి) భాస్కర రామాయణ కృతి సమీక్ష. ఇతర కవులు - 1, వేములవాడ భీమకవి (త్రిపురాంతకోదాహరణం). 2. కృష్ణమాచార్యులు (సింహగిరి నరహరి వచనాలు)
- Unit V**
- (a) శ్రీనాథ యుగం (1361-1500) శ్రీనాథుని కృతుల సమీక్ష - నైషధాంధ్రీకరణ పద్ధతి - కవితారీతులు - ఆత్మీయత.
- (బి) పోతన కృతులు - సమీక్ష. ఇతర కవులు - 1. పినవీరన (శృంగార శాకుంతలం), 2. గౌరన (హరిశ్చంద్రోపాఖ్యానం), 3. జక్కన (విక్రమార్క చరిత్రం), 4. అనంతామాత్యుడు (భోజరాజీయం), 5. అన్నమయ్య - వేమనల సామాజిక సంస్కరణ దృక్పథం.

ప్రదించవలసిన గ్రంథాలు :-

1. ఆంధ్ర సాహిత్య చరిత్ర - పింగళి లక్ష్మీకాంతం, 2. తెలుగు సాహిత్య చరిత్ర (సంపుటం 3,4,5) - కొర్లపాటి రామమూర్తి, 3. తెలుగు సాహిత్య సమీక్ష - జి.నాగయ్య, 4. ఆంధ్ర ప్రబంధము - అవతరణ వికాసములు - కెవిఆర్ సింహం, 5. దక్షిణాంధ్రయుగ వాఙ్మయ చరిత్ర - కెవిఆర్ నరసింహం, 6. తంజాపురాంధ్ర సాహిత్య చరిత్ర - కొక్కాండ సతి, 7. ఉషకిరణాలు - యండమూరి సత్యనారాయణ, 8. ఆంధ్ర సంస్థానములు - సాహిత్య పోషణములు - తూమాటి దొణప్ప, 9. గు సాహిత్యచరిత్ర - ఆచార్య వెలమల సిమ్మన్న.



తెలుగుశాఖ, ఆంధ్రవిశ్వ కళాపరిషత్, విశాఖపట్నం

Department of Telugu : Andhra University

M.A. Telugu (Previous) First Semester

Model Question Paper

(Effect from the Admitted Batch of 2015-16)

Paper - 2 : తెలుగు సాహిత్య చరిత్ర

సమయం : 3 గంటలు

Max. Marks : 80

అన్ని ప్రశ్నలకు సమాధానాలు రాయండి.

1. ఎ) వాఙ్మయ, సారస్వత, సాహిత్య శబ్దాల్ని చర్చించండి. 12 మార్కులు  
(లేదా)  
బి) సాహిత్య అధ్యయన పద్ధతుల్ని వివరించండి.
2. ఎ) ప్రాబ్లున్నయ యుగంలో శాసన కవిత్వాన్ని విశదీకరించండి. 12 మార్కులు  
(లేదా)  
బి) నన్నయ కవితారీతుల్ని వివరించండి.
3. ఎ) శైవ కవితా వైశిష్ట్యాన్ని తెల్పి, పాల్కురికి సోమనాథుని వైలక్షణ్యాన్ని వివరించండి. 12 మార్కులు  
(లేదా)  
బి) తిక్కన నాటకీయతను గురించి రాయండి.
4. ఎ) ఎర్రన - సోమనల కవితా తారతమ్యాల్ని వివరించండి. 12 మార్కులు  
(లేదా)  
బి) భాస్కర రామాయణ కర్మత్వాన్ని నిర్ణయించండి.
5. ఎ) శ్రీనాథుని కవితారీతులు తెల్పండి. 12 మార్కులు  
(లేదా)  
బి) పోతన భాగవత వైశిష్ట్యాన్ని వివరించండి.
6. ఈ క్రింది లఘు ప్రశ్నల్లో నాల్గింటికి సమాధానాలు రాయండి. 4x5 = 20 మార్కులు  
ఎ. కేతన ఇ. శృంగార శాకుంతలం  
బి. అన్నమయ్య ఎఫ్. పలనాటి వీరచరిత్ర  
సి. జక్కన జి. యధావాక్కుల అన్నమయ్య  
డి. అనంతామాత్యుడు హెచ్. గౌరన

తెలుగుశాఖ, ఆంధ్రవిశ్వ కళాపరిషత్, విశాఖపట్నం

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Unit I

- ఎ) 1) ఆంధ్రుల పుట్టు పూర్వోత్తరాలు - వివరణ, 2) సంఘం, నాగరికత, సంస్కృతి - నిర్వచనాలు, వివరణ  
బి) 1) భారతీయ సంస్కృతి వికాసానికి ప్రముఖుల సేవ, 2) భారతీయ సంస్కృతి వికాసానికి రాజవంశాల సేవ

Unit II

- ఎ) 1) ఆంధ్ర సంస్కృతి వికాసానికి ప్రముఖుల సేవ, 2) ఆంధ్ర సంస్కృతి వికాసానికి రాజవంశాల సేవ  
బి) 1) ఆంధ్ర సంస్కృతిపై వైదిక మత ప్రభావం, 2) ఆంధ్ర సంస్కృతిపై జైనమత ప్రభావం  
3) ఆంధ్ర సంస్కృతిపై బౌద్ధమత ప్రభావం

Unit III

- ఎ) 1) ఆంధ్ర సంస్కృతిపై శైవమత ప్రభావం, 2) ఆంధ్ర సంస్కృతిపై వైష్ణవ మత ప్రభావం.  
బి) 1) ఆంధ్ర సంస్కృతిపై ఇస్లాం, క్రైస్తవ మతాల ప్రభావం.,  
2) ఆంధ్ర సంస్కృతిపై ఆర్య సమాజ, బ్రహ్మ సమాజాల ప్రభావం.  
3) ఆంధ్ర సంస్కృతి వికాసానికి యోగుల, సాధువుల, సన్యాసుల సేవ.

Unit IV

- ఎ) 1) సంస్కృతి పరిపోషకాలుగా నాట్యం, సంగీతం., 2) సంస్కృతి పరిపోషకాలుగా శిల్పం, చిత్రలేఖనాలు.  
బి) 1) సాంస్కృతిక కేంద్రాలుగా దేవాలయాలు, 2) జాతరలు, తిరునాళ్ళు, ఉత్సవాలు, తీర్థాల్లో సాంస్కృతికాంశాలు.

Unit V

- ఎ) 1) పండుగలు పబ్లిక్లలోని సాంస్కృతిక అంశాలు., 2) ఆట పాటల్లోని సాంస్కృతికాంశాలు.  
బి) 1) ఆంధ్ర సంస్కృతికి స్త్రీలు చేసిన సేవ, 2) భారతీయ సంస్కృతి వికాసానికి ఆంధ్రుల సేవ.

సంప్రదించవలసిన గ్రంథాలు :

1. సమగ్ర ఆంధ్ర దేశ చరిత్ర - సంస్కృతి : 1,2 భాగాలు ముప్పాళ్ళ హనుమంతరావు.
2. ఆంధ్రుల సాంఘిక చరిత్ర : సురవరం ప్రతాపరెడ్డి
3. ఆంధ్రుల సంస్కృతి - చరిత్ర : 1, 2 భాగాలు, కంభంపాటి సత్యనారాయణ
4. ఆంధ్రుల చరిత్ర - సంస్కృతి : ఖండవల్లి లక్ష్మీరంజనం.
5. ఆంధ్ర దేశ చరిత్ర - సంస్కృతి : పి.శ్రీరామశర్మ : తెలుగు అకాడమీ ప్రచురణ.
6. తెలుగు చరిత్ర - సంస్కృతి : సి.వి.రామచంద్రరావు, బి.భాస్కర చౌదరి : తెలుగు అకాడమీ ప్రచురణలు
7. తెలుగు సంస్కృతి : ప్రథమ సంపుటం - తెలుగు భాషా సమితి ప్రచురణ
8. విజ్ఞాన సర్వస్వం : 3, 4 సంపుటాలు : తెలుగు భాషా సమితి ప్రచురణ
9. ఆంధ్రుల సంక్షిప్త చరిత్ర - డా. తిరుమల రామచంద్ర
10. ఆధునిక తెలుగు సాహిత్యంలో ప్రక్రియలు, ధోరణులు - తెలుగు అకాడమీ  
తెలుగు సంపాదకులు - డా॥ అవుల మంజులత (2005, 2009), సంపాదకులు - ఆచార్య ఎస్వీ సత్యనారాయణ
11. తెలుగులో కవిత్వోద్యమాలు - సంపాదకులు - డా॥ అవుల మంజులత - 2003

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సమయం : 3 గంటలు

Max. Marks : 80

అన్ని ప్రశ్నలకు సమాధానాలు రాయండి.

1. ఎ) ఆంధ్రుల పుట్టుపూర్వోత్తరాలను వివరించండి. 12 మార్కులు  
(లేదా)  
బి) భారతీయ సంస్కృతీ వికాసానికి రాజవంశాల సేవను తెలుపండి.
2. ఎ) ఆంధ్ర సంస్కృతీ వికాసానికి ప్రముఖులు చేసిన సేవను రాయండి. 12 మార్కులు  
(లేదా)  
బి) ఆంధ్ర సంస్కృతిపై బౌద్ధమత ప్రభావాన్ని వివరించండి.
3. ఎ) ఆంధ్ర సంస్కృతి మీద శైవ మత ప్రభావాన్ని వివరించండి. 12 మార్కులు  
(లేదా)  
బి) ఆంధ్ర సంస్కృతీ వికాసానికి యోగులు, సాధువులు, సన్యాసులు చేసిన సేవను వివరించండి.
4. ఎ) సంస్కృతీ పరిపోషకాలుగా శిల్పం చిత్రలేఖనాల పాత్రను నిరూపించండి. 12 మార్కులు  
(లేదా)  
బి) మన దేవాలయాలు సాంస్కృతిక కేంద్రాలు - వివరించండి.
5. ఎ) మన పండుగలు, పబ్బాల్లోని సాంస్కృతిక అంశాలను విశ్లేషించండి. 12 మార్కులు  
(లేదా)  
బి) ఆంధ్ర సంస్కృతికి స్త్రీలు చేసిన సేవను వివరించండి.
6. ఈ క్రింది లఘు ప్రశ్నల్లో నాల్గింటికి లఘు సమాధానాలు రాయండి. 4×5 = 20 మార్కులు  
ఎ. సంఘం - నాగరికత - సంస్కృతి ఇ. భారతీయ సంస్కృతికి ఆంధ్రుల సేవ  
బి. బ్రహ్మసమాజం ఎఫ్. ఆటపాటలు  
సి. జాతరలు, ఉత్సవాలు జి. ఇస్లాం మతం  
డి. క్రైస్తవమతం హెచ్. వైదికమతం

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Paper - 4 : కావ్యనాటకాలు

- Unit I తిక్కన - శ్రీకృష్ణ రాయబారము: ఉద్యోగపర్వం - తృతీయాశ్వాసం (1-144 పద్యాలు)
- Unit II శ్రీనాథుడు - గుణనిధి కథ: కాశీఖండం - నాల్గవ ఆశ్వాసం (76-133 పద్యాలు)
- Unit III పింగళి సూరన - కళాపూర్ణోదయము సుగాత్రిశాలీనుల కథ - 4-ఆశ్వాసం  
(60-142 వరకు)
- Unit IV విశ్వనాథ సత్యనారాయణ - ఆంధ్ర ప్రశస్తి.
- Unit V ఆత్రేయ - ఎన్.జి.ఓ (నాటకం)

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Paper - 4 : కావ్యనాటకాలు

సమయం : 3 గంటలు

Max. Marks : 80

అన్ని ప్రశ్నలకు సమాధానాలు రాయండి.

- 1) ఎ) పాండవులు కృష్ణునితో చేసిన సంభాషణను వివరించండి? 12మార్కులు  
(లేదా)  
బి) కృష్ణరాయబారంలో తిక్కన కవితాచాతుర్యాన్ని పరిశీలించండి?
  - 2) ఎ) గుణనిధి కథా స్వరూప పరమార్థాలను విశదీకరించండి? 12మార్కులు  
(లేదా)  
బి) గుణనిధి కథలో శ్రీనాథుడు చూపిన కవితా విశేషాలను పేర్కొనండి?
  - 3) ఎ) సుగాత్రీశాలీసుల వృత్తాంతాన్ని వివరించండి. 12మార్కులు  
(లేదా)  
బి) పింగళి సూరన రచనలోని కథా వేగ గాంభీర్యాలు నిరూపించండి.
  - 4) ఎ) "ఆంధ్రప్రశస్తి" లోని ఆంధ్రుల సంస్కృతి సంపదను వివరించండి? 12మార్కులు  
(లేదా)  
బి) "ఆంధ్రప్రశస్తి" లో విశ్వనాథ వారి భావజాలాన్ని ఆవిష్కరించండి?
  - 5) ఎ) ఎస్టివో నాటకంలోని చిరుద్యోగివెధలను వివరించండి? 12మార్కులు  
(లేదా)  
బి) ఎస్టివో నాటకంలోని కథా ప్రయోజనాలను అన్వేషించండి?
  - 6) ఎ) ఈ కింది వానిలో ఒక పద్యానికి సమగ్రవ్యాఖ్య రాయండి? 10మార్కులు
- 1) నావుడు నవ్వుటాలకనిసంబవనాత్మజ యింతయేటికిం  
గేవల యోధవే పరులకిల్లిషముల్ దలపోయ కిమ్మెయిన్  
జావడమైన జూచి యిది చందము గాదని యంటిగాక నీ  
చేవయులావు నీవు మునుచేసిన భంగులు నేనెఱుంగనే
  - 2) ఇట్టి నిరర్థునెందు గన మేమనఁ బోయిన నీవు మిక్కిలిన్  
దిట్టెదు నాదు సంపదకు దిక్కుగుచున్ మగమొల్క నీకికన్  
బుట్టు నొయంటిమే నితని పొడిమి గంటిమ వట్టి గొడ్డుతా  
కట్టితడెంతయున్న విను గాఠియపెట్టుట వెళ్ళ గొట్టినన్
- 6) బి) కిందివానిలో రెండింటికి సందర్భసహిత వ్యాఖ్యలు రాయండి? 2x5=10మార్కులు
- 1) వలవదధిక దీర్ఘవైరవృత్తి 2) పొమ్మొవ్వుడ నేను నీకు బుద్ధులు సెప్పన్
  - 3) అధిపు నెఱగనీక యడచుచుండు 4) కాంతయునట్లయిన నెట్టు కాపురమింకన్

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Paper - 5 : జానపద విజ్ఞానం - సామాజికత

- Unit I
- ఎ) 1. జానపద విజ్ఞానం - నిర్వచనం, లక్షణాలు, వర్గీకరణ  
 2. ఆటవిక, గ్రామీణ, నాగరిక, విజ్ఞానాల తారతమ్యాలు
- బి) 1. పాశ్చాత్య జానపద విజ్ఞాన కృషికులు  
 2. తెలుగు జానపద విజ్ఞాన కృషికులు
- Unit II
- ఎ) 1. జానపద భాష - మాండలికాలు, సంధులు, జాతీయాలు, నామవిజ్ఞానం.  
 2. జానపద భాష - ధ్వనుల మార్పు, పదజాలం, అన్యదేశ్యాలు, మారుమూల పదాలు, జానపద విరుక్తి
- బి) 1. జానపద కళలు - బుర్రకథ, తప్పెటగుళ్ళు, పగటి వేషాలు  
 2. జానపద కళలు - వాలకం, మోడి, దొమ్మరాట,
- Unit III
- ఎ) 1. జానపద వస్తుసంస్కృతి - వృత్తులు, వృత్తి పరికరాలు, గృహ నిర్మాణం, ఆహారం.  
 2. జానపద వస్తుసంస్కృతి - దుస్తులు, ఆభరణాలు, చిత్రకళ, చేతి పనులు
- బి) 1. జానపద సాంఘికాచారాలు - పుట్టుక, వివాహం, మరణం, మతం  
 2. జానపద సాంఘికాచారాలు - పండుగలు, ఉత్సవాలు, జాతరలు, నమ్మకాలు.
- Unit IV
- ఎ) 1. ప్రాథమిక మానవ సమాజం - దాని పెరుగుదలలో అంతరాలు  
 2. జానపదుల దృక్పథంలో సమాజం - దాని పరిధి, లక్షణాలు
- బి) 1. మత, నీతి నేపథ్యంలో జానపద సమాజ నిర్మాణం.  
 2. జానపదుల ప్రచార సాధనాలు - జానపద విధానంలో ప్రచారాలు.
- Unit V
- ఎ) 1. జానపద విజ్ఞానంలో కనిపించే గ్రామీణ రాజకీయ ధోరణులు  
 2. ఆధునిక గ్రామీణ జీవితంలో వచ్చిన, వస్తున్న మార్పులు.
- బి) 1. తెలుగు వారి జీవన విధానంలో జానపద ఛాయలు  
 2. జానపద విజ్ఞాన వస్తుప్రదర్శనశాలలు

సంప్రదించవలసిన గ్రంథాలు :

- 1) జానపద విజ్ఞానాధ్యయనం - ఆచార్య జి.ఎస్. మోహన్
- 2) ఆంధ్రుల జాన పద విజ్ఞానం - ఆర్వీఎస్. సుందరం
- 3) తెలుగు జానపద గేయా సాహిత్యం - బి.రామరాజు
- 4) తెలుగు జానపద విజ్ఞానం - సమాజం - సంస్కృతి - సాహిత్యం - (సంకలనం)  
 - డా॥ తంగిరాల వెంకట సుబ్బారావు & ఆచార్య ఆర్వీఎస్.సుందరం

తెలుగుశాఖ, ఆంధ్రవిశ్వ కళాపరిషత్, విశాఖపట్నం  
 Department of Telugu : Andhra University  
 M.A. Telugu (Previous) First Semester  
 Model Question Paper  
 (Effect from the Admitted Batch of 2015-16)

పేపర్ - 5, జానపద విజ్ఞానం - సామాజికత

సమయం : 3 గంటలు

మార్కులు : 80

అన్ని ప్రశ్నలకు సమాధానాలు రాయాలి

- 1 ఎ) జానపద విజ్ఞానాన్ని నిర్వచించి, లక్షణాలను తెలుపండి? 12 మార్కులు  
 (లేదా)  
 బి) తెలుగు జానపద విజ్ఞాన కృషికుల గురించి రాయండి?
- 2 ఎ) జానపద భాషలోని ధ్వనుల మార్పు, అన్యదేశ్యాలు, జానపద నిరుక్తిలను గురించి రాయండి? 12 మార్కులు  
 (లేదా)  
 బి) జానపద కళలలో వాలకం, మోడిల ప్రదర్శనను వివరించండి?
- 3 ఎ. వస్తు సంస్కృతిలోని దుస్తులు, ఆభరణాలు చిత్రకళను గురించి రాయండి? 12 మార్కులు  
 (లేదా)  
 బి) పండుగలు, ఉత్సవాలు, జాతరలను గురించి వివరించండి?
- 4 ఎ) జానపదుల దృశ్యకళలో సమాజాన్ని గురించి జానపద సమాజ లక్షణాలను గురించి విశ్లేషించండి. 12 మార్కులు  
 (లేదా)  
 బి) జానపదుల ప్రచార సాధనాలను, జానపద విధానంలో ప్రచారాలను గురించి రాయండి.
- 5 ఎ. ఆధునిక గ్రామీణ జీవితంలోని వచ్చిన, వస్తున్న మార్పులను వివరించండి. 12 మార్కులు  
 (లేదా)  
 బి. తెలుగు వారి జీవన విధానంలోని జానపద ఛాయలను గురించి రాయండి.
- 6 ఈ క్రింది లఘు ప్రశ్నల్లో నాల్గింటికి లఘు సమాధానాలు రాయండి. 4 X 5 = 20 మార్కులు  
 ఎ. ఆటవిక విజ్ఞానం ఇ. జానపద విజ్ఞాన వస్తు ప్రదర్శన శాలలు  
 బి. మాండలికాలు ఎఫ్. జానపద విజ్ఞాన వర్గీకరణ  
 సి. జానపదుల గృహ నిర్మాణం, ఆహారం జి. పాశ్చాత్య జానపద విజ్ఞానకృషికులు  
 డి. ప్రాథమిక మానవ సమాజం హెచ్. నాగరిక విజ్ఞానం

# తెలుగు విభాగం : ఆదికవి నన్నయ విశ్వవిద్యాలయం

ఎం.ఏ. తెలుగు (ప్రథమ) రెండవ సెమిస్టర్

పేపర్-1 : తెలుగు భాషాచరిత్ర

- యూనిట్ 1. (ఎ) తెలుగులో గ్రాంథిక, వ్యావహారిక తెలులు - నిర్వచనం, ఉత్పత్తి విలాసాలు.  
(బి) ఆధునిక ప్రామాణిక తెలుగుభాష - ఆవశ్యకం.

- యూనిట్ 2. (ఎ) క్రియ : క్రియాధాతు నిర్మాణం - ప్రాథమికం, ద్వితీయం - సకర్మణం - అకర్మణం  
(బి) సమాపక క్రియలు - అసమాపక క్రియలు, భూత, భవిష్యద్భూతకాలాలు - చరిత్ర, సంయుక్తక్రియా నిర్మాణం.

- యూనిట్ 3. (ఎ) పదజాలం : దేశ్యం, దేశ్యేతరం.  
(బి) హిందూర్వ, మధ్య ప్రాచ్య, పాశ్చాత్య, ద్రావిడ భాషల నుండి తెలుగులోకి వచ్చి చేరిన సమీకృత పదాలు - అసమీకృత పదాలు.  
(సి) ధ్వని పరిణామం

- యూనిట్ 4. (ఎ) అర్థ పరిణామం  
(బి) వాక్య నిర్మాణం - పురుష లోధక ప్రత్యయాలు  
(సి) ఔపవిభక్తిరూపాలు - విభక్తి ప్రత్యయాలు

సంప్రదించవలసిన గ్రంథాలు :

1. అంధ్రభాషా వికాసం - అచార్య గండికోటి సోమయాజి.
2. తెలుగుభాషా చరిత్ర - అచార్య భద్రరాజు కృష్ణమూర్తి.
3. ద్రావిడ భాషలు - అచార్య పి.ఎస్. సుబ్రహ్మణ్యం.
4. తెలుగు వాక్యం - అచార్య వేణుగిరి రామారావు.
5. సంధి - అచార్య కోరాడ రామకృష్ణయ్య.
6. ఎ స్టడీ ఆఫ్ తెలుగు సెమాంటిక్స్ - అచార్య జి.ఎస్. రెడ్డి.
7. ద్రావిడ భాషలు చరిత్ర - డా॥ ఈశ్వరప్ప వెంకటాచార్యులు.
8. అంధ్ర విశ్వకావ చరిత్ర - వ్యావహారిక తెలుగు భాషా వ్యాప్తి - డా॥ డి.వి. రమణారెడ్డి.
9. తెలుగు భాషా చరిత్ర - డా॥ వెంకట నిమ్మిళ్ళ.

ఆదికవి నన్నయ విశ్వవిద్యాలయం, ఎం.ఏ. తెలుగు విశ్వవిద్యాలయం, హైదరాబాద్



**తెలుగు విభాగం : ఆదికవి సన్నయ విశ్వవిద్యాలయం**  
**ఎం.ఏ. తెలుగు (ప్రథమ) రెండవ సెమిస్టర్ మాదిరి ప్రశ్నాపత్రం**  
**పేపర్-1 : తెలుగు భాషాచరిత్ర**

Effective from the admitted batch of 2016-17

Time : 3 Hours

Marks: 75

అన్ని ప్రశ్నలకు సమాధానాలు రాయాలి.

- I. (ఎ) గ్రాంథిక వ్యావహారిక భాషావాద ప్రధాన అంశాలను పేర్కొనుండి. 15 మార్కులు  
 లేదా  
 (బి) ఆధునిక తెలుగుభాష ప్రమాణీకరణ అవశ్యకతను వెల్లడి.
- II. (ఎ) తెలుగులో త్రియాధాతు నిర్మాణాన్ని వివరించండి. 15 మార్కులు  
 లేదా  
 (బి) తెలుగులో సంయుక్త త్రియా నిర్మాణాన్ని వివరించండి.
- III. (ఎ) తెలుగులోడి వచ్చి చేరిన సమీకృత, అసమీకృత పదాల్ని పేర్కొనుండి. 15 మార్కులు  
 లేదా  
 (బి) తెలుగులో వచ్చిన ధ్వని మార్పుల్ని వివరించండి.
- IV. (ఎ) తెలుగులో వాక్య నిర్మాణ రీతిల్ని వివరించండి. 15 మార్కులు  
 లేదా  
 (బి) అర్థపరిణామాన్ని నిర్వచించి, తార్కిక అర్థపరిణామ రూపాల్ని పేర్కొనుండి.
- V. త్రింది వాటిలో ఐదుప్రశ్నలకు సమాధానాలు రాయండి. 5 × 3 = 15 మార్కులు  
 (అ) పత్రికల్లో ప్రామాణిక భాష (ఆ) సమాచార త్రియలు (ఇ) ఐదవితైక ప్రత్యయాలు  
 (ఈ) తెలుగులో దేశ్యకర పదాలు (ఊ) అదర్శక త్రియలు (ఊ) పురుషలోఠక ప్రత్యయాలు  
 (ఎ) గడుగు రామూర్తి సంకులు (ఏ) అలార్య వీరుని రామారావు.

# తెలుగుశాఖ, ఆంధ్రవిశ్వ కళాపరిషత్, విశాఖపట్నం

Department of Telugu : Andhra University

M.A. Telugu (Previous) Second Semester Syllabus  
(With Effect from Batch 2015-16) UNIT - I ఎ)

## పేపర్ : 2 తెలుగు సాహిత్య చరిత్ర

- Unit I
- ఎ) 1. రాయల యుగం (1501-1600) - ప్రబంధ యుగం L ప్రబంధ లక్షణాలు (స.స. చరిత్ర)  
2. అప్పదిగజ కవుల పరిచయం - పుష్పదేవరాయలు, 4. తిలకాచారి, 5. కవిత్వం.
- బి) కవులు : (శ్రీకృష్ణదేవరాయలు (అనుభవనాథుడు), 1. అల్లసాని పెద్దన (మనుచరిత్ర),  
2. నంది తిమ్మన (సాహిత్యాపహరణం), 3. దూర్జటి (శ్రీకాళహస్తిశ్లోక మాహాత్మ్యం),  
4. మారయ్య గారి మల్లన (రాజశేఖర చరిత్ర), 5. అయ్యలరాజు రామభద్రుడు (రామాభ్యుదయం), 6. రామరాజభూషణుడు (వసుచరిత్ర), 7. పింగళి సూరన (కళాపూర్ణోదయం, ప్రభావతీ ప్రద్యుమ్నం), 8. తెనాలి రామకృష్ణుడు (పాండురంగ మాహాత్మ్యం).
- Unit II
- ఎ) 1. రాయల యుగం - ఇతర కవులు : 1. కందుకూరి రుద్రకవి (నిరంకుశోపాఖ్యానం)  
2. చింతలపూడి ఎల్లనార్యుడు (రాధామాధవీయం), 3. చెదలవాడ మల్లన (విప్రనారాయణ చరిత్రం).
- బి) 1. నాదెండ్ల గోపనమంత్రి (కృష్ణార్జున సంవాదం), 2. ఆద్దంతి గంగాధరుడు (తపతీ సంవరణోపాఖ్యానం), 3. సంకుసాల నృసింహకవి (కవి కర్తరసాయనం),  
4. పొన్నిగంటి తెలగన్న (యయాతి చరిత్ర), 5. కంకంటి పాపరాజు (ఉత్తర రామాయణం)
- Unit III
- ఎ) 1. దక్షిణాంధ్ర యుగం (1601 - 1855) తంజావూరు, మధుర, పుదుక్కోట, మైసూరు, పాలకుల వాఙ్మయ సేవ, చేమకూర జేంకటకవి.
- బి) 1. రఘునాథ నాయకుని కృతుల సమీక్ష, యక్షగాన, వచన కావ్య ప్రక్రియల పుట్టుక - వికాసం.
- Unit IV
- ఎ) 1. దక్షిణాంధ్ర యుగ ఇతర కవులు : 1. రంగాజమ్మ (మన్నారుదాస విలాస నాటకం)  
2. ముద్దు పళ ని (రాధికా సాంతనం), 3. సముఖం వెంకట కృష్ణపునాయకుడు (జైమిని భారతం - వచన ప్రబంధం).
- బి) 1. శేషం వేంకటపతి (తారాశాంకం), 2. కలువెవీరరాజు (ఆంధ్ర వచన భారతం),  
దక్షిణాంధ్ర యుగవైశిష్ట్యం.
- Unit V
- ఎ) క్షీణయుగం - క్షీణయుగ కవితా లక్షణాలు : వివిధ సంస్థానాలు (1. విజయనగరం, 2. పెద్దాపురం, 3. వెంకటగిరి, 4. గద్వాల) వాఙ్మయ సేవలు సంక్షిప్తంగా, కూచిమంచి తిమ్మన కృతుల సమీక్ష.
- బి) ఇతర కవులు : 1. పాలవేకరి కదిరీపతి (శుకసప్తతి), 2. ఏనుగు లక్ష్మణకవి (సుభాషిత రత్నావళి), 3. అడిదం సూరన (కవి జనరంజనం), 4. పిండిప్రోలు లక్ష్మణకవి (రావణ దమ్మీయం), 5. గోగులపాటి కూర్మనాథకవి (నారసింహ శతకం),  
6. కాసుల పురుషోత్తమకవి (ఆంధ్రనాయక శతకం) - పాశ్చాత్యుల వాఙ్మయ సేవ, ప్రత్యేకించి సి.పి. బ్రౌన్.

### సంప్రదించవలసిన గ్రంథాలు :-

1. ఆంధ్ర సాహిత్య చరిత్ర - పింగళి లక్ష్మీకాంతం, 2. తెలుగు సాహిత్య చరిత్ర (సంపుటం 3,4,5) - కొర్లపాటి రామమూర్తి, 3. తెలుగు సాహిత్య సమీక్ష - జి.నాగయ్య, 4. ఆంధ్ర ప్రబంధము - అవతరణ వికాసములు - కెవిఆర్ నరసింహం, 5. దక్షిణాంధ్రయుగ వాఙ్మయ చరిత్ర - కెవిఆర్ నరసింహం, 6. తంజావూరాంధ్ర సాహిత్య చరిత్ర - కొక్కొండ త్యవతి, 7. ఉష:కిరణాలు - యండమూరి సత్యనారాయణ, 8. ఆంధ్ర సంస్థానములు - సాహిత్య షోషణములు - తూమాటి ణప్ప, 9. తెలుగు సాహిత్యచరిత్ర - ఆచార్య వెలమల సిమ్మన్న.



తెలుగుశాఖ, ఆంధ్రవిశ్వ కళాపరిషత్, విశాఖపట్నం  
 Department of Telugu : Andhra University  
 M.A. Telugu (Previous) Second Semester Syllabus  
 (With Effect from Batch 2015-16)

పేపర్ : 3 ఛందోవ్యాకరణాలంకారాలు

Unit I	బాల వ్యాకరణం :	ఎ) సంజ్ఞా పరిచ్ఛేదం, బి) సంధి పరిచ్ఛేదం
Unit II	బాలవ్యాకరణం,	ఎ) తత్సమం పరిచ్ఛేదం, బి) కారక పరిచ్ఛేదం
Unit III	ఎ) బాలవ్యాకరణం, సమాస పరిచ్ఛేదం. బి) ప్రౌఢ వ్యాకరణం, వాక్యపరిచ్ఛేదం.	
Unit IV	అప్పకవీయం :	ఎ) యతులు బి) ప్రాసలు
Unit V	అలంకారాలు,	ఎ) 1. ఉపమ, 2. రూపక, అపహ్నావ, 4. ఉత్పేక్ష, 5. దీపక, 6. సహోక్తి 7. సమాసోక్తి, 8. శ్లేష 9. వ్యాజస్తుతి, 10. కావ్యలింగం. బి) 11. అర్థాంతరన్యాసం, 12. తద్గుణ, 13. వక్రోక్తి, 14. సందేహ, 15. అతిశయోక్తి, 16. విభావన, 17. నిదర్శన, 18. దృష్టాంతం 19. పర్యాయోక్తి, 20. పరికర అలంకారాలు. 21. శబ్దాలంకారాలు.

సంప్రదించవలసిన గ్రంథాలు :

- 1) రమణీయం - దువ్వూరి వెంకటరమణ శాస్త్రి
- 2) ఘంటాపథవ్యాకరణం (బాలవ్యాకరణం) వంతరాం, రామకృష్ణారావు
- 3) వ్యాకరణ దీపిక - కోరాడ ఉమహదేవశాస్త్రి
- 4) బాలవ్యాకరణ, వికాస వ్యాఖ్య - బొడ్డుపల్లి పురుషోత్తం
- 5) గుప్తార్థ ప్రకాశిక - దూసిరామమూర్తి శాస్త్రి
- 6) బాల - ప్రౌఢ వ్యాకరణాల విశ్లేషణ - సజ్జా మోహనరావు
- 7) అప్పకవీయం - (తృతీయాశ్వాసం - యతి, ప్రాసలు) - అప్పకవి.
- 8) చంద్రాలోకం, అక్కిరాజు ఉమాకాంతం గారి వ్యాఖ్యానం

తెలుగుశాఖ, ఆంధ్రవిశ్వ కళాపరిషత్, విశాఖపట్నం  
Department of Telugu : Andhra University

M.A. Telugu (Previous) Second Semester

Model Question Paper

(Effect from the Admitted Batch of 2015-16)

పేపర్ : 3 ఛందోన్యాయకరణాలంకారాలు

సమయం : 3 గంటలు

Max. Marks : 80

అన్ని ప్రశ్నలకు సమాధానాలు రాయండి.

I. ఈ క్రింది వానిలో నాలుగింటికి సమగ్ర వ్యాఖ్య రాయండి. 4×3 = 12 మార్కులు

1. నకారంబు ద్రుతంబు
2. యరలవ లు లఘువులని యలఘువులని ద్వివిధంబులగు.
3. అత్తునకు సంధి బహుళంబుగానగు.
4. లుప్తశేషము పరంబగునపుడు నుగాగమంబగు.
5. కద్రువ నాగమాత
6. విశ్వకర్మాదులకు స్త్రీత్వంబగు
7. అధికరణంబున సప్తమియగు.
8. వాక్యమునా యోగ్యతాకాంక్షా సహితంబగు నర్థముగల యాసత్తి యుక్త పద సముదాయంబు.

II. ఈ క్రింది వానిలో నాల్గింటికి రూపసాధన ప్రక్రియ చేయండి. 4×3 = 12 మార్కులు

1. నన్నడిగె 2. మూరెడు 3. రామునిని 4. ఋక్షమును
5. హనుమానుడు 6. జ్ఞానము బట్టి ముక్తుడగు 7. వెవెలుగు 8. ఇంటివాడు

III. ఈ క్రింది వానిలో నాలుగు పారిభాషిక పదాలను వివరించండి. 4×3 = 12 మార్కులు

1. దంత్యం 2. ఉపధ 3. ద్రుతప్రకృతికములు 4. సంక్షేపం
5. అనుహతు 6. ఉద్దేశ్యం 7. అధ్యాహార్యం 8. వాక్యము

4. ఎ) సంధిని నిర్వచించి, ఆగమ సంధులను పేర్కొనండి. 12 మార్కులు

(లేదా)

బి) వాక్యపరిచ్ఛేదాన్ని సమీక్షించండి.

5. ఎ) కిందివానిలో రెండింటికి లక్ష్య లక్షణ సమన్వయం చేయండి. 2×3 = 6 మార్కులు

1. ఋవళి 2. వర్ణజయతి 3. ముకారయతి 4. భిన్నయతి

బి) కిందివానిలో రెండింటికి లక్ష్య లక్షణ సమన్వయం చేయండి. 2×3 = 6 మార్కులు

1. సంయుతాక్షరప్రాస 2. రేఫయుత ప్రాస

3. అనునాసిక ప్రాస 4. స్వవర్ణజప్రాస

4×5 = 20 మార్కులు

6. ఈ క్రింది లఘు ప్రశ్నల్లో నాల్గింటికి లఘు సమాధానాలు రాయండి.

1. రూప 2. ఉత్పేక్ష 3. క్షేప 4. కావ్యలింగ 5. వక్రోక్తి 6. అతిశయోక్తి 7. సమాసోక్తి 8. సందేహ

తెలుగుశాఖ, ఆంధ్రవిశ్వ కళాపరిషత్, విశాఖపట్నం  
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Paper - 4 : కావ్యనాటకాలు

- Unit I భారతం - దుష్యంతోపాఖ్యానం - ఆదిపర్వం - చతుర్థాశ్వాసం (5 - 109 పద్యాలు)
- Unit II మొల్ల రామాయణము (బాలకాండ అవతారికతో సహా)
- Unit III కాసుల పురుషోత్తమ కవి ఆంధ్రనాయకశతకము
- Unit IV దేవులపల్లి కృష్ణశాస్త్రి - కృష్ణపక్షం
- Unit V బండ్ల సుబ్రహ్మణ్యకవి - బుద్ధావతారము (నాటకం)

అలుగుశాఖ, ఆంధ్రవిశ్వ కళాపరిషత్, విశాఖపట్నం  
 Department of Telugu : Andhra University  
 M.A. Telugu (Previous) Second Semester  
 Model Question Paper  
 (Effect from the Admitted Batch of 2015-16)  
**Paper - 4 : కావ్యనాటకాలు**

సమయం : 3 గంటలు

Max. Marks : 80

అన్ని ప్రశ్నలకు సమాధానాలు రాయండి.

- 1) ఎ) శకుంతలా జన్మ వృత్తాంతాన్ని వివరించండి? 12మార్కులు  
 (లేదా)  
 బి) మీ పాఠ్యభాగం ఆధారంగా నన్నయ "నానారుచిరార్థసూక్తినిధి" అని నిరూపించండి?
- 2) ఎ) మొల్ల కవిత్వంలోని విశేషాలను విశదీకరించండి? 12మార్కులు  
 (లేదా)  
 బి) మొల్ల రామాయణంలోని బాలకాండ కథా స్వరూపాన్ని విశదీకరించండి?
- 3) ఎ) ఆంధ్రనాయక శతకంలోని విశిష్టాంశాలను నిరూపించండి? 12మార్కులు  
 (లేదా)  
 బి) ఆంధ్రనాయక శతకం లోని పౌరాణికాంశాలను వివరించండి? 12మార్కులు
- 4) ఎ) 'కృష్ణశాస్త్రి కవిత్వంలోని ప్రేమ తత్వాన్ని నిరూపించండి? 12మార్కులు  
 (లేదా)  
 బి) కృష్ణపక్షంలోని కవితా విశేషాలను విశదీకరించండి? 12మార్కులు
- 5) ఎ) బుద్ధావతారంలోని కథాస్వరూపాన్ని వివరించండి? 12మార్కులు  
 (లేదా)  
 బి) నాటకనామ సార్థక్యాన్ని ప్రతిపాదించండి? 10మార్కులు
- 6) ఎ) ఈ కింది వానిలో ఒక పద్యానికి సమగ్రవ్యాఖ్య రాయండి? 10మార్కులు  
 1) వనజ భవప్రభావు డగువాని వసిష్ఠ నవత్యశోక మ  
 స్వననిధిలోన ముంచిన యవారిత సత్త్వుడు నిన్ను దొట్టి యీ  
 యనిమిషులెల్ల వానికి భయంపడుచుండుదు రట్టి యుగ్ర కో  
 పను కడకిప్పు డేగుమని పాడియె యిప్పని నన్ను బంపగన్.  
 2) కదలకు మీ ధరాతలమ! కాశ్యపి బట్టు ఫణీంద్ర! భూవిషా  
 స్పదులను బట్టుకూర్మమ! రసాతల భోగిధులీకులీశులన్  
 వదలకపట్టు ఘృష్టి! ధరణీఫణి కచ్చప పోత్రివర్గమున్  
 బొదువుచు బట్టుడీకరులు భూవరుడీశుని చాపమెక్కిదున్.  
 6) బి) కిందివానిలో రెండింటికి సందర్భసహిత వ్యాఖ్యలు రాయండి? 2x5=10మార్కులు  
 1) కోప పరుపాలికి భామలు వోవనోడరే 2) పతులకడనయునికి సతులకు ధర్మవు  
 3) దేవర చిత్తము వీరిభాగ్యమున్ 4) నవ్విపోదురుగాక నాకేటి సిగ్గు.

తెలుగుశాఖ, ఆంధ్రవిశ్వ కళాపరిషత్, విశాఖపట్నం  
 Department of Telugu : Andhra University  
 M.A. Telugu (Previous) Second Semester Syllabus  
 (With Effect from Batch 2015-16)

Paper - 5 : జానపద సాహిత్యం

Unit I ఎ) 1. జానపద సాహిత్యం - లక్షణాలు, వర్గీకరణ, 2. ఆదిమ గీతం - పుట్టుక, వికాసం  
 3. జానపద గేయం - నిర్వచనం, లక్షణాలు

బి) 1. శ్రామికగేయాలు - స్త్రీల గేయాలు, 2. పిల్లల గేయాలు - కౌటుంబిక గేయాలు

Unit II ఎ) 1. శృంగార గేయాలు - హాస్యగేయాలు, 2. కరణరస గేయాలు - పారమార్థిక గేయాలు.

బి) 1. కథాగేయం - నిర్వచనం, లక్షణాలు, వర్గీకరణ  
 2. చిన్న కథాగేయాలు - సుభద్ర సారెపాట, అల్లారి సీతారామరాజు పాట,  
 బుద్ధా వెంగళ రెడ్డి పాట

Unit III ఎ. 1. పెద్దకథాగేయాలు - గంగా వివాహం కథ, 2. కథాగేయ చక్రాలు - కాటమరాజు కథలు

బి. 1. సామెత, నిర్వచనం, లక్షణాలు వర్గీకరణ, 2. పొడుపు కథ - నిర్వచనం, లక్షణాలు, వర్గీకరణ

Unit IV ఎ. 1. వచన కథలు - స్త్రీల కథలు, వినోద కథలు, 2. కట్టుకథలు, ప్రాచీకథలు

బి. 1. నీలి కథలు, అద్భుత కథలు, 2. జానపద పురాణాలు

Unit V ఎ. 1. జానపద సాహిత్యం - సాహిత్య విశేషాలు, 2. జానపద సాహిత్యం - సాంఘిక విశేషాలు

బి. 1. జానపద సాహిత్యం - ఛందస్సు, పల్లవి, అను పల్లవి, పునరుక్తులు, అనుప్రాసలు, అంత్యప్రాసలు  
 2. గాయక భిక్షుకులు - వారి జీవన విధానం, ఆహార్యం, వాద్య పరికరాలు మొదలగునవి.

సంప్రదించవలసిన గ్రంథాలు :

- 1) జానపద విజ్ఞానాధ్యయనం - ఆచార్య జి.ఎస్. మోహన్
2. ఆంధ్రుల జానపద విజ్ఞానం - ఆర్వీయస్.సుందరం
3. తెలుగు జానపద గేయ సాహిత్యం - బి.రామరాజు
4. యాదవుల జానపద ప్రదర్శన కళలు - ఆచార్య ఎం.జయదేవ్
5. పొడుపు కథ - డా॥ కసిరెడ్డి వెంకటరెడ్డి
6. రాయలసీమ రాగాలు - (సంపాదకుడు - కె.మునయ్య.)
7. చిత్తూరు జిల్లా శృంగార గేయాలు - డా॥ కె.మునిరత్నం
8. జానపద విజ్ఞానంలో స్త్రీ - డా॥ రావి, ప్రేమలత
9. కాటమరాజు కథలు - (మొదటిభాగం) - డా॥ తంగిరాల వెంకట సుబ్బారావు
10. సంస్కృత మహాభారతంలో జానపద కథలు - ఆచార్య ఎం.జయదేవ్



తెలుగుశాఖ, ఆంధ్రవిశ్వ కళాపరిషత్, విశాఖపట్నం  
Department of Telugu : Andhra University

M.A. Telugu (Previous) Second Semester  
Model Question Paper

(Effect from the Admitted Batch of 2015-16)

పేపర్ - 5 : జానపద సాహిత్యం

సమయం : 3 గంటలు

Max. Marks : 80

అన్ని ప్రశ్నలకు సమాధానాలు రాయండి.

- 1 ఎ) ఆదిమ గీతం పుట్టుక వికాసాన్ని గురించి రాయండి?  
(లేదా)  
బి) కౌటుంబిక గేయాలు సోదాహరణంగా వివరించండి? 12 మార్కులు
- 2 ఎ) శృంగార గేయాలను విశ్లేషించండి?  
(లేదా)  
బి) చిన్న కథా గేయాలను గురించి రాయండి? 12 మార్కులు
- 3 ఎ. కాటమరాజు కథల గురించి రాయండి?  
(లేదా)  
బి) పొడుపు కథ లక్షణాలు తెలపండి ? 12 మార్కులు
- 4 ఎ) స్త్రీల కథలను, వినోద కథలను గురించి రాయండి?  
(లేదా)  
బి) జానపద పురాణాలను గురించి తెలపండి? 12 మార్కులు
- 5 ఎ) జానపద సాహిత్యంలోని సాంఘికాంశాలను తెలుపండి?  
(లేదా)  
బి) గాయక భిక్షకుల జీవన విధానాన్ని వారి వాద్య పరికరాలను గురించి రాయండి? 12 మార్కులు
- 6 ఈ క్రింది లఘు ప్రశ్నల్లో నాల్గింటికి లఘు సమాధానాలు రాయండి. 4 X 5 = 20 మార్కులు  
ఎ. జానపద సాహిత్య వర్గీకరణ  
బి. పారమార్థిక గేయాలు  
సి. గంగావివాహం కథ  
డి. కట్టు కథలు  
ఇ. జానపద సాహిత్యంలో ఛందస్సు - పల్లవి  
ఎఫ్. సామెత లక్షణాలు  
జి. జానపద సాహిత్య లక్షణాలు  
హెచ్. ప్రాణి కథలు

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ANDHRA UNIVERSITY

Syllabus

Telegrams:  
UNIVERSITY  
Telephone: 284 4000  
Fax: 0891-755324



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No. L.II (2)/M.A. Telugu/Rev.Syll./2010.

Visakhapatnam  
Dt: 03-12-2010

From: The Dean, Academic Affairs,

To

The Principals of A.U. Affiliated Colleges offering  
M.A. Telugu Course.

Sir,

Sub: M.A. Telugu course - Revised syllabus with effect from the admitted batch of 2011-2012 - Regarding.

- Ref:
1. Minutes of the meeting of the Board of Studies in Telugu held on 24-07-2010 in the Dept. of Telugu, A.U., VSP.
  2. Minutes of the meeting of the Standing Committee of the Academic Senate held on 05-10-2010 (vide Item Ni. 23 A).
  3. Minutes of the meeting of the Academic Senate held on 29-10-2010.

\*\*\*

With reference to the above subject, I am by direction to inform you, that the syllabus of M.A. Telugu (Regular) with effect from the admitted batch of 2011-2012 has been revised and the syllabus along with model question papers are placed in Andhra University Web Site.

I request you to kindly download the syllabus and model question papers from the web.site. ([www.adhrauniversity.info/pgcourses](http://www.adhrauniversity.info/pgcourses)).

Yours faithfully,

  
(R.P. BABJI RAO)

Deputy Registrar (Academic)

- Copy to the Principal, A.U. College of Arts & Commerce, VSP.  
Copy to the Chairman, Board of Studies in Telugu, A.U., VSP.  
Copy to the Head of the Dept. of Telugu, A.U., VSP.  
Copy to the Dean Academic Affairs, A.U., VSP.  
Copy to the Special Registrar and Controller of Examinations, A.U., VSP.  
Copy to the E.VII Section for information.

M.A. DEGREE EXAMINATION.  
Telugu Language and Literature  
(Department of Telugu Andhra University )  
(Effective from the admitted batch of 2011-2012)

సిలబస్ : ఎం.ఎ. తెలుగు (ప్రీవియస్) - మొదటి సెమిస్టర్.

- పేపర్ 1. : తెలుగుభాషాచరిత్ర  
పేపర్ 2 - తెలుగుసాహిత్యచరిత్ర  
పేపర్ 3 - దళితసాహిత్యం  
పేపర్ 4 - కావ్యనాటకాలు  
పేపర్ 5 - జానపదవిజ్ఞానం - సామాజికత

సిలబస్ : ఎం.ఎ. తెలుగు (ప్రీవియస్) - రెండో సెమిస్టర్.

- పేపర్ 1. : తెలుగుభాషాచరిత్ర  
పేపర్ 2 - తెలుగుసాహిత్యచరిత్ర  
పేపర్ 3 - ఛందోవ్యాకరణాలంకారాలు  
పేపర్ 4 - కావ్యనాటకాలు  
పేపర్ 5 - జానపదసాహిత్యం

సిలబస్ : ఎం.ఎ. తెలుగు (ఫైనల్) - మూడో సెమిస్టర్.

- పేపర్ 1. : ప్రాచీన సాహిత్య విమర్శ సిద్ధాంతాలు - సూత్రాలు  
పేపర్ 2 - నవ్యాండ్ర కవిత్వం  
పేపర్ 3 - సామాన్య భాషాశాస్త్రం  
పేపర్ 4 - జర్నలిజం  
పేపర్ 5 - ఐచ్ఛికం 1. సంస్కృతం  
2. మాండలిక విజ్ఞానం  
3. బాల, ప్రౌఢవ్యాకరణాలు  
4. వేమన

సిలబస్ : ఎం.ఎ. తెలుగు (ఫైనల్) - నాలుగో సెమిస్టర్.

- పేపర్ 1. : ఆధునిక సాహిత్య విమర్శ సిద్ధాంతాలు - సూత్రాలు  
పేపర్ 2 - నవ్యాండ్ర వచన సాహిత్యం  
పేపర్ 3 - సామాన్య భాషాశాస్త్రం  
పేపర్ 4 - జర్నలిజం - అనువాదం  
పేపర్ 5 - ఐచ్ఛికం 1. సంస్కృతసాహిత్యం  
2. హేతువాద సాహిత్యం  
3. స్త్రీవాద సాహిత్యం  
4. గురజాడ

Paper - 1 : తెలుగు భాషా చరిత్ర

Unit 1 (ఎ) భారతదేశంలోని భాషలు - హింద్యార్య, ద్రావిడ, ముండా, సిన్, డిబెటన్ భాషాకుటుంబాలు.

(బి) హింద్యార్య ద్రావిడ భాషలు - పరస్పర ప్రభావం.

Unit 2. (ఎ) ద్రావిడ భాషలు, తర్వాతవహర్తలు - వారి ప్రాంతాలు, ద్రావిడ భాషలలో తెలుగు స్థానం - భౌగోళికంగా సరిహద్దు భాషలు.

(బి) ద్రావిడ భాషా లక్షణాలు, ఆంధ్రము, తెలుగు, తెనుగు, పదాల పుట్టుపూర్వోత్తరాలు - వాటి వ్యాప్తి

Unit 3. (ఎ) ప్రాబున్నయ యుగాంధ్ర భాష, నన్నయ యుగాంధ్ర భాష.

(బి) మధ్య యుగాంధ్ర భాష, ఆధునిక భాష.

Unit 4. (ఎ) చారిత్రకంగా తెలుగులో సంధి - ఆగమసంధి, ఆదేశసంధి, లోపసంధి, (కళ, ద్రుత ప్రకృతికం) - పదాల వర్గీకరణ - (ప్రాచీన) ఆధునిక తెలుగు భాషలో సంధి.

(బి) తెలుగు పద నిర్మాణం - నామవాచకం - లింగం - వచనం.

Unit 5. (ఎ) (ప్రాచీనాంధ్రం నుంచి ఆధునికాంధ్రం వరకు వచ్చిన మార్పు) సర్వనామాలు - సంఖ్యావాచకాలు.

(బి) మాండలిక విజ్ఞానం, మాండలికాల అవిరూపం - లక్షణాలు, భేదాలు, వ్యాప్తి మాండలిక భూగోళం.

నంప్రదించవలసిన గ్రంథాలు :

1. ఆంధ్ర భాషా వికాసం - ఆచార్య గంటికోగి సోమయాజి.
2. తెలుగు భాషా చరిత్ర - ఆచార్య భద్రరాజు కృష్ణమూర్తి
3. ద్రావిడ భాషలు - ఆచార్య పి.ఎస్. సుబ్రహ్మణ్యం
4. తెలుగు వాక్యం - ఆచార్య చేకూరి రామారావు
5. సంధి - ఆచార్య కోరాడ రామకృష్ణయ్య
6. ద్రావిడ భాషల చరిత్ర - డా॥ కరెవరపు వెంకట్రామయ్య
7. తెలుగు భాషా చరిత్ర - డా॥ వెలమల సిమ్మన్న.

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Paper - 3 : దళిత సాహిత్యం

Unit I దళిత సాహిత్యం - పరిధి - నిర్వచనం - నేపథ్యం.  
దళిత సాహిత్య ఆవిర్భావ వికాసం  
దళిత సాహిత్యం - ఉద్యమాల, వ్యక్తుల ప్రభావం  
దళిత సాహిత్య సిద్ధాంతాలు - అన్వయం

Unit II కవిత్వం - నరలోక ప్రార్థన (కవితా సంపుటి) : మద్దూరి నగేష్ బాబు

Unit III నాటకం - పాలేరు : బోయి భీమన్న

Unit IV నవల - అంటరాని వసంతం : జి. కళ్యాణరావు

Unit V కథ - చీమలు (కథా సంపుటి) : బోయి జంగయ్య

సంప్రదించవలసిన గ్రంథాలు :

1. దళిత సాహిత్య చరిత్ర - డా॥ పిల్లి శాంసన్.
2. దళిత సాహిత్యం తాత్విక దృక్పథం - జి. లక్ష్మీనరసయ్య.
3. దళిత సాహిత్యం - శిఖామణి.
4. ఆధునికాంధ్ర కవిత్వం - హరిజనాభ్యుదయం - డా॥ కల్లూరి ఆనందరావు
5. తెలుగునాటకం - హరిజనాభ్యుదయం - డా॥ వి. పోతన్న
6. తెలుగుకథ - హరిజనాభ్యుదయం - డా॥ కె. లక్ష్మీనారాయణ.
7. 1980 తర్వాత తెలుగు దళిత నవల (సం.) ఆచార్య రాచపాళెం చంద్రశేఖరరెడ్డి.
8. దళితుల సాహిత్య దర్శనం - ఆచార్య కొండపల్లి సుదర్శనరాజు.

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Paper - 4 : కావ్య నాటకాలు

- Unit 1 : తిక్కన - మహాభారతం - ఉద్యోగవర్షం - తృతీయాశ్వాసం -  
కృష్ణరాయబారం - 4వ పద్యం "మనము జనార్దనుపాలిన" నుంచి 144వ  
పద్యం - "నకులు సహదేవులును" వరకు 256వ పద్యం "జలదస్వస్ గంభీరత"  
నుంచి 288వ పద్యం "కావున" వరకు.
- Unit 2 : ఎర్రన - మహాభారతం - అరణ్యపర్వం - పంచమాశ్వాసం -  
ధర్మవ్యాధోపాఖ్యానం - 27వ వచనం "ఆక్షణంబ" నుండి 112 "నీపడిగిన"  
వచనం వరకు.
- Unit 3 : జాషువ - గబ్బిలం (మొదటి భాగం)
- Unit 4 : శ్రీశ్రీ - మహాప్రస్థానం.
- Unit 5 : కందుకూరి - బ్రాహ్మ వివాహం.

**Paper - 5 : జానపద విజ్ఞానం - సామాజికత**

- Unit I
- (ఎ) 1. జానపద విజ్ఞానం నిర్వచనం - లక్షణాలు, పర్యవేక్షణ.  
2. అటవిక, గ్రామీణ, సాగరిక విజ్ఞానాల తారతమ్యాలు.
- (బి) 1. పాశ్చాత్యుల జానపద విజ్ఞాన భృషి.  
2. ఆంధ్రుల జానపద విజ్ఞాన భృషి
- Unit II
- (ఎ) 1. జానపద కళలు-ప్రదర్శక కళలు (Performing Arts) ఐత్రకథ, తప్పెటగుళ్ళు, వగదీవేషాలు.  
2. అప్రదర్శక కళలు (Non-performing Arts) వాలకం, మోడీ, దొమ్మరాట.
- (బి) 1. జానపద భాష - మాండలికాలు, సంఘటనలు, జాతీయాలు, నామ విజ్ఞానం,  
2. జానపద భాష - ధ్వనుల మార్పు, పదజాలం, అస్వదేశ్యాలు, మారుమూల పదాలు, జానపద నిరుక్తి.
- Unit III
- (ఎ) 1. జానపద వస్తు సంస్కృతి - పుత్తులు, వృత్తిపరికరాలు, గృహనిర్మాణం, అవోరం,  
2. జానపద వస్తు సంస్కృతి - దుస్తులు, అభరణాలు, చిత్రకళ, చేతివనసులు.
- (బి) 1. జానపద సాంఘికాచారాలు - పుట్టుక, వివాహం, మరణం, మతం,  
2. జానపద సాంఘికాచారాలు - పండుగలు, ఉత్సవాలు, నమ్మకాలు.
- Unit IV
- (ఎ) 1. ప్రాథమిక మానవ సమాజం - దాని పెరుగుదలలో అంతరాలు  
2. జానపదుల దృక్పథంలో సమాజం - దాని పరిధి, లక్షణాలు.
- (బి) 1. మత, నీతి నేపథ్యంలో జానపద సమాజ నిర్మాణం  
2. జానపదుల ప్రచార సాధనాలు - జానపద విధానంలో ప్రచారాలు.
- Unit V
- (ఎ) 1. జానపద విజ్ఞానంలో కనిపించే గ్రామీణ రాజకీయ ధోరణులు  
2. ఆధునిక గ్రామీణ జీవితంలో వచ్చిన, వస్తున్న మార్పులు
- (బి) 1. తెలుగువారి జీవన విధానంలో జానపద ఛాయలు  
2. జానపద విజ్ఞాన వస్తు ప్రదర్శనశాలలు (Folk lore Museums)

**నంబ్రదించవలసిన గ్రంథాలు :**

1. జానపద విజ్ఞానాధ్యయనం - డా॥ జి.ఎస్. మోహన్.
2. ఆంధ్రుల జానపద విజ్ఞానం - ఆర్వీయస్ సుందరం.
3. తెలుగు జానపద గేయసాహిత్యం - బి. రామరాజు
4. తెలుగు జానపద విజ్ఞానం - సమాజం - సంస్కృతి - సాహిత్యం - వ్యాస సంపుటం సంపాదకులు - తంగిరాల వేంకట సుబ్బారావు, ఆర్వీయస్ సుందరం.
5. ప్రసిద్ధ జానపద విజ్ఞాన విద్వాంసులు - జి.ఎస్. మోహన్.

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Paper - 1 : తెలుగు భాషా చరిత్ర

- Unit I (ఎ) తెలుగులో గ్రాంథిక, వ్యావహారిక శైలులు - నిర్వచనం, ఉత్పత్తి వికాసాలు.  
(బి) ఆధునిక ప్రామాణిక తెలుగు భాష - ఆవశ్యకత.
- Unit II (ఎ) క్రియ : క్రియాధాతు నిర్మాణం - ప్రాథమికం, ద్వితీయం - సకర్మకం - అకర్మకం.  
(బి) సమాపక క్రియలు - అసమాపక క్రియలు, భూత, భవిష్యద్వర్తమాన కాలాలు - చరిత్ర, సంయుక్త క్రియా నిర్మాణం.
- Unit III (ఎ) పదజాలం : దేశ్యం, దేశ్యేతరం.  
(బి) హింద్వార్థ, మధ్య ప్రాచ్య, పాశ్చాత్య, ద్రావిడ భాషల నుండి తెలుగులోకి వచ్చి చేరిన సమీకృత పదాలు - అసమీకృత పదాలు.
- Unit IV (ఎ) ధ్వని పరిణామం.  
(బి) ఆర్థ పరిణామం.
- Unit V (ఎ) వాక్య నిర్మాణం - పురుష బోధక ప్రత్యయాలు  
(బి) ఔపవిభక్తికాలు - విభక్తి ప్రత్యయాలు, పురుష బోధక ప్రత్యయాలు.

నంపదించవలసిన గ్రంథాలు :

1. ఆంధ్ర భాషా వికాసం - ఆచార్య గంటిజోగి సోమయాజి.
2. తెలుగు భాషా చరిత్ర - ఆచార్య భద్రరాజు కృష్ణమూర్తి
3. ద్రావిడ భాషలు - ఆచార్య పి.ఎన్. సుబ్రహ్మణ్యం
4. తెలుగు వాక్యం - ఆచార్య చేకూరి రామారావు
5. సంధి - ఆచార్య కోరాడ రామకృష్ణయ్య
6. ఎ స్టడీ ఆఫ్ తెలుగు సెమాన్టిక్స్ - ఆచార్య జి.ఎన్. రెడ్డి
7. ద్రావిడ భాషల చరిత్ర - డా॥ కరెవరపు వెంకట్రామయ్య
8. ఆంధ్ర విశ్వకళా పరిషత్తు - వ్యావహారిక తెలుగు భాషా వ్యాప్తి - డా॥ బి.వి. రమణారెడ్డి
9. తెలుగు భాషా చరిత్ర - డా॥ వెలమల సిమ్మన్న.



**Paper - 2 : తెలుగు సాహిత్య చరిత్ర**

Unit I

- (ఎ) రాయల యుగం (1501-1600) - ప్రబంధ యుగం - ప్రబంధ లక్షణాలు, అష్టదిగ్గజ కవుల పరిచయం.  
 (బి) కవులు : శ్రీకృష్ణదేవరాయలు (అముక్తమాల్యద), 1. అల్లసాని పెద్దన (మనుచరిత్ర), 2. నంది తిమ్మన (పారిజాతాపహరణం), 3. ధూర్జటి (శ్రీకాళహస్తీశ్వర మాహాత్మ్యం), 4. మోదయ్యగారి మల్లన (రాజశేఖర చరిత్ర), 5. అయ్యలరాజు రామభద్రుడు (రామాభ్యుదయం), 6. రామరాజభూషణుడు (వసుచరిత్ర), 7. పింగళి సూరన (కళాపూర్ణోదయం, ప్రభావతీ ప్రద్యుమ్నం), 8. తెనాలి రామకృష్ణుడు (పాండురంగ మాహాత్మ్యం)

Unit II

- (ఎ) రాయల యుగం - ఇతర కవులు : 1. కందుకూరి రుద్రకవి (నిరంకుశోపాఖ్యానం) 2. చింతలపూడి ఎల్లనార్యుడు (రాధామాధవీయం), 3. చెరలవాడ మల్లన (విప్రనారాయణ చరిత్రం).  
 (బి) 1. నాదెండ్ల గోనమంత్రి (కృష్ణార్జున సంవాదం), 2. అద్దంకి గంగాధరుడు (శపథీ సంపరణోపాఖ్యానం), 3. నంకుసాల నృసింహకవి (కవి కర్తరసాయనం), 4. పొన్నికంటి తెలగన్న (యయాతి చరిత్ర), 5. కంకంటి పాపరాజు (ఉత్తర రామాయణం)

Unit III

- (ఎ) దక్షిణాంధ్ర యుగం (1601-1855) తంజావూరు, మధుర, పుదుక్కోట, మైసూరు, పాలకుల వాఙ్మయ సేవ, చేమకూర వేంకటకవి.  
 (బి) రఘునాథ నాయకుల కృతుల సమీక్ష, యక్షగాన, వచనకావ్య ప్రక్రియల పుట్టుక - వికాసం.

Unit IV

- (ఎ) దక్షిణాంధ్ర యుగ ఇతర కవులు : 1. రంగాజమ్మ (మన్నారుదాస విలాస నాటకం) 2. ముద్దు పళని (రాధికా సాంత్యం), 3. సముఖం వెంకట కృష్ణప్పనాయకుడు (తైమిని భారతం - వచన ప్రబంధం).  
 (బి) 1. శేషం వేంకటపతి (తారాశశాంకం), 2. కలువెవీరరాజు (ఆంధ్ర వచన భారతం), దక్షిణాంధ్ర యుగవైశిష్ట్యం.

Unit V

- (ఎ) క్షీణయుగం-క్షీణయుగ కవితా లక్షణాలు : వివిధ సంస్థానాలు (1. విజయనగరం, 2. పెద్దాపురం, 3. వెంకటగిరి, 4. గద్వాల) వాఙ్మయ సేవలు సంక్షిప్తంగా, కూచిమంచి తిమ్మన కృతుల సమీక్ష.  
 (బి) ఇతర కవులు : 1. పాలవేకరి కదిరీపతి (శుకసప్తతి), 2. ఏనుగు లక్ష్మణకవి (సుభాషిత రత్నావళి), 3. అడిదం సూరన (కవి జనరంజనం), 4. పిండిక్రోలు లక్ష్మణకవి (రావణ దమ్మీయం), 5. గోగులపాటి కూర్మనాథకవి (నారసింహ శతకం) 6. కాసుల పురుషోత్తమకవి (ఆంధ్రనాయక శతకం) - పాశ్చాత్యుల వాఙ్మయ సేవ, ప్రత్యేకించి సి.పి. బ్రౌన్.

**సంప్రదించవలసిన గ్రంథాలు :**

1. ఆంధ్ర సాహిత్య చరిత్ర - పింగళి లక్ష్మీకాంతం. 2. తెలుగు సాహిత్య చరిత్ర (సంపుటం 3,4,5)-కొల్లపాటి శ్రీరామమూర్తి 3. తెలుగు సాహిత్య సమీక్ష - జి. నాగయ్య, 4. ఆంధ్ర ప్రబంధము - అవతరణ వికాసములు - కెవిఆర్ నరసింహం, 5. దక్షిణాంధ్రయుగ వాఙ్మయ చరిత్ర - కెవిఆర్ నరసింహం, 6. తంజావూరాంధ్ర సాహిత్య చరిత్ర - కొక్కొండ సత్యవతి, 7. ఉపాకిరణాలు - యండమూరి సత్యన్నారాయణ, 8. ఆంధ్ర సంస్థానములు - సాహిత్య పోషణములు - తూమాటి దొణప్ప.

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**Paper - 3 : ఛందోవ్యాకరణాలంకారాలు**

(బాల వ్యాకరణం - సంజ్ఞ - సంధి - తత్సమ - ఆచ్యుక - కారక - సమాస పరిచ్ఛేదాలు)

Unit I . బాల వ్యాకరణం - సంజ్ఞ, సంధి పరిచ్ఛేదాలు

Unit II బాల వ్యాకరణం - తత్సమ, ఆచ్యుక పరిచ్ఛేదాలు

Unit III బాల వ్యాకరణం - కారక, సమాస పరిచ్ఛేదాలు

Unit IV అప్పకవీయం - యతి, ప్రాసలు.

Unit V అలంకారాలు : 1. ఉపమ, 2. రూపక, 3. అపహ్నవ, 4. ఉత్ప్రేక్ష, 5. దీపక, 6. సహోక్తి, 7. సమాసోక్తి, 8. శ్లేష, 9. వ్యాజస్తుతి, 10. కావ్యలింగ, 11. అర్థాంతరన్యాస, 12. తద్గుణ, 13. వక్రోక్తి, 14. సందేహ, 15. అతిశయోక్తి, 16. విభావన, 17. నిదర్శన, 18. దృష్టాంత, 19. పర్యాయోక్తి, 20. పరికర, 21. శబ్దాలంకారాలు.

**నంప్రదించవలసిన గ్రంథాలు :**

1. రమణీయం - దువ్వూరి వెంకట రమణశాస్త్రి
2. ఘంటాపథ వ్యాఖ్యానం (బాలవ్యాకరణం) - వంతరాం రామకృష్ణారావు
3. వ్యాకరణ దీపిక - కోరాడ మహదేవశాస్త్రి
4. వికాస వ్యాఖ్య - బొడ్డుపల్లి పురుషోత్తం
5. గుప్తార్థ ప్రకాశిక - దూసి రామమూర్తిశాస్త్రి
6. బాల - ప్రౌఢ వ్యాకరణాల విశ్లేషణ - సజ్జా మోహనరావు
7. అప్పకవీయం (తృతీయాశ్వాసం - యతి - ప్రాసలు) - అప్పకవి
8. చంద్రాలోకం : అక్కిరాజు ఉమాకాంతం వ్యాఖ్యానం.

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**Paper - 4 : కావ్య నాటకాలు**

Unit I : నాచన సోమన : ఉత్తర హరివంశం - చతుర్థాశ్వాసం - హంస డిభకోపాఖ్యానం -  
1వ పద్యం "శ్రీ హైమావతీ కలహ" మొదలు 133 పద్యం  
"తడయక చనును" వరకు.

Unit II : రామరాజభూషణుడు : వసుచరిత్ర - మంజువాణి రాయబారం 4వ ఆశ్వాసం  
58వ పద్యం "అమ్మనుజేంద్ర" నుండి 133 వ పద్యం "మున్నుగ నన్నుగాత్మజ"  
వరకు.

Unit III : బాలగంగాధర తిలక్ - అమృతం కురిసిన రాత్రి

Unit IV : జోయి భీమన్న : గుడిసెలు కాలిపోతున్నై

Unit V : నార్ల వేంకటేశ్వరరావు - సీత జోస్యం.

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Paper - 5 : జానపద సాహిత్యం

- Unit I (ఎ) 1. జానపద సాహిత్యం - లక్షణాలు, వర్గీకరణ  
2. ఆదిమగీతం - పుట్టుక, వికాసం  
3. జానపద గేయం - నిర్వచనం, లక్షణాలు  
(బి) 1. శ్రామిక గేయాలు, స్త్రీల గేయాలు  
2. పిల్లల గేయాలు, కౌటుంబిక గేయాలు
- Unit II (ఎ) 1. శృంగార గేయాలు, హాస్య గేయాలు  
2. కరుణరస గేయాలు, పారమార్థిక గేయాలు  
(బి) 1. కథాగేయం - నిర్వచనం, లక్షణాలు, వర్గీకరణ  
2. చిన్నకథాగేయాలు - సుభద్ర సారెపాట, అల్లూరి సీతారామరాజు పాట, బుద్ధా వెంగళరెడ్డి పాట.
- Unit III (ఎ) 1. పెద్దకథాగేయాలు - గంగా వివాహంకథ, బొట్టిలికథ, సర్వాయి పాపనికథ,  
2. కథాగేయ చక్రాలు - కాటమరాజుకథలు - శక్తికథలు.  
(బి) 1. సామెత - నిర్వచనం, పుట్టుక, లక్షణాలు, వర్గీకరణ  
2. పొదుపుకథ - నిర్వచనం, లక్షణాలు, వర్గీకరణ.
- Unit IV (ఎ) 1. పచన కథలు - స్త్రీలకథలు, వినోదకథలు.  
2. కట్టుకథలు, ప్రాణికథలు.  
(బి) 1. నీతికథలు, అద్భుతకథలు.  
2. జానపద పురాణాలు.
- Unit V (ఎ) 1. జానపద సాహిత్యం - సాహిత్య విశేషాలు.  
2. జానపద సాహిత్యం - సాంఘిక విశేషాలు.  
(బి) 1. జానపద సాహిత్యం - ఛందస్సు, వల్లవి, అనువల్లవి, పునరుక్తులు, అనుప్రాసలు, అంతుప్రాసలు.  
2. గాయక భిక్షుకులు వారి జీవన విధానం ఆచార్యం వాద్య పరికరాలు మొదలైనవి.

సంప్రదించవలసిన గ్రంథాలు :

1. జానపద విజ్ఞానాద్యయనం - జి.ఎస్. మోహన్.
2. ఆంధ్రుల జానపద విజ్ఞానం - ఆర్మీయన్ సుందరం
3. తెలుగు జానపద గేయ సాహిత్యం - డి. రామరాజు
4. సింహాచలం దేవతల కట్టుబడి కథాగేయం - ఎం. జయదేవ్
5. పొదుపు కథ - కసిరెడ్డి వెంకటరెడ్డి
6. రాయలసీమ రాగాలు - సంపాదకుడు - డి. మునయ్య
7. చిత్తూరు జిల్లా శృంగార గేయాలు - డి. మునిరత్నం
8. జానపద విజ్ఞానంలో స్త్రీ - రావి ప్రేమలత
9. జానపద గేయగాథలు - నాయని కృష్ణమూరి
10. బాలగేయ సాహిత్యం - ఎం. దేవతీ
11. కాటమరాజు కథలు - మొరటి భాగం - తంగిరాల వెంకట సుబ్బారావు.

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Paper - I : ప్రాచీన సాహిత్య విమర్శ సిద్ధాంతాలు - సూత్రాలు

Unit I (ఎ) 1. విమర్శ - నిర్వచనం, ఆవశ్యకత, ప్రయోజనం; 2. నవ్వాదయుడు - వివిధ అభిప్రాయాలు  
(బి) 1. ఉత్తమ విమర్శకుని లక్షణాలు, బాధ్యతలు ; 2. విమర్శ భేదాలు, పద్ధతులు

Unit II (ఎ) 1. కావ్యం, కవిత్వం - ప్రాచ్య, పాశ్చాత్య నిర్వచనాలు, భేద సాధ్యతలు  
2. కావ్య భేదాలు - ప్రాచ్య పాశ్చాత్య ఆలంకారికులు విశ్లేషణ  
(బి) 1. కావ్యహేతువులు-వివిధ అభిప్రాయాలు ; 2. కావ్యాత్మ-వివిధ ఆలంకారికుల అభిప్రాయాలు.

Unit III (ఎ) 1. రస సిద్ధాంతం - విభిన్న ఆలంకారికుల మతం; 2. రసం - కెథార్సిస్ - భేద సాధ్యతలు  
(బి) 1. రస నిష్ఠ - వివిధ అభిప్రాయాలు ; 2. రస సంఖ్య - నవరస, ఏకరసవాదాలు

Unit IV (ఎ) 1. ధ్వని - నిర్వచనం, భేదాలు, ద్వన్వభావవాదాలు 2. త్రివిధ శబ్దవృత్తులు - స్వరూప స్వభావాలు  
(బి) 1. ప్రాచ్య, పాశ్చాత్య నాటకోత్పత్తి వాదాలు ; 2. నాటక లక్షణాలు.

Unit V (ఎ) 1. కావ్యావతారికలు - విమర్శ స్వరూప స్వభావాలు  
2. చాటుపద్యాలు - విమర్శ స్వరూపస్వభావాలు  
(బి) 1. ప్రాచీన సాహిత్య ప్రక్రియలు - ఇతిహాసం, పురాణం, వాటి విమర్శ  
2. ప్రాచీన సాహిత్య ప్రక్రియలు - కావ్యం, శతకం, వాటి విమర్శ.

సంప్రదించవలసిన గ్రంథాలు :

1. సాహిత్య దర్శనం - కె.వి.ఆర్. నరసింహం.
2. కావ్యాలంకార సంగ్రహం - సన్నిధానం సూర్యనారాయణశాస్త్రి వ్యాఖ్య
3. సాహిత్య శిల్ప సమీక్ష - పింగళి లక్ష్మీకాంతం.
4. తెలుగు కావ్యావతారికలు - జి. నాగయ్య
5. సాహిత్య భావలహరి - ఎస్సీ జోగరావు
6. తెలుగు సాహిత్య విమర్శ సిద్ధాంతాలు - సూత్రాలు - వి. సిమ్మన్న
7. ప్రాచీనాంధ్రకవుల సాహిత్యాభిప్రాయాలు - అభిరుచులు - రాచపాలెం చంద్రశేఖరరెడ్డి
8. విమర్శాశిల్పం - వల్లంపాటి వెంకటసుబ్బయ్య
9. తెలుగులో సాహిత్య విమర్శ - అవతరణ - వికాసములు - ఎస్సీ రామారావు.
10. తెలుగులో సాహిత్య విమర్శ - పాటిబండ చూడవశర్మ
11. పట్నది - అప్పారావు వెంకటసుబ్బయ్య
12. కవితా కళ - ఆచార్య తిరుమల
13. విమర్శ చౌళిక లక్షణాలు - ముదికొండ వీరభద్రయ్య
14. అనుశీలన - చదలి మండేళ్లరావు
15. సాహిత్యం - విమర్శ - చదలి మండేళ్లరావు.

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**Paper - 2 : నవ్యాంధ్ర కవిత్వం**

- Unit I ( ) (ఎ) నవ్యాంధ్ర కవిత్వోద్యమ హేతువులు - లక్షణాలు - యుగకర్త.  
(బి) సంఘసంస్కరణోద్యమ కవిత్వం - లక్షణాలు - ధోరణులు
- Unit II ✓ (ఎ) భావకవిత్వం నిర్వచనం - వివిధ శాఖలు  
(బి) అభ్యుదయ కవిత్వ స్వరూప స్వభావాలు - ధోరణులు
- Unit III (ఎ) వచన కవిత్వం నిర్వచనం - లక్షణాలు - వికాసం  
(బి) దిగంబర కవిత్వ లక్షణాలు - సమీక్ష
- Unit IV (ఎ) విప్లవ కవిత్వ లక్షణాలు - ధోరణులు  
(బి) 'స్త్రీవాద కవిత్వ స్వరూపస్వభావం - భిన్న దృక్పథాలు
- Unit V (ఎ) దళిత కవిత్వ లక్షణాలు - స్వరూప స్వభావం  
(బి) మైనారిటీ కవిత్వ తీరుతెన్నులు - ధోరణులు

**నంవ్రదించవలసిన గ్రంథాలు :**

1. ఆధునికాంధ్ర కవిత్వం - సంప్రదాయాలు - ప్రయోగాలు : డా॥ సి. నారాయణరెడ్డి.
2. తెలుగులో కవితా విప్లవాల స్వరూపం : డా॥ వెల్చేరు నారాయణరావు
3. అభ్యుదయ విప్లవ కవిత్వాలు - సిద్ధాంతాలు - శిల్పరీతులు : డా॥ అద్దేపల్లి రామమోహనరావు
4. తెలుగు కవితా వికాసం : డా॥ కడియాల రామమోహన్‌రాయ్
5. దళిత సాహిత్యం - తాత్విక దృక్పథం : జి. లక్ష్మీనరసయ్య
6. దళిత సాహిత్య తత్వం : శిఖామణి
7. స్త్రీవాద వివాదాలు (సం.) డా॥ యస్వీ సత్యనారాయణ
8. తెలుగు సాహిత్య విమర్శ సిద్ధాంతాలు : ఆచార్య వెలమల సిమ్మన్న
9. దళిత సాహిత్య దర్శనం : ఆచార్య కొండపల్లి సుదర్శనేరాజు
10. తెలుగులో కవిత్వోద్యమాలు - (సం.) డా॥ ఆవుల మంజులత
11. మైనారిటీ కవిత్వం - తాత్విక నేపథ్యం : డా॥ ఎస్. షమీఉల్లా.

Paper - 3 : సామాన్య భాషాశాస్త్రం

Unit I

(ఎ) భాష - నిర్వచనం, స్వభావం, పుట్టుక, వికాసం - వివిధ సిద్ధాంతాలు -  
మానవ భాషకున్న ప్రత్యేకతలు.

(బి) భాషా విజ్ఞాన శాస్త్రం - ప్రాచ్య పాశ్చాత్య దేశాలలో భాషాశాస్త్రాభివృద్ధి, చరిత్ర.

Unit II

(ఎ) వర్ణనాత్మక, చారిత్రక, తులనాత్మక భాషాశాస్త్రం - భాషాశాస్త్రంలోని వివిధ  
సంప్రదాయాలు (Schools)

(బి) భాషల వర్గీకరణ - భౌగోళిక, వంశానుగుణ, పదాంశానుగుణ విభజన -  
ప్రధాన ప్రపంచ భాషా కుటుంబాలు

Unit III

(ఎ) ధ్వని మార్పు - భాషా పరిణామం - హేతువులు, మార్పుల రకాలు.

(బి) ధ్వని సూత్రం, స్వభావం, ధ్వని సూత్రాలకు అపవాదాలు, అర్థవిపరిణామం

Unit IV

(ఎ) తులనాత్మక పద్ధతి - మూలభాషా పునర్నిర్మాణం - లాభాలు.

(బి) ఆంతరంగిక పునర్నిర్మాణం - పరిమితులు.

Unit V

(ఎ) భాషలలోని ఆదానాలు - ఆదానాలలోని రకాలు - భౌగోళిక, సాంస్కృతిక,  
సన్నిహిత ఆదానాలు.

(బి) తెలుగుభాషలోని ఆన్యదేశ్యాలు.

సంప్రదించవలసిన గ్రంథాలు :

1. Broomfield, L - Language
2. Hockett, C.F. - A Course in Modern Linguistics
3. H.A. Gleason, J - A introduction to Descriptive Linguistics
4. Lahmann, W.P. - Historical Linguistics - An introduction
5. S.K. Varma - General Linguistics
6. Cruse - Semantics.
7. సుబ్రహ్మణ్యం, పి.ఎస్. - ఆధునిక భాషాశాస్త్ర సిద్ధాంతాలు.
8. చక్రధరరావు, ఎల్. - భాషాశాస్త్ర వ్యాసములు.
9. దొణప్ప, డి. - భాషా చారిత్రక వ్యాసావళి
10. వెలమల సిమ్మన్న - ప్రపంచ భాషలు
11. చేకూరి రామారావు - భాషాంత రంగం.
12. చేకూరి రామారావు - భాషా పరివేషం
13. బూదరాజు రాధాకృష్ణ - భాషాశాస్త్ర వ్యాసాలు
14. భద్రరాజు కృష్ణమూర్తి - భాష - సమాజం - సంస్కృతి.
15. బూదరాజు రాధాకృష్ణ - ఆధునికాంధ్ర భాష సంగ్రహం.

**Paper - 4 : జర్నలిజం**

**Unit I**

- (ఎ) కమ్యూనికేషన్ - నిర్వచనం, స్వభావం, అంశాలు, విధులు, రకాలు.  
మాస్ కమ్యూనికేషన్ - సమాజ పాత్ర
- (బి) పత్రికా రచన - పుట్టుక - పరిణామం. తొలితెలుగు పత్రిక  
తెలుగు ముద్రణ - పుట్టుపూర్వోత్తరాలు.

**Unit II**

- (ఎ) వార్త - నిర్వచనం, లక్షణాలు, వార్తాంశాలు, వార్త విలువలు, రకాలు, వనరులు.  
వార్తా సేకరణ విధానాలు - బీట్లు, ఇంటర్వ్యూలు, పత్రికా ప్రకటనలు, సభలు - సమావేశాలు.
- (బి) వార్తాసేకరణ (విలేఖరి) - అర్హతలు, లక్షణాలు . విలేఖర్ల రకాలు.  
వార్తా సేకరణలో పాటించదగ్గ మెకకువలు - జాగ్రత్తలు.  
ప్రత్యేక సందర్భాలలో (చట్టసభలు, న్యాయస్థానాలు, నేరవార్తలు, మొలైన చోట్ల) వార్తా సేకరణ.

**Unit III**

- (ఎ) వార్తా రచన నూత్రాలు - నియమాలు. ప్రత్యేక సందర్భాలలో వార్తా రచన.  
(బి) వార్తా రచయిత (ఉపసంపాదకుడు) - అర్హతలు, లక్షణాలు, విధులు - బాధ్యతలు.  
వార్తా రచనలో తీసుకోవలసిన జాగ్రత్తలు.

**Unit IV**

- (ఎ) తొలితరం పత్రికలు - వృత్తాంతి, హితవాది, వివేకవర్ధిని.  
తొలితరం పాత్రికేయులు - కందుకూరి, గాడిచర్ల, తాపీ, కాశీనాధుని.  
(బి) ఆధునిక పత్రికల పోకడలు - ధోరణులు. ఆధునిక పత్రికలు - ఆంధ్రప్రభ,  
ఆంధ్రభూమి, ఆంధ్రజ్యోతి, ఈనాడు, వార్త.  
ఆధునిక పాత్రికేయులు - నార్ల, కాసా, ముట్నూరి, ఎ.బి.కె.  
ప్రత్యేక పత్రికలు - మహిళ, సాహిత్య, పిల్లల, రాజకీయ, సినిమా పత్రికలు.

**Unit V**

- (ఎ) రేడియో, టి.వి.లలో వార్తా సేకరణ, వార్తా ప్రసార విధానం.  
రేడియో, టి.వి., పత్రికలకు ప్రకటనలు తయారుచేసే విధానం.  
(బి) ఆధునిక కాలంలో రేడియో అవసరం, టి.వి. ఛానళ్ల విస్తృతి.

**సంప్రదించవలసిన గ్రంథాలు :**

1. తెలుగు జర్నలిజం : డా॥ వి. లక్ష్మణరెడ్డి
2. వార్తా రచన : కె. శ్రీరామచంద్రమూర్తి.
3. తెలుగు జర్నలిజం - పరిచయం : డా॥ బూదరాజు రాధాకృష్ణ
4. సమాచారాల చేరవేత మరియు పాత్రికేయత్వం : డా॥ ఎస్.జి.డి. చంద్రశేఖర్.
5. ఛానళ్ల విస్తృతి - సీరియళ్ల వికృతి : డా॥ ఎస్.జి.డి. చంద్రశేఖర్.
5. టి.వి. ముచ్చట్లు : శ్రీ నాగసూరి వేణుగోపాల్.
6. తెలుగు పత్రిక నాడు - నేడు.
7. పత్రికా రచన - పరిచయాంశాలు : డా॥ జి. యోహాన్ బాబు.
8. ఎ.బి.కె. సంపాదకీయాలు.
9. జర్నలిజం అంటే - నామాల విశ్లేషణరూపు.



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Paper - 5 : బచ్చికాంశం (4) వేమన

- Unit I (ఎ) 1. కథల ఆధారంగా వేమన జీవితం ; 2. వేమన వద్దాల ఆధారంగా అతని జీవితం  
(బి) 1. వేమన చేతకాకాలు - భిన్నాభిప్రాయాలు ; 2. వేమన విద్యమకుటం - వివిధ అభిప్రాయాలు
- Unit II (ఎ) 1. వేమన వద్ద ఛందస్సు - ఆటవెంది ప్రశ్నోత్తర ; 2. వేమన కవిత్వం - చోన్యం, నీతులు  
(బి) 1. వేమన కవితా సౌందర్యం - భాష, శైలి ; 2. వేమన కవితా సౌందర్యం - అలంకారాలు
- Unit III (ఎ) 1. వేమన దృశ్యం - కులం ; 2. వేమన దృశ్యం - మతం  
(బి) 1. వేమన ఆర్థిక దృశ్యం ; 2. వేమన స్త్రీ దృశ్యం
- Unit IV (ఎ) 1. వేమన దృశ్యం - రాచరికం, రసవారం 2. వేమన కత్తం - ఆర్యైకం, నాథయోగం  
(బి) 1. వేమన కత్తం - నాస్తికత్వం, మానవతాచారం  
2. వేమన సదృశకవులు - అప్పయ్యార్ (తమిళం), సర్వజ్ఞుడు (కన్నడం)
- Unit V (ఎ) 1. వేమన సదృశకవులు - కబీరు (హిందీ), భుకారాం (మరాఠీ)  
2. వేమన పై జరిగిన పరిశోధన - విమర్శకుల అభిప్రాయాలు  
(బి) 1. వేమన వైశిష్ట్యం ; 2. తెలుగు సాహిత్యంలో వేమన స్థానం.

సంప్రదించవలసిన గ్రంథాలు :

1. ప్రతాపి వేమన - ఎన్. గోపి.
2. వేమన - రాళ్లపల్లి అనంతకృష్ణశర్మ
3. నాథయోగి మన వేమన - కొద్లపాటి శ్రీరామమూర్తి
4. వేమన్నవారం - ఎన్. గోపి.
5. వేమన వైశిష్ట్యం - శ్రీ దృశ్యం - ఎం. జయదేవ్
6. వేమన వైశిష్ట్యం - నార్ల వెంకటేశ్వరరావు (తెలుగు అనువాదం)
7. విశ్వరాధిరామ వినయవేమ - త్రిపురనేని వెంకటేశ్వరరావు
8. వేమన - సర్వజ్ఞుడు - గంధం అప్పారావు
9. వేమన జీవితం, సాహిత్యం - ఎన్. ఎం. సుబాని
10. లోకకవి వేమనయోగి - మరుఘూరు కోదండరామలిక్కి
11. వేమన కవితా సౌందర్యం - పొన్నగండ్రి హనుమంతరెడ్డి.

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Paper - 5 : బచ్చికాంశం (2) మాండలిక విజ్ఞానం

- యానిట్ 1. (ఎ) మండలం - నిర్వచనం, మాండలికం - నిర్వచనం  
మాండలిక భాష - ఏర్పాటుపదాలు, మాండలిక భాష - పరిశోధన  
(బి) మాండలికాలు - లక్షణాలు, కారణాలు - ప్రయోజనాలు  
మాండలిక పరిశీలనా పద్ధతులు.
- యానిట్ 2. (ఎ) వ్యవహార భేదక రేఖ - మాండలిక పదాలు  
(బి) ఆదాన పదాలు - అన్యదేశ్యాలు, వ్యావహారిక భాష, ప్రామాణిక భాష.
- యానిట్ 3. (ఎ) తెలుగు భాష - వ్యావహారిక మండలాలు  
1. పూర్వ మండలం  
2. మధ్య మండలం  
3. దక్షిణ మండలం  
4. ఉత్తర మండలం  
(బి) మాండలికాల భేదాలు.
- యానిట్ 4. (ఎ) మాండలికాల వర్గీకరణ  
1. ప్రాంతీయ మాండలికం  
2. సామాజిక మాండలికం  
3. భౌతిక మాండలికం  
4. జీవనస్థానసారీ మాండలికం  
(బి) మాండలిక భాషా ప్రయోగాలు
- యానిట్ 5. (ఎ) 1. ప్రాచీన కావ్యాలు - మాండలిక ప్రయోగాలు  
2. ఆధునిక యుగం - మాండలిక ప్రయోగాలు  
3.3. నాటకాలు - మాండలిక ప్రయోగాలు  
(బి) 1. కథలు - మాండలిక ప్రయోగాలు  
2. నవలలు - మాండలిక ప్రయోగాలు

సంప్రదించవలసిన గ్రంథాలు :

1. మాండలిక వృత్తిపదకోశాలు - వ్యవసాయం, కేవలం, కుమ్మరం, మత్స్యం
2. తెలుగు భాషావర్ణిత (సంకలనం) - ఆచార్య భట్టిరాజు కృష్ణమూర్తి
3. మాండలికాలు, ఆంధ్రప్రదేశ్ లోని విశాఖపట్నం, ఖమ్మం మొదలైనవి.
4. తెలుగుభాషా చరిత్ర - ఆచార్య వెలమల సీమ్మన్న

Paper - 1 : ఆధునిక సాహిత్య విమర్శ సిద్ధాంతాలు - సూత్రాలు

(19)

- Unit I (ఎ) 1. సమాజం - సాహిత్యం - సాహిత్య విమర్శ - పరస్పర సంబంధం  
2. రచయిత-సామాజిక స్పృహ-సమాజ విశ్లేషణ-సామాజిక సమస్యలు-పరిష్కార బాధ్యత.  
(బి) 1. ఆధునిక సాహిత్య విమర్శ లక్షణాలు ; 2. ఆధునిక సాహిత్య విమర్శ పద్ధతులు

- Unit II (ఎ) 1. సంస్కరణ సాహిత్య విమర్శ ; 2. కాల్పనిక సాహిత్య విమర్శ  
(బి) 1. హేతువాద సాహిత్య విమర్శ ; 2. అభ్యుదయ సాహిత్య విమర్శ

- Unit III (ఎ) 1. దిగంబర కవిత్వ విమర్శ ; 2. విప్లవ సాహిత్య విమర్శ  
(బి) 1. దళిత సాహిత్య విమర్శ ; 2. స్త్రీవాద సాహిత్య విమర్శ

- Unit IV (ఎ) 1. మైనారిటీ సాహిత్య విమర్శ ; 2. నవల - విమర్శ  
(బి) 1. కథానిక - విమర్శ ; 2. నాటకం - విమర్శ

- Unit V (ఎ) 1. వ్యాసం - విమర్శ ; 2. హైకు, నానీల విమర్శ  
(బి) 1. ఆధునిక సాహిత్య విమర్శకారులు - కట్టమంచి, కందుకూరి, రాళ్లపల్లి, శ్రీశ్రీ  
2. అత్యాధునిక సాహిత్య విమర్శకారులు - రాచమల్లరామచంద్రారెడ్డి, సుదర్శనం, ఆర్. ఎన్  
కత్తి పద్మారావు, క్రాత్యాయనీ విద్యుహే.

నంప్రదించవలసిన గ్రంథాలు :

1. సాహిత్య దర్శనం - కె.వి.ఆర్. నరసింహం.
2. సాహిత్యం - మౌళిక భావనలు - పాపినేని శివశంకర్
3. భ్రమ - వాస్తవం - కాడ్వెల్ క్రిష్టియన్ (పొట్లూరి వెంకటేశ్వరరావు అనువాదం)
4. తెలుగునాటక వికాసం - పి.ఎస్. ఆర్. అప్పారావు
5. తెలుగు సాహిత్య విమర్శ - సిద్ధాంతాలు - సూత్రాలు - వి. సిమ్మన్న
6. ఆధునికాంధ్ర కవిత్వము - సంప్రదాయములు - ప్రయోగములు - సి. నారాయణరెడ్డి.
7. సాహిత్యం - సౌందర్యం - బి. సూర్యసాగర్.
8. ఆధునిక తెలుగు సాహిత్య విమర్శ - సంప్రదాయరీతి - కోవెల సుప్రసన్నాచార్య
9. ఆధునిక సాహిత్య విమర్శ సూత్రం - కొలకలూరి ఇనాక్
10. ఆధునిక సాహిత్య విమర్శ - ఆంగ్ల భాషా ప్రభావం - జి.వి. సుబ్రహ్మణ్యం.
11. విమర్శ మౌళిక లక్షణాలు - ముదిగొండ వీరభద్రయ్య
12. వల్లంపాటి సాహిత్య వ్యాసాలు - వల్లంపాటి వెంకట సుబ్బయ్య
13. సాహిత్య నేపథ్యం - ఆర్. ఎస్. సుదర్శనం.

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Paper - 2 : నవ్యాంధ్ర వచన సాహిత్యం

- Unit I (ఎ) 1. నవల - స్వరూప స్వభావాలు ; 2. ప్రపంచ భాషలలో నవల  
(బి) 1. తెలుగు నవల - నిర్వచనాలు - లక్షణాలు ; 2. తొలితెలుగు నవల - వాదవివాదాలు
- Unit II (ఎ) 1. తెలుగు నవల వర్గీకరణ ; 2. నవల వికాసదశలు  
(బి) 1. సాంఘిక నవలలు ; 2. మనోవైజ్ఞానిక నవలలు
- Unit III (ఎ) 1. కథానిక - నిర్వచనం - లక్షణాలు ; 2. కథానిక ఆరంభ వికాసాలు  
(బి) 1. కథానిక - వర్గీకరణ ; 2. కథానికలు - సామాజికత
- Unit IV (ఎ) 1. తెలుగు నాటకం - లక్షణాలు ; 2. తెలుగు నాటకం - ఆరంభ వికాసాలు  
(బి) 1. నాటకాలు - వర్గీకరణ ; 2. ప్రయోగాత్మక నాటక రంగం
- Unit V (ఎ) 1. నాటిక - నిర్వచనం, లక్షణాలు ; 2. నాటిక - ఆరంభ వికాసాలు  
(బి) 1. వ్యాసం - నిర్వచనం, లక్షణాలు ; 2. వ్యాస సపరిణామం.

నంబ్రదించవలసిన గ్రంథాలు :

1. తెలుగు నవల వికాసం : డా॥ మొదలి నాగభూషణశర్మ
2. తెలుగు నవల సాహిత్య వికాసం : పుల్లారావు వెంకటేశ్వర్లు
3. కథానిక స్వరూప స్వభావాలు : డా॥ చోరంకి దక్షిణామూర్తి
4. తెలుగు నాటక వికాసం : డా॥ పోణంగి శ్రీరామ అప్పారావు
5. తెలుగు సాంఘిక నాటకం : డా॥ పి.వి. రమణ
6. తెలుగు ఏకాంకికా వికాసం : డా॥ చనం మధుసూదన్
7. తెలుగు నవల సాహిత్యంలో మనో విశ్లేషణ - కోడూరి శ్రీరామమూర్తి
8. తెలుగు వ్యాస పరిణామం - డా॥ కొలకలూరి ఇనాక్
9. వచన వాఙ్మయ వీచిక : డా॥ జి. యోహాన్ బాబు.

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Paper - 3 : సామాన్య భాషాశాస్త్రం

Unit I (ఎ) ధ్వని విజ్ఞాన శాస్త్రం - ధ్వని విజ్ఞాన శాస్త్రాధ్యయనంలో ప్రధాన మార్గాలు - శ్రవణాత్మక, ఉచ్చారణాత్మక, ధ్వని తరంగాత్మక, వాగింద్రియాలు - ఉత్పత్తి, ధ్వనుల వర్గీకరణ - ధ్వని ప్రతిలేఖనం.

(బి) అంతర్జాతీయ ధ్వని పట్టిక, చరిత్ర - ప్రామాణిక ధ్వని పట్టిక తయారీ.

Unit II (ఎ) వర్ణవిజ్ఞాన శాస్త్రం - ధ్వని విజ్ఞాన శాస్త్రం, వర్ణ ధ్వని విజ్ఞాన శాస్త్రాలకున్న భేదం - నిర్వచనం.

(బి) వర్ణాల రకాలు - వర్ణ విశేషణ - ప్రయోగాత్మక ధ్వని లేఖనం, ధ్వని - వర్ణనం - నవర్ణం.

Unit III (ఎ) పద విజ్ఞాన శాస్త్రం - పదాంశం - నపదాంశం - నిర్వచనం - పదాంశాల గుర్తింపు.

(బి) పదాంశాల రకాలు - నైదా సూత్రాలు.

Unit IV (ఎ) వాక్య విజ్ఞాన శాస్త్రం - పదాంశ, వాక్య నిర్మాణ పరిమితుల్ని స్థాపించటానికి పద్ధతులు - సన్నిహిత సంబంధాల విశేషణ.

(బి) సంగ్రహంగా తెలుగు వాక్య నిర్మాణం.

Unit V (ఎ) సామాజిక భాషాశాస్త్రం - సమాజం, భాషా సంబంధం - వైయక్తిక మాండలికం, మాండలికం, భాష - నిర్వచనం, భాషలో మాండలికాలు ఏర్పడే విధానం, కారణాలు.

(బి) మాండలికాల వర్గీకరణ - ప్రాంతీయ, సాంఘిక, వృత్తినబంధి - వ్యవహార భేదక రేఖాపటాల తయారీ - మాండలిక సరిహద్దుల్ని గుర్తించటం - భాషా ప్రామాణీకరణ - ప్రత్యేకించి తెలుగు.

వంప్రదించవలసిన గ్రంథాలు :

1. Chomsky, N : Aspects Theory of Syntax
2. Chomsky, N. : Theoretical Linguistics
3. Pike, K. L. : Phonetics
4. Nida, L.A : Morphology
5. Seminar papers on Socio-Linguistics, Telugu Academy, Hyd., 1977
6. సుబ్రహ్మణ్యం, పి.ఎస్. - ఆధునిక భాషాశాస్త్ర సిద్ధాంతాలు.
7. మాండలిక వృత్తిపరకోశం (వ్యవసాయం) : సం. భద్రరాజు కృష్ణమూర్తి
8. ప్రపంచ భాషలు - వెలమల సిమ్మన్న
9. తెలుగు భాషా చరిత్ర - వెలమల సిమ్మన్న

10. కృష్ణమూర్తి, భద్రరాజు : భాష - సమాజం - సంస్కృతి, దోకకమక పబ్లికేషన్స్ ప్రైవేట్ లిమిటెడ్, హైదరాబాద్-1, 2000.

11. రాధాకృష్ణ, బుర్రాజు : భాషా శాస్త్ర చరిత్ర, విశాలాంధ్ర పబ్లిషింగ్ హౌస్, హైదరాబాద్, 1992.

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Paper - 4 : జర్నలిజం - అనువాదం

- Unit I
  - (ఎ) సమాచార సంకలన స్థలం - సిబ్బంది విధులు.  
వార్తాపత్రిక స్వరూపం. పత్రికా సిద్ధాంతాలు! పత్రికా భాష.
  - (బి) సంపాదకుని విధులు - బాధ్యతలు. సంపాదకత్వం. సంపాదకీయం.  
ప్రముఖ సంపాదకీయాలు - నార్ల, ఎ.బి.కె.

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- Unit II
  - (ఎ) ఫీచర్ - నిర్వచనం, లక్షణాలు, రకాలు, మిడిల్స్, పాఠకుల ఉత్తరాలు.  
శీర్షికలు - రకాలు. బ్యానరు. కార్టూన్లు, ఫోటోలు. లిద్లు.
  - (బి) సెన్సేషనల్ జర్నలిజం. ఎల్లో జర్నలిజం. జాతీయ వార్త సంస్థలు - యు.ఎన్.ఐ., పి.టి.ఐ.

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- Unit III
  - (ఎ) ప్రజా సంబంధాలు - ప్రాధాన్యత. ప్రజా సంబంధాలలో మీడియా పాత్ర.
  - (బి) పత్రికా స్వేచ్ఛ, పత్రికా చట్టాలు, పరువునష్టం, కోర్టుధిక్కారం, చట్టసభధిక్కారం, రాజద్రోహం.

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- Unit IV
  - (ఎ) అనువాదం - నిర్వచనం - మూలభాష - లక్ష్యభాష పరస్పర సంబంధం.
  - (బి) అనువాద పద్ధతులు - స్వేచ్ఛానువాదం - యథామాతృకానువాదం - మక్కికిమక్కి  
అనువాదం - అనువాదంలో రకాలు - వ్యాప్తి - పరిపూర్ణం - పాక్షికం - అనువాద దోషాలు.

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- Unit V
  - అనువాదం - ప్రాక్టికల్స్ (విద్యార్థుల చేత అనువాదం చేయించాలి)  
ఇంగ్లీషు నుండి తెలుగులోనికి అనువాదం.

నంప్రదించవలసిన గ్రంథాలు :

1. అనువాద సమస్యలు : రాచమల్లు రామచంద్రారెడ్డి
2. తెలుగు జర్నలిజం - చరిత్ర : రావోలు ఆనంద భాస్కర్
3. తెలుగు జర్నలిజం - అవగాహన - ఆచరణ : బూదరాజు రాధాకృష్ణ
4. తెలుగు జర్నలిజం - దుర్గం రవీందర్
5. సమాచారాల చేరవేత మరియు పాత్రికేయత్వం - డా॥ ఎస్.జి.డి. చంద్రశేఖర్.
6. పత్రికా రచన - సరిచయాంశాలు : డా॥ జి. యోహాన్ బాబు. ✓

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Paper - 5 : ఐచ్ఛికాంశం (4) గురజాడ

- యూనిట్ 1. (ఎ) 1. గురజాడ - జీవితం ; 2. ఆధునిక సాహిత్య మార్గదర్శి - గురజాడ  
(బి) 1. ముత్యాల సరాలు - వస్తు నవ్యత ; 2. ముత్యాలసరాలు - భావ నవ్యత
- యూనిట్ 2. (ఎ) 1. ముత్యాలసరాలు - భాష, ఛందో నవ్యతలు ;  
2. కన్యాశుల్కం - ఇతివృత్త నిర్వహణ  
(బి) 1. కన్యాశుల్కం - గిరీశం పాత్ర ప్రాధాన్యత  
2. కన్యాశుల్కం - ఇతర పురుష పాత్రలు
- యూనిట్ 3. (ఎ) 1. కన్యాశుల్కం - స్త్రీ పాత్రలు ; 2. కన్యాశుల్కం - సంఘ సంస్కరణలు  
(బి) 1. కన్యాశుల్కం - భాషా నవ్యత ; 2. కొండుభట్టియం - సమీక్ష
- యూనిట్ 4. (ఎ) 1. బిల్వణీయం - సమీక్ష ; 2. గురజాడ కథలు - కథాకథనం  
(బి) 1. గురజాడ కథలు - పాత్రచిత్రణ ; 2. గురజాడ కథలు - అభ్యుదయ భావాలు
- యూనిట్ 5. (ఎ) 1. గురజాడ - వ్యావహారిక భాషోద్యమం  
2. గురజాడ అసమ్మతి పత్రం - పరిశీలన  
(బి) 1. గురజాడ వ్యాసాలు - విమర్శనా దృక్పథం ; 2. గురజాడ - యుగకర్త.

సంప్రదించవలసిన గ్రంథాలు :

1. ఆధునికాంధ్ర కవిత్వము - సంప్రదాయములు - ప్రయోగములు : డా. సి. నారాయణరెడ్డి
2. తెలుగులో కవితా విప్లవాల స్వరూపం : డా. వెల్చేరు నారాయణరావు
3. మహోదయం - కె.వి. రమణారెడ్డి, విశాలాంధ్ర
4. కన్యాశుల్కం - నాటక కళ : సర్వేశ్వరయ్య తిరుమలరావు
5. మన గురజాడ - శ్రీశ్రీ : చలసాని ప్రసాద్ : వి. ర. సం.
6. గురజాడ - వి. ఆర్. నార్ల (అను. జి. లలిత) : కేంద్ర సాహిత్య అకాడమీ.
7. గురజాడ - తొలి తెలుగు కొత్త కథలు : డా. రాచపాలెం చంద్రశేఖరరెడ్డి, అనంతపురం.
8. కన్యాశుల్కం - నూరేళ్ళ సమాలోచనం - విశాలాంధ్ర.

తెలుగుశాఖ, ఆంధ్రవిశ్వ కళాపరిషత్, విశాఖపట్నం

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Paper - 1 : ప్రాచీన సాహిత్య విమర్శ సిద్ధాంతాలు - సూత్రాలు

- Unit I ఎ) 1. విమర్శ, నిర్వచనం, ఆచార్యత, ప్రయోజనం,  
2. సహృదయుడు - వివిధ అభిప్రాయాలు

- బి) 1. ఉత్తమ విమర్శకుని లక్షణాలు. బాధ్యతలు  
2. విమర్శ భేదాలు, పద్ధతులు

- Unit II ఎ) 1. కావ్యం, కవిత్వం - ప్రాచ్య, పాశ్చాత్య నిర్వచనాలు, భేద సాధ్యతలు  
2. కావ్య భేదాలు - ప్రాచ్య పాశ్చాత్య అలంకారికులు విశ్లేషణ

- బి) 1. కావ్యహేతువులు - వివిధ అభిప్రాయాలు  
2. కావ్యాత్మ - వివిధ అలంకారికుల అభిప్రాయాలు.

- Unit III ఎ. 1. రస సిద్ధాంతం - విభిన్న అలంకారికుల మతం,  
2. రసం - కెథార్సిస్ - భేద సాధ్యతలు

- బి. 1. రస నిష్ఠ - వివిధ అభిప్రాయాలు  
2. రస సంఖ్య - సవరస, ఏకరసవాదాలు

- Unit IV ఎ. 1. ధ్వని - నిర్వచనం, భేదాలు, ధ్వన్యభావవాదాలు  
2. త్రివిధ శబ్దవృత్తులు - స్వరూప స్వభావాలు

- బి. 1. ప్రాచ్య, పాశ్చాత్య నాటకోత్పత్తి వాదాలు  
2. నాటక లక్షణాలు

- Unit V ఎ. 1. కావ్యావతారికలు - విమర్శ స్వరూప స్వభావాలు  
2. చాటుపద్యాలు - విమర్శ స్వరూపస్వభావాలు

- బి. 1. ప్రాచీన సాహిత్య ప్రక్రియలు - ఇతిహాసం, పురాణం, వాటి విమర్శ  
2. ప్రాచీన సాహిత్య ప్రక్రియలు - కావ్యం, శతకం, వాటి విమర్శ.

సంప్రదించవలసిన గ్రంథాలు :

- 1) సాహిత్య దర్శనం - కె.వి.ఆర్. నరసింహం. 2) కావ్యాలంకార సంగ్రహం - సన్నిధానం సూర్యనారాయణశాస్త్రి వ్యాఖ్య  
3) సాహిత్య శిల్ప సమీక్ష - పింగళి లక్ష్మీకాంతం. 4) తెలుగు కావ్యావతారికలు - జి.నాగయ్య. 5) సాహిత్య భావలహరి -  
ఎస్వీ జోగారావు. 6) తెలుగు సాహిత్య విమర్శ సిద్ధాంతాలు - సూత్రాలు - వి.సిమ్మన్న. 7) ప్రాచీనాంధ్రకవుల  
సాహిత్యాభిప్రాయాలు - అభిరుచులు - రాచపాలెం చంద్రశేఖరరెడ్డి. 8) విమర్శాశిల్పం - వల్లంపాటి వెంకటసుబ్బయ్య.  
9) తెలుగులో సాహిత్య విమర్శ - అవతరణ - వికాసములు - ఎస్వీ రామారావు. 10) తెలుగులో సాహిత్య విమర్శ -  
పాటిబండ మాధవశర్మ. 11) కవితా కళ - ఆచార్య తిరుమల. 12) విమర్శ మౌఖిక లక్షణాలు - ముదికొండ వీరభద్రయ్య.  
13) అనుశీలన - వడలి మందేశ్వరరావు. 14) సాహిత్యం - విమర్శ - వడలి మందేశ్వరరావు

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Paper - 2 : నవ్యాంధ్ర కవిత్వం

- Unit I ఎ) 1. ఆధునిక యుగం- నేపథ్యం, యుగకర్త  
2. నవ్యాంధ్ర కవిత్వ హేతువులు - లక్షణాలు  
బి) 1. సంఘసంస్కరణోద్యమ కవిత్వం - నేపథ్యం, లక్షణాలు  
2. సంఘసంస్కరణ కవిత్వంలో ప్రధానాంశాలు
- Unit II ఎ) 1. వచన కవిత్వం - నిర్వచనం, లక్షణాలు  
2. వచన కవితా వికాసం  
బి) 1. భావ కవిత్వం - నిర్వచనం, లక్షణాలు  
2. భావకవిత్వం - వివిధ శాఖలు
- Unit III ఎ. 1. అభ్యుదయ కవిత్వ నేపథ్యం - నిర్వచనం, లక్షణాలు  
2. అభ్యుదయ కవిత్వ ధోరణులు  
బి. 1. దిగంబర కవిత్వ స్వరూప స్వభావాలు  
2. దిగంబర కవిత్వ లక్షణాలు
- Unit IV ఎ. 1. విప్లవ కవిత్వం - నేపథ్యం, నిర్వచనం, లక్షణాలు  
2. విప్లవ కవితారీతులు  
బి. 1. స్త్రీవాద కవిత్వం - నేపథ్యం, లక్షణాలు  
2. స్త్రీవాద కవితారీతులు
- Unit V ఎ. 1. దళిత కవిత్వ నిర్వచనాలు - లక్షణాలు  
2. మైనారిటీ కవిత్వ తీరు తెన్నులు  
3. బి.సి.వాద కవిత్వం  
బి. 1. ఆదివాసీ కవిత్వం  
2. మినీ కవిత  
3. హైకులు, నానీలు

సంప్రదించవలసిన గ్రంథాలు :

- 1) ఆధునికాంధ్ర కవిత్వం - సంప్రదాయాలు - ప్రయోగాలు : డా॥ సి.నారాయణరెడ్డి
- 2) తెలుగులో కవితా విప్లవాల స్వరూపం : డా॥ వెల్చేరు నారాయణరావు
- 3) అభ్యుదయ విప్లవ కవిత్వాలు - సిద్ధాంతాలు - శిల్పరీతులు : డా॥ అద్దేపల్లి రామమోహనరావు
- 4) తెలుగు కవితా వికాసం : డా॥ కడియాల రామమోహన్‌రావు
- 5) దళిత సాహిత్యం - తాత్విక దృక్పథం : జి.లక్ష్మీనరసయ్య
- 6) దళిత సాహిత్య తత్వం - శిఖామణి
- 7) స్త్రీవాద వివాదాలు (సం.) డా॥ యస్వీ సత్యనారాయణ
- 8) తెలుగు సాహిత్య విమర్శ సిద్ధాంతాలు : ఆచార్య వెలమల సిమ్మన్న
- 9) దళిత సాహిత్య దర్శనం : ఆచార్య కొండపల్లి సుదర్శనరాజు
- 10) తెలుగులో కవిత్వోద్యమాలు - (సం.) డా॥ ఆవుల మంజులత
- 11) మైనారిటీ కవిత్వం - తాత్విక నేపథ్యం : డా॥ ఎస్.షమీఉల్లా.



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Paper - 3 : సామాన్య భాషాశాస్త్రం

Unit I ఎ)

1. భాష - నిర్వచనం, స్వభావం
2. భాష లక్షణాలు

బి)

1. భాషల పుట్టుక - వివిధ సిద్ధాంతాలు, ఇటీవలి దృక్పథాలు
2. భాష - సమాజం - వాటి సంబంధం

Unit II ఎ)

1. భాష - లిపి, భాషాశాస్త్రం - వ్యాకరణం
2. భాషాశాస్త్రం - మూలసిద్ధాంతాలు

బి)

1. ప్రాచ్య దేశాల్లో భాషాశాస్త్ర కృషి
2. పాశ్చాత్య దేశాల్లో భాషాశాస్త్ర కృషి
3. భాషాశాస్త్రం - వివిధ ధోరణులు (స్కూల్స్)

Unit III ఎ.

- భాషాశాస్త్ర విభాగాలు - 1. వర్ణనాత్మక భాషాశాస్త్రం
2. చారిత్రక భాషాశాస్త్రం
  3. తులనాత్మక భాషాశాస్త్రం

బి.

- ప్రపంచ భాషల వర్గీకరణ
1. భౌగోళిక వర్గీకరణ
  2. వంశానుగుణ వర్గీకరణ
  3. పదాంశానుగుణ వర్గీకరణ

Unit IV ఎ.

1. భాషా పరిణామం - ధ్వనుల మార్పు, హేతువులు
2. ధ్వనుల మార్పు - రకాలు

బి.

1. ధ్వనిసూత్రాలు - వాటి స్వభావాలు - మినహాయింపులు
2. అర్థ విపరిణామం - హేతువులు, రకాలు

Unit V ఎ.

1. భాషల్లో ఆదాన ప్రదానాలు - హేతువులు
2. ఆదాన ప్రదానాల రకాలు - భాషానిర్మాణం మీద వాటి ప్రభావం.

బి.

1. మూల భాష పునర్నిర్మాణం - తులనాత్మక పద్ధతి
2. ఆంతరంగిక పునర్నిర్మాణం - దాని పరిమితులు.

సంప్రదించవలసిన గ్రంథాలు :

1. ఆధునిక భాషాశాస్త్ర సిద్ధాంతాలు - పి.ఎస్. సుబ్రహ్మణ్యం
2. భాషాశాస్త్ర వ్యాసములు - ఎల్. చక్రధరరావు
3. భాషాశాస్త్ర వ్యాసాలు - బూదరాజు రాధాకృష్ణ
4. భాష - సమాజం - సంస్కృతి - భద్రరాజు కృష్ణమూర్తి
5. ఆధునిక భాషాశాస్త్రం - వెలమల సిమ్మన్న

తెలుగుశాఖ, ఆంధ్రవిశ్వ కళాపరిషత్, విశాఖపట్నం  
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Paper - 4 : పత్రికా రచన

Unit I ఎ)

1. కమ్యూనికేషన్ - నిర్వచనం - విధులు, రకాలు
2. పత్రికా రచన ఆవిర్భావ వికాసాలు

బి)

1. తొలితరం పత్రికలు - వృత్తాంతి, హితవాది, వివేకపర్షిని
2. తొలితరం పాత్రికేయులు - కందుకూరి, గాడిచర్ల, కాశీనాథుని, ముట్టూరి

Unit II ఎ)

1. ఆధునిక పత్రికల పోకడలు - ధోరణులు
2. పత్రికా సిద్ధాంతాలు - స్వేచ్ఛ, పత్రికాభాష

బి)

1. ఆధునిక పత్రికలు - ఆంధ్రపత్రిక, ఆంధ్రప్రభ, ఆంధ్రజ్యోతి, ఈనాడు, సాక్షి, ప్రజాశక్తి.
2. ఆధునిక పాత్రికేయులు - తాపీ, నార్ల, ఎబికె ప్రసాద్

Unit III ఎ.

1. వార్త - నిర్వచనం, లక్షణాలు, విలువలు, వనరులు
2. వార్తాసేకరణ విధానాలు - మెలకువలు

బి.

1. విలేఖరి - లక్షణాలు, రకాలు
2. ప్రత్యేక సందర్భాల్లో వార్తా సేకరణ, ఇంటర్వ్యూలు, పత్రికా ప్రకటనలు, సమావేశాలు, చట్టసభలు కోర్టు వార్తలు, నేర వార్తలు, క్రీడావార్తలు, సాంస్కృతిక వార్తలు

Unit IV ఎ.

1. వార్తా రచన - తీసుకోవలసిన జాగ్రత్తలు
2. సంపాదకత్వం - సంపాదకీయం - ప్రాముఖ్యం,
3. సంపాదకుడు, ఉపసంపాదకుడు

బి.

1. ఫీచర్లు, లీడ్లు - శీర్షికలు
2. పత్రికలకు ప్రకటనలు తయారు చేసే విధానం.
3. ప్రత్యేక పత్రికలు - సాహిత్య పత్రికలు, పిల్లల పత్రికలు, స్త్రీల పత్రికలు, రాజకీయ పత్రికలు.

Unit V ఎ.

1. రేడియోలో వార్తాసేకరణ - వార్తాప్రసారం, వ్యాపార ప్రకటనలు, కార్మికుల కార్యక్రమాలు తయారు చెయ్యడం.
2. టీ.వీ.లో వార్తాసేకరణ - వార్తా ప్రసారం- వ్యాపారప్రకటనలు తయారు చెయ్యడం, ధారావాహికలు రాయడం.

బి.

1. అనువాదం - నిర్వచనం, మూలభాష - లక్ష్య భాష, అనువాదవిధానాలు (సాహిత్య, ఇతర), - రకాలు
2. అనువాదప్రయోజనాలు - అనువాద సమస్యలు ( సాంస్కృతిక, నుడికార, సామాజికం)

సంప్రదించవలసిన గ్రంథాలు :

1. తెలుగు జర్నలిజం - డా.వి.లక్ష్మణరెడ్డి,
2. పత్రికా రచన - పి.శ్రీరామచంద్రమూర్తి
3. తెలుగు జర్నలిజం చరిత్ర - 1, 2 సంపుటాలు - నామాల విశ్వేశ్వరరావు
4. సమాచారాల చేరవేత - మరియు పాత్రికేయత్వం - ఆచార్య ఎస్.డి. చంద్రశేఖర్
5. మీడియా ముచ్చట్లు - డా. గజ్జాయోహన్ బాబు

తెలుగుశాఖ, ఆంధ్రవిశ్వ కళాపరిషత్, విశాఖపట్నం  
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Paper - 5 ఐచ్ఛికం (1) : దళిత సాహిత్యం

- Unit I ఎ) 1. దళిత సాహిత్యం - పరిధి - నిర్వచనం - నేపథ్యం  
2. దళిత సాహిత్య ఆవిర్భావ వికాసం

- బి) 1. దళిత సాహిత్యం - ఉద్యమాల, వ్యక్తుల ప్రభావం  
2. దళిత సాహిత్య సిద్ధాంతాలు - అన్వయం

- Unit II ఎ) 1. సాంప్రదాయ కవిత్వం - దళితాభ్యుదయం  
2. ప్రముఖ దళిత కవితా సంకలనాలు

- బి) 1. ప్రముఖ దళిత కవితా సంపుటాలు  
2. భిన్న కవితా ప్రక్రియల్లో దళిత కవిత్వం

- Unit III ఎ. 1. దళిత నాటకాలు - ఆవిర్భావ వికాసం  
2. స్వాతంత్ర్య పూర్వ దళిత నాటకాలు

- బి. 1. స్వాతంత్ర్యానంతర దళిత నాటకాలు  
2. దళిత నాటికలు

- Unit IV ఎ. 1. దళిత నవలలు - ఆవిర్భావ వికాసం  
2. దళితేతర రచయితలు - దళిత నవలలు

- బి. 1. దళిత రచయితలు - దళిత నవలలు  
2. దళిత నవలలు - వస్తు వైవిధ్యం

- Unit V ఎ. 1. దళిత కథలు - ఆవిర్భావ వికాసం  
2. స్వాతంత్ర్య పూర్వ దళిత కథలు

- బి. 1. స్వాతంత్ర్యానంతర దళిత కథలు  
2. దళిత కథలు వస్తు వైవిధ్యం

సంప్రదించవలసిన గ్రంథాలు :

1. దళిత సాహిత్య చరిత్ర - డా॥ పిల్లి శాంసన్
2. ఆధునికాంధ్ర కవిత్వం - హరిజనాభ్యుదయం - డా. కల్లూరి ఆనందరావు
3. తెలుగు నాటకం - హరిజనాభ్యుదయం - డా॥ వి.పోతన్న
4. తెలుగు నవల అస్పృశ్యతా సమస్య - డా॥ ననుమాసస్వామి
5. దళితసాహిత్య వ్యాసాలు - ఆచార్య కొండపల్లి సుదర్శనరాజు
6. దళిత సాహిత్యం - తాత్వికదృక్పథం - జి.లక్ష్మీనరసయ్య
7. దళిత సాహిత్యం - శిఖామణి
8. 1980 తర్వాత తెలుగు దళిత నవల - ఆచార్య రాచపాకెం చంద్రశేఖరరెడ్డి

తెలుగుశాఖ, ఆంధ్రవిశ్వ కళాపరిషత్, విశాఖపట్నం  
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Paper - 5 ఐచ్ఛికం (3) : వేమన

- Unit I ఎ) 1. కథల ఆధారంగా వేమన జీవితం  
 2. వేమన పద్యాల ఆధారంగా అతని జీవితం  
 బి) 1. వేమన దేశకాలాలు - భిన్నాభిప్రాయాలు  
 2. వేమన పద్యమకుటం - వివిధ అభిప్రాయాలు
- Unit II ఎ) 1. వేమన పద్య చందస్సు - అటవెలది ప్రత్యేకత  
 2. వేమన కవిత్వం - హాస్యం, నీతులు  
 బి) 1. వేమన కవితా సౌందర్యం - భాష, శైలి  
 2. వేమన కవితా సౌందర్యం - అలంకారాలు
- Unit III ఎ. 1. వేమన దృశ్యభంగం - కులం  
 2. వేమన దృశ్యభంగం - మతం  
 బి. 1. వేమన ఆర్థిక దృశ్యభంగం  
 2. వేమన స్త్రీ దృశ్యభంగం
- Unit IV ఎ. 1. వేమన దృశ్యభంగం - రాచరికం, రసవాదం  
 2. వేమన తత్వం - అద్వైతం, నాథయోగం  
 బి. 1. వేమన తత్వం - నాస్తికత్వం, మానవతావాదం  
 2. వేమన సదృశకవులు - అవ్వయ్యార్ (తమిళం), ఆభో (గుజరాతీ)
- Unit V ఎ. 1. వేమన సదృశకవి - సర్వజ్ఞుడు (కన్నడం)  
 2. వేమన సదృశకవులు - కబీరు (హిందీ), తుకారాం (మరాఠీ)  
 బి. 1. వేమనపై జరిగిన పరిశోధన - విమర్శకుల అభిప్రాయాలు  
 2. వేమన వైశిష్ట్యం

సంప్రదించవలసిన గ్రంథాలు :

1. ప్రజాకవి వేమన - ఎన్. గోపి
2. వేమన - రాజ్ కపూర్ అనంతకృష్ణశర్మ
3. నాథయోగి మన వేమన - కొల్లపాటి శ్రీరామమూర్తి
4. వేమన్నవాదం - ఎన్. గోపి
5. వేమన వైశిష్ట్యం - స్త్రీ దృశ్యభంగం - ఎం. జయదేవ్
6. వేమన వైశిష్ట్యం - నార్ల వెంకటేశ్వరరావు (తెలుగు అనువాదం)
7. విశ్వదాభిరామ విసురవేమ - త్రిపురనేని వెంకటేశ్వరరావు
8. వేమన - సర్వజ్ఞుడు - గంధం అప్పారావు
9. వేమన జీవితం, సాహిత్యం - ఎన్. ఎం. సుబాని
10. వేమన పద్యాల ఆధారంగా అతని జీవితం - మరువూరు కోదండరామరెడ్డి

తెలుగుశాఖ, ఆంధ్రవిశ్వ కళాపరిషత్, విశాఖపట్నం  
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Paper - 5 ఐచ్ఛికం (4) మాండలిక విజ్ఞానం

- Unit I ఎ) 1) సమాజం - భాష - సంబంధ బాంధవ్యాలు  
 2) మండల, మాండలిక పదాల నిర్వచనాలు - మాండలిక విజ్ఞాన అధ్యయన ఆవశ్యకత  
 బి) 1) జాతీయాలు - మాండలికాలు - నిర్వచనం, భేదాలు  
 2) భాషలో మాండలికాల ఏర్పాటు - కారణాలు, లక్షణాలు, అధ్యయన పద్ధతులు

- Unit II ఎ) 1) తెలుగు వ్యవహార మాండలికాల వివరణ  
 2) తెలుగు నాట పూర్వ, మధ్య మాండలికాల సోదాహరణ నిరూపణ  
 బి) 1) తెలుగు నాట దక్షిణ, ఉత్తర మాండలికాల సోదాహరణ నిరూపణ.  
 2) తెలుగు మాండలికాల గుర్తింపు

- Unit III ఎ) 1) మాండలికాలు-వృత్తి, కుల మాండలికాల వివరణ  
 2) వైయక్తిక మాండలికాలు - ప్రామాణిక మాండలికాలు - సోదాహరణ నిరూపణ  
 బి) 1) వ్యవహార భేదక రేఖలు - మాండలిక పటాలు  
 2) మాండలికాల వర్గీకరణ పద్ధతులు - వివరణ

- Unit IV ఎ) 1) చారిత్రక, సామాజిక మాండలికాల వివరణ  
 2) తెలుగు మాండలికాలపై ఇతర భాషల ప్రభావం  
 బి) 1) ఆదాన ప్రదాన ప్రక్రియ - భేదాలు, మాండలికాలలో ఆదత్త పదత్త పదజాలం  
 2) భాషల ప్రామాణీకరణ - పద్ధతులు - ప్రమాణాలు

- Unit V ఎ) 1) వృత్తి పదకోశాల ప్రాముఖ్యం - వ్యవసాయ వృత్తి పదకోశం  
 2) వృత్తి పదకోశాలు - చేనేత, మత్స్య పదకోశాలు.  
 బి) 1) తెలుగు మాండలిక సామెతలు - జానపద నిరుక్తులు  
 2) ప్రాచీనాంధ్ర భాషలో మాండలిక ప్రయోగాలు.

సంప్రదించవలసిన గ్రంథాలు (కథలు-మాండలికాలు):

- 1) మాండలిక వృత్తి పదకోశాలు - వ్యవసాయం, చేనేత, కుమ్మరం, మత్స్యం
- 2) తెలుగు భాషా చరిత్ర (సంకలనం) - ఆచార్య భద్రరాజు కృష్ణమూర్తి
- 3) మాండలికాలు, ఆంధ్రప్రదేశ్ లోని విశాఖపట్నం, ఖమ్మం మొదలగునవి.
- 4) తెలుగు భాషా చరిత్ర - ఆచార్య వెలమల సిమ్మన్న.

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Paper - 1 ఆధునిక సాహిత్య విమర్శ సిద్ధాంతాలు - సూత్రాలు

- Unit I ఎ)** 1. సమాజం - సాహిత్య - సాహిత్య విమర్శ - పరస్పర సంబంధం  
2. రచయిత - సామాజిక స్పృహ - సమాజ విశ్లేషణ
- బి)** 1. ఆధునిక సాహిత్య విమర్శ పద్ధతులు  
2. ఆధునిక సాహిత్య విమర్శ పద్ధతులు
- Unit II ఎ)** 1. సంస్కరణ సాహిత్య విమర్శ  
2. కాలానిక సాహిత్య విమర్శ
- బి)** 1. హేతువాద సాహిత్య విమర్శ  
2. అభ్యుదయ సాహిత్య విమర్శ
- Unit III ఎ.** 1. దిగంబర కవిత్వ విమర్శ  
2. విప్లవ సాహిత్య విమర్శ
- బి.** 1. దళిత సాహిత్య విమర్శ  
2. స్త్రీవాద సాహిత్య విమర్శ
- Unit IV ఎ.** 1. మైనారిటీ సాహిత్య విమర్శ  
2. నవల - విమర్శ
- బి.** 1. కథానిక - విమర్శ  
2. నాటకం - విమర్శ
- Unit V ఎ.** 1. రూపవాద, నిర్మాణవాద దృక్పథాలు  
2. ఊహాచిత్ర - ప్రతీక దృక్పథాలు
- బి.** 1. సామాజిక, చారిత్రక (ఆదర్శ) దృక్పథాలు,  
2. తాత్విక, మనస్తత్వ దృక్పథాలు

సంప్రదించవలసిన గ్రంథాలు :

1. సాహిత్య దర్శనం - కె.వి.ఆర్. నరసింహం
2. సాహిత్యం - మౌళిక భావనలు - పాపినేని శివశంకర్
3. భ్రమ - వాస్తవం - కాన్వెయ్ట్ క్రిస్టియన్ (పోట్లూరి వెంకటేశ్వరరావు అనువాదం).
4. తెలుగు నాటక వికాసం - పి.ఎస్.ఆర్. ఈ.అప్పారావు.
5. తెలుగు సాహిత్య విమర్శ - సిద్ధాంతాలు - సూత్రాలు - వెలమల సిమ్మన్న.
6. ఆధునికాంధ్ర కవిత్వము - సంప్రదాయములు - ప్రయోగములు - సి.నారాయణరెడ్డి.
7. సాహిత్యం - సౌందర్యం - బి.సూర్యసాగర్.
8. ఆధునిక తెలుగు సాహిత్య విమర్శ - సంప్రదాయరీతి - కోవెల సుప్రసన్నాచార్య.
9. ఆధునిక సాహిత్య విమర్శ సూత్రం - కొలకలూరి ఇనాక్.
10. ఆధునిక సాహిత్య విమర్శ - ఆంగ్ల ప్రభావం - జి.వి.సుబ్రహ్మణ్యం.
11. విమర్శ మౌళిక లక్షణాలు - ముదిగొండ వీరభద్రయ్య.
12. వల్లంపాటి సాహిత్య వ్యాసాలు - వల్లంపాటి వెంకటసుబ్బయ్య.
13. సాహిత్య నేపథ్యం - ఆర్.ఎస్.సుదర్శనం.

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## Paper - 2 నవ్యాంధ్ర వచన సాహిత్యం

- Unit I ఎ)** 1. వచన ప్రక్రియ - నేపథ్యం - ఆవశ్యకత  
2. తెలుగులో వచన ప్రక్రియ ఆవిర్భావ వికాసం
- బి)** 1. తెలుగు నవల - నిర్వచనాలు - లక్షణాలు,  
2. తొలి తెలుగు నవల - వాద వివాదాలు
- Unit II ఎ)** 1. తెలుగు నవల వర్గీకరణ  
2. నవల - వికాస దశలు
- బి)** 1. సాంఘిక నవలలు  
2. మనోవైజ్ఞానిక నవలలు
- Unit III ఎ.** 1. కథానిక - నిర్వచనం - లక్షణాలు  
2. కథానిక ఆరంభ వికాసాలు
- బి.** 1. కథానిక వర్గీకరణ  
2. కథానికలు - సామాజికత
- Unit IV ఎ.** 1. ఆధునిక కాలం వరకు తెలుగులో నాటకం ఆవిర్భవించకపోవడానికి కారణాలు  
2. తెలుగు నాటకం - లక్షణాలు
- బి.** 1. తెలుగు నాటకం - ఆరంభ వికాసాలు  
2. నాటకాలు - వర్గీకరణ
- Unit V ఎ.** 1. నాటిక - నిర్వచనం, లక్షణాలు  
2. నాటిక - ఆరంభ వికాసాలు
- బి.** 1. వ్యాసం - నిర్వచనం, లక్షణాలు  
2. వ్యాస పరిణామం.

సంప్రదించవలసిన గ్రంథాలు :

1. తెలుగు నవల వికాసం : డా. మొదలి నాగభూషణశర్మ
2. తెలుగు నవల సాహిత్య వికాసం : పుల్లారావు వెంకటేశ్వర్లు
3. కథానిక స్వరూప స్వభావాలు : డా. పోరంకి దక్షిణామూర్తి
4. తెలుగు నాటక వికాసం : పోరంకి శ్రీరామ అప్పారావు
5. తెలుగు సాంఘిక నాటకం : డా. పి.వి.రమణ
6. తెలుగు ఏకాంకికా వికాసం : డా. వనం మధుసూదన్
7. తెలుగు నవల సాహిత్యంలో మనోవిశ్లేషణ : కోడూరి శ్రీరామమూర్తి
8. తెలుగు వ్యాస పరిణామం : డా. కొలకలూరి ఇనాక్
9. వచన వాఙ్మయ వీచిక : డా. జి. యోహాన్ బాబు & డా. జె. అప్పారావు
10. తెలుగు నవల - సంక్షిప్త చరిత్ర : డా. జి. యోహాన్ బాబు
11. తెలుగులో వచన వికాసము : డా. ఎం. కులశేఖరరావు

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Paper - 3 సామాన్య భాషాశాస్త్రం

- Unit I** ఎ) 1. ధ్వని - నిర్వచనం, ధ్వని అధ్యయన విధానాలు  
2. వాగింద్రియాలు - ధ్వనుల ఉత్పత్తి  
బి) 1. ధ్వనుల వర్గీకరణ  
2. అంతర్జాతీయ ధ్వని పట్టిక చరిత్ర - ప్రామాణిక ధ్వని పట్టిక తయారీ  
3. ధ్వన్యాత్మక లేఖనం
- Unit II** ఎ) 1. వర్ణం - నిర్వచనం, ధ్వని - వర్ణం  
2. వర్ణం - సవర్ణం  
బి) 1. వర్ణ ప్రవృత్తి లేదా వర్ణ నిర్ణయ విధానం  
2. వర్ణాల రకాలు
- Unit III** ఎ. 1. పదం - పదాంశం - సపదాంశం వాటి వివరణ  
2. పదాంశాల గుర్తింపు - నైదా సూత్రాలు  
బి. 1. పదాంశాల రకాలు  
2. పద నిర్మాణ వర్ణనా పద్ధతులు  
3. సంధి - వివరణ
- Unit IV** ఎ. 1. వాక్యం - నిర్వచనం, వాక్య నియమాలు  
2. పద నిర్మాణ, వాక్య నిర్మాణాల సంబంధం - వాటి పరిధి  
బి. 1. వాక్య నిర్మాణ రీతులు  
2. ఆధునిక వాక్య నిర్మాణాలు - భేదాలు  
3. సన్నిహితావయాల వివరణ
- Unit V** ఎ. 1. పరివర్తన వ్యాకరణం - పద బంధ నిర్మాణం  
2. అంతరంగ నిర్మాణం - బహిరంగ నిర్మాణం  
3. పరివర్తన సూత్రాలు  
బి. 1. అర్థం - విశ్లేషణ  
2. అర్థాల రకాలు

సంప్రదించవలసిన గ్రంథాలు :

1. ఆధునిక భాషాశాస్త్ర సిద్ధాంతాలు - పి.ఎస్.సుబ్రహ్మణ్యం
2. ఆధునిక భాషాశాస్త్రం - ఆచార్య వి.సిమ్మన్న
3. భాషా విజ్ఞాన పరిచయం - జి.ఎన్.రెడ్డి
4. భాషాశాస్త్ర పరిచయం - బొడ్డుపల్లి పురుషోత్తం



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**Paper - 4 సంస్కృతం**

- Unit I ఎ)** 1. సంస్కృత భాషా ప్రాముఖ్యం  
 2. భారతీయ సాంస్కృతిక భాషగా సంస్కృతం
- బి)** 1. వైదిక వాఙ్మయ రీతులు  
 2. భారత రామాయణాల పరిచయం (ఇతిహాసపరిచయం)
- Unit II ఎ)** 1. పురాణాల పరిచయం  
 2. మహాభారత్య లఘు కావ్యాల పరిచయం
- బి)** 1. నాటక సాహిత్య పరిచయం  
 2. ఉపదేశాత్మక సాహిత్య పరిచయం
- Unit III ఎ.** 1. సంస్కృత వ్యాకర్తల పరిచయం - పాణిని - వరరుచి - వతంజలి  
 2. సంస్కృత నిఘంటుకర్తల పరిచయం - యాస్కుడు
- బి.** 1. వాల్మీకి, వ్యాస సాహిత్యాల పరిచయం  
 2. భాస - కాళిదాస - భవభూతి సాహిత్య పరిచయం  
 3. శ్రీ హర్ష - మాఘ - భారవి - భర్తృహరి - కల్దణుల సాహిత్య పరిచయం
- Unit IV ఎ.** 1. ప్రతిమా - అభిజ్ఞానశాకుంతల నాటకాల పరిచయం - ఉత్తర రామచరిత్ర  
 2. నాగానంద - మృచ్చకతిక - వేణీసంహార - ముద్రారాక్షసాల పరిచయం  
 3. గద్యకావ్యాల పరిచయం - కాదంబరి, దశకుమార చరిత్రలు
- బి.** 1. కథాకావ్యాల పరిచయం - పంచతంత్ర - విక్రమార్క చరిత్రలు  
 2. ప్రసిద్ధ అలంకార శాస్త్ర గ్రంథాల పరిచయం - నాట్యశాస్త్రం - ధ్వన్యాలోకం  
 3. అలంకారశాస్త్ర పరిచయం - సాహిత్యదర్పణం - రసగంగాధరం
- Unit V ఎ.** 1. రఘువంశం - పంచమసర్గ- 1-30 శ్లోకాల వరకు  
 2. రఘువంశం - పంచమసర్గ - 31- చివరి వరకు
- బి.** 1. సంస్కృత సంధుల, స్త్రీ ప్రత్యయాల పరిచయం  
 2. నిర్దిష్ట శబ్దాల - పారిభాషిక పదాల పరిచయం

**శబ్దములు :** రామ - హరి - శంభు - ధాత్య - రమా - మతి - గౌరీ - ధేను - వధూ - మాతృ - జ్ఞాన - మధు -  
 జలమున్ - భిషజ్ - మరుత్ - దివిషద్ - రాజన్ - తత్ - యత్ - కిం - యుష్మద్ - అస్మద్ శబ్దములు.  
**పారిభాషికపదాలు :** గుణము - వృద్ధి - తపరకరణం - పదం - ధాతువు సంయోగం - నిపాత - ఉపసర్గ - ప్రాతిపదిక

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Paper - 5 ఐచ్ఛికం(1) ఆదివాసీ విజ్ఞానం

- Unit I ఎ) 1. ఆటవిక, గిరిజన, ఆదివాసి శబ్దాల వివరణ  
2. భారతదేశంలో ఆదివాసీల సంక్షిప్త పరిచయం  
బి) 1. ఆదివాసీల చారిత్రక నేపథ్యం - హేతు దృక్పథ పరిశీలన  
2. ఆంధ్రప్రదేశ్ లో ఆదివాసి తెగల సంక్షిప్త పరిచయం

- Unit II ఎ) 1. ప్రాచీన సాహిత్యంలో ఆదివాసీల ప్రస్తావన  
2. ఆదివాసీల మౌఖిక సాహిత్యం - గేయాలు  
బి) 1. ఆదివాసీ సాహిత్యం - కథలు  
2. ఆదివాసీ సాహిత్యం - సామెతలు, పొడుపు కథలు

- Unit III ఎ) 1. ఆదివాసీల కళలు  
2. ఆదివాసీల భాష - మాండలికాలు  
బి) 1. ఆదివాసీల భాష - నామ విజ్ఞానం  
2. ఆదివాసీల వృత్తులు - వృత్తుల్లో వారి నైపుణ్యం

- Unit IV ఎ) 1. ఆదివాసీల ఆహార పానియాలు  
2. ఆదివాసీల ఆభరణాలు  
బి) 1. ఆదివాసీల వేడుకలు, వినోదాలు  
2. ఆదివాసీల వైద్యం

- Unit V ఎ) 1. ఆదివాసీల - పండుగలు - మతం  
2. ఆదివాసీల జాతరలు, ఉత్సవాలు  
3. ఆదివాసీల నమ్మకాలు  
బి) 1. ఆదివాసీల సామాజిక వ్యవస్థ  
2. ఆదివాసీల రాజకీయ వ్యవస్థ  
3. ఆదివాసీలపై జరిగిన పరిశోధన

సంప్రదించవచ్చిన గ్రంథాలు :

1. జానపద విజ్ఞాన అధ్యయనం - డా.జి.ఎస్.మోహన్
2. భారతీయ గిరిజనులు - నదీంహస్ సైన్
3. భారతదేశం - గిరిజన సముదాయాలు (తెలుగు అకాడమీ)
4. గిరిజన సాహిత్యం - ఆచార్య గోనా నాయక్
5. ఆదివాసీ విజ్ఞానం - డా.జె.అప్పారావు
6. సుగాలి సంస్కృతి భాషా సాహిత్యాలు - ఆచార్య గోనా నాయక్

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**Paper - 5 ఐచ్ఛికం(2) హేతువాద సాహిత్యం**

- Unit I**      ఎ. హేతువాద నిర్వచనం - లక్షణాలు - ఉద్యమం.  
              బి. హేతువాదం ఇతర వాదాలతో గల సంబంధం - చార్వకం, నాస్తికవాదం,  
              మానవవాదం, సామ్యవాదం
- Unit II**      ఎ. హేతువాద సాహిత్యం - ఆంగ్ల భాషా ప్రభావం  
              బి. ప్రముఖ హేతువాద రచయితలు - సాహిత్యం - సంక్షిప్త పరిచయం
- Unit III**     ఎ. హేతువాద కవిత్వం - శతకాలు  
              బి. తెలుగు కవిత్వం - హేతువాద ప్రశంస
- Unit IV**     ఎ. నాటక ప్రక్రియ - హేతువాదం  
              బి. హేతువాద రూపక సాహిత్యం - పౌరాణికాంశాలు
- Unit V**      ఎ. వ్యాస ప్రక్రియ - హేతువాదం  
              బి. హేతువాదం - పరిశోధనా వ్యాసం

సంప్రదించవచ్చిన గ్రంథాలు :

1. ఆంధ్రప్రదేశ్‌లో హేతువాద ఉద్యమం : రావిపూడి వెంకటాద్రి
2. తెలుగు పౌరాణిక నాటకాలు - హేతువాదం : డా. జి.ప్రభాకర్
3. నాస్తికవాదం - హేతువాదం - మానవవాదం : రంగనాయకమ్మ
4. పౌరాణిక రూపకాలు - భావ విప్లవం : ఆచార్య కొండపల్లి సుదర్శనరాజు
5. హేతువాదం : రావిపూడి వెంకటాద్రి
6. ఆంధ్రదేశంలో హేతువాద మానవవాద ఉద్యమాలు (సం.) : డా.ఆవుల మంజులత
7. హేతువాద వ్యాసావళి : ఆచార్య కొండపల్లి సుదర్శనరాజు

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### Paper - 5 ఐచ్ఛికం(3) స్త్రీవాద సాహిత్యం

#### Unit I

- (ఎ) 1) స్త్రీవాద నిర్వచనం-నేపథ్యం  
2) స్త్రీవాద సాహిత్య లక్షణాలు
- (బి) 1) భారతదేశలో మహిళాభ్యుదయ ఉద్యమాలు-పుట్టు పూర్వోత్తరాలు  
2) స్త్రీవాదం - వివిధ ధోరణులు

#### Unit II

- (ఎ) 1) స్త్రీవాద కవిత్వం - ఆవిర్భావ వికాసాలు  
2) స్త్రీవాద కవితా సంకలనాలు-ప్రముఖాంశాలు
- (బి) 1) స్త్రీవాద కవితా సంపుటాలు, వివిధాంశాలు  
2) స్త్రీవాదం - ఇతర కవితా ప్రక్రియల్లోని అంశాలు

#### Unit III

- (ఎ) 1) స్త్రీవాద నవలా సాహిత్యం - ఆవిర్భావ వికాసాలు  
2) ప్రముఖ స్త్రీవాద నవలలు - పరిచయం, ప్రధానాంశాలు.
- (బి) 1) స్త్రీవాద నవలలు - భిన్న సమస్యలు  
2) స్త్రీవాద నవలా ప్రక్రియ - రచనా వైశిష్ట్యం

#### Unit IV

- (ఎ) 1) స్త్రీవాద కథలు - ఆవిర్భావ వికాసాలు  
2) స్త్రీవాద కథలు - పరిచయం
- (బి) 1) స్త్రీవాదాలు - వివిధ సమస్యలు  
2) స్త్రీవాద కథా ప్రక్రియ - రచనా వైశిష్ట్యం

#### Unit V

- (ఎ) 1) స్త్రీవాద వ్యాస పరిణామ వికాసం  
2) ప్రముఖ స్త్రీవాద వ్యాసాలు - పరిచయం
- (బి) 1) స్త్రీవాద సాహిత్యం - పరస్పర భిన్నాభిప్రాయాలు  
2) స్త్రీవాద, దళిత వాదాల - భేద, సాదృశ్యాలు.

#### సంప్రదించవలసిన గ్రంథాలు:

1. మాకు గోడలు లేవు (స్త్రీవాద సిద్ధాంత పరిచయం) - అస్మిత
2. సరిహద్దులు లేని సంధ్యలు - అస్మిత
3. స్త్రీవాద వివాదాలు - ఆచార్య యస్వీ సత్యనారాయణ
4. మనకు తెలియని మన చరిత్ర - అస్మిత

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Paper - 5 ఐచ్ఛికం(4) సాహితీ ప్రక్రియలు

- Unit I ఎ) 1. సాహితీ ప్రక్రియ - నిర్వచనం, స్వరూప స్వభావాలు  
2. ఆంధ్ర సారస్వత ప్రమాణిష్యుల్లో సాహితీ ప్రక్రియలు  
బి) 1. పురాణ ప్రక్రియ - ప్రత్యేక స్వభావాలు  
2. ఇతిహాసప్రక్రియ - ప్రత్యేకస్వభావాలు
- Unit II ఎ) 1. కావ్య ప్రక్రియ - ప్రత్యేకతలు  
2. ప్రబంధ ప్రక్రియ - ప్రత్యేకతలు  
బి) 1. శతక ప్రక్రియ - పుట్టుక, వికాసం లక్షణాలు  
2. ఉదాహరణ, రగడ ప్రక్రియల ప్రత్యేకతలు
- Unit III ఎ) 1. సంకీర్తన, పద ప్రక్రియల స్వరూప స్వభావాలు  
2. కృతి, రచన, విన్నప ప్రక్రియల ప్రత్యేకతలు  
బి) 1. యక్షగానం పుట్టుక వికాసాలు  
2. హరికథ పుట్టుక వికాసాలు
- Unit IV ఎ) 1. తెలుగు నాటకం పుట్టుక - వికాసం - లక్షణాలు  
2. ప్రహసనం, నాటిక స్వరూప స్వభావాలు  
బి) 1. నవల పుట్టుక వికాసం, లక్షణాలు  
2. కథ పుట్టుక వికాసాలు
- Unit V ఎ) 1. యాత్రా చరిత్ర, స్వీయ చరిత్ర, జీవితచరిత్ర ప్రక్రియల ప్రత్యేకలక్షణాలు  
2. వ్యాసప్రక్రియ పుట్టుక వికాసాలు  
3. లేఖ, డైరీ, మ్యూజింగ్స్ ప్రక్రియల ప్రత్యేకతలు  
బి) 1. ఖండ కావ్యం పుట్టుక వికాసాలు  
2. నవన కవితపుట్టుక వికాసాలు  
3. మ్యూజింగ్స్ ప్రక్రియల, నానీలు, హైకూల ప్రత్యేకతలు.

సంప్రదించవలసిన గ్రంథాలు:

- 1) సమగ్ర ఆంధ్ర సాహిత్యం-అరుద్ర-తెలుగు అకాడమీ
- 2) తెలుగు సాహిత్య సమీక్ష (రెండు సంపుటాలు)-జి.నాగయ్య
- 3) ఆంధ్ర యక్షగాన వాఙ్మయ చరిత్ర-ఎస్.వి.కోగారావు
- 4) తెలుగు నవల వికాసం-మొదలి నాగభూషణ శర్మ
- 5) తెలుగు నాటక వికాసం-పి.ఎస్.ఆర్.అప్పారావు
- 6) సంస్కృత సాహిత్య చరిత్ర-సుజాతారెడ్డి ముదిగంటి, గోపాలరెడ్డి ముదిగంటి
- 7) ఆంధ్రప్రబంధములు-అవతరణ వికాసాలు-డా॥కె.వి.ఆర్.నరసింహం
- 8) అధునిక తెలుగు సాహిత్యంలో ప్రక్రియలు-ధోరణులు-తెలుగు అకాడమీ

SX - S110 SYLLABUS  
Ne 2003 - 2004 AB

ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
/M.Sc MATHEMATICS  
I SEMISTER  
M 101 ALGEBRA - I

UNIT I

Normal subgroups- Quotient groups-Isomorphism theorems-  
Automorphisms- Conjugacy and G-Sets - Cyclic Decomposition -  
Alternating group  $A_n$ - Simplicity of  $A_n$ .

Chapters 5 and 7 of the Prescribed text book.

UNIT II

Direct Products- finitely generated abelian groups - Invariants of a finite  
abelian group-Sylow theorems - Groups of orders  $p^2$ ,  $pq$ .

Chapter 8 of the Prescribed text book.

UNIT III

Ideals, Homomorphisms, Sum and direct sum of ideals, Maximal and  
Prime Ideals

Chapter 10.1, 10.2, 10.3, 10.4 of the Prescribed text book.

UNIT IV

Nilpotent and Nil Ideals, Zorn's Lemma, unique factorization domains,  
Principal ideal domains, Polynomial rings over UFD

Chapter 10.5, 10.6 and Chapter 11 of the Prescribed text book.

Prescribed Book:

Basic Abstract Algebra: P.B. Bhattacharya, S.K.Jain and S.R.Nagpaul,  
Second edition, reprinted in India 1997,2000,2001

W.e.f 2003-2004 AB

M 102 - Real Analysis

SX-5111 ✓

UNIT I : Definition and existence of the Riemann Stieltjes integral, Properties of the integral, integration and differentiation - the fundamental theorem of calculus-integration of vector values functions -Rectifiable curves.

Chapter 6 of the textbook.

UNIT II : Sequences and series of the functions - Pointwise and uniform convergences - Uniform convergences and continuity - Uniform convergence and integration - Uniform convergence and differentiation.

Sections 7.1 to 7.18 of the textbook.

UNIT III : The Stone Wierstrass Theorem 7.26 to 7.33 of the textbook Power series - Abel's theorem - inversion in the order of summation - Taylor's theorem - uniqueness of power series.

Sections 8.1 to 8.5 of the textbook.

UNIT IV : Functions of several variables - linear transformation - Derivatives in an open subset of  $\mathbb{R}^n$  - Chain rule - Partial derivatives - The contraction principles - The inverse function theorem - the implicit functions theorem.

Textbook :

Walter Rudin : Principles of Mathematical Analysis (3rd edition) McGraw-Hill, Kogakusha, 1976, International Student Edition.

N.e.f. 2003-2004 AB 3-  
SX-S112 SYLLABUS

ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
M.Sc MATHEMATICS  
I SEMISTER

M 103 TOPOLOGY - I

UNIT I

Finite sets- Countable and uncountable sets-infinite sets and the axiom of choice -well ordered sets- the maximum principle  
Sections 6,7,9,10 and 11 of Chapter 1

UNIT II

Topological spaces- Basis for a Topology- The order topology-The product topology on  $X \times Y$ -the subspace topology- closed sets and limit points  
Sections 12 to 17 of Chapter 2

UNIT III

Continuous functions - the product topology-Metric spaces- the metric topology  
Sections 18 to 21 of Chapter 2

UNIT IV

Connected spaces-connected subspaces of the real line-Compact spaces-compact subspaces of the real line-limit point compactness - Local compactness  
Sections 23,24,26 to 29 of Chapter 3

Extent and content as in the book: Topology by James R.Munkers,Second edition,Pearson education Asia-Low price edition



SX-S 118

W. e f 2005 - 2006 AB

B-A

ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
M. A / M. SC MATHEMATICS  
I SEMESTER  
M 104 DIFFERENTIAL EQUATIONS - I

Syllabus

UNIT I: Linear Differential equations of Higher Order: Preliminaries - Higher order linear differential equations - a modelling problem - Linear independence - equations with constant coefficients - equations with variable coefficients - Wronskian - variation of parameters - some standard methods - method of Laplace transforms.

Chapter 2 of prescribed text book.

UNIT II: Solutions of Differential equations in Power Series: Preliminaries - Second order linear equations with Ordinary points - Legendre equations with Legendre Polynomials - Second order equations with regular singular points - Properties of Bessel functions.

Chapter 3 of prescribed text book.

UNIT III: Systems of Linear Differential Equations: Preliminaries - Systems of First order equations - Model for arms competitions between two nations - Existence and uniqueness theorem - Fundamental matrix - Non homogeneous linear systems - Linear systems with constant coefficients - Linear systems with periodic coefficients.

Chapter 4 of prescribed text book.

UNIT IV: Existence and Uniqueness of solutions: Preliminaries - Successive approximations - Picard's theorem - Some examples - Continuation and dependence on initial conditions - Existence of solutions in the Large - Existence and Uniqueness of solutions of systems - Fixed point method.

Chapter 5 of prescribed text book.

Text book: S.G. Deo, V. Lakshmikantham and V Raghavendra: Text book of Ordinary Differential Equations, Second edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1997.

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SX - S 114  
ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
M.Sc MATHEMATICS  
I SEMESTER

M 105 DISCRETE MATHEMATICS  
W. e. f. 2003 - 2004 AB

UNIT I

Graphs, digraphs, network, multigraph, Elementary results, structure based on connectivity, characterization, theorems on trees, tree distances, binary trees

Chapters 1, 2, and 3 of textbook I

UNIT II

Eulerian graphs, Hamiltonian graphs, Spanning trees, Fundamental cycles, unrestricted graphs, minimal spanning trees, kruskal algorithm, prim's algorithm

Chapter 4 of text book I and 8.5 of text book II

UNIT III

Definition of lattices, Modular lattices and distributive lattices

Chapter 1 of text book of III

UNIT IV

Basic properties: Boolean polynomials, ideals, minimal forms of Boolean polynomials, Application of Lattices, Switching circuits

Chapter 2 of Text Book III

Text Book I: Graph Theory applications By L.R. Foulds, Narosa publishing House, and New Delhi

Text Book II: Discrete Mathematical Structures by Kolman and Busby and Sharon Ross, Prentice Hall of India-2000 3rd Edn.

Text Book III: Applied Abstract Algebra by Rudolf Lidl and Gunter Pilz, Published by Springer verlag.

5X-S 210  
W. e. f. 2003-2004 AB

ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
M.Sc MATHEMATICS  
II SEMESTER  
M 201 ALGEBRA II

UNIT I

Algebraic extension of fields: Irreducible polynomials and Eisenstein's criterion. Adjunction of roots. Algebraic extensions, Algebraically closed fields.

Chapter 15 of the prescribed text book

UNIT II

Normal and separable extensions: splitting fields, Normal extensions, multiple roots, finite fields, separable extensions

Chapter 16 of the prescribed text book

UNIT III

Galois theory: Automorphism groups and fixed fields, fundamental theorem of Galois theory, Fundamental theorem of algebra

Chapter 17 of the prescribed text book

UNIT IV

Applications of Galois theory to classical problems: Roots of unity and cyclotomic polynomials, cyclic extensions, polynomials solvable by radicals, symmetric functions, Ruler and compass constructions

Chapter 18 of the prescribed text book

Prescribed Book;

**Basic Abstract Algebra** : P.B. Bhattacharya, S.K.Jain and S.R.Nagpaul ,  
Second edition, Cambridge University Press, printed and bound in India at  
Replika Press Pvt. Ltd.,2001.

SX.5216

ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
M.A/M.SC MATHEMATICS  
II-SEMESTER

2005-2006 AB

M 202 REAL ANALYSIS-II

UNIT I

Lebesgue measure: Introduction, Outer measure, measurable sets and Lebesgue measure, A non measurable set, measurable functions, Little woods three principles.

Chapter 3 of the text book

UNIT II

The Lebesgue Integral: The Riemann integral, The Lebesgue integral of a bounded function over a set of finite measure, the integral of a nonnegative function, the general Lebesgue integral, convergences in measure.

Chapter 4 of the textbook

UNIT III

Differentiation and integration: Differentiation of monotone functions, Functions of bounded variation and differentiation of an integral, Absolute continuity, and convex functions.

Chapter 5 of the textbook

UNIT IV

The classical Banach spaces: The  $L^p$ -spaces, The Holder's and Minkowski's inequality, convergences and completeness, approximations in  $L^p$  spaces, Linear functionals on  $L^p$  spaces.

Chapter 6 of the textbook

Textbook: Real analysis by H. L. Royden, Macmillan publishing co.inc. 3<sup>rd</sup> edition, New York, 1988.

SX-527

ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
M.A/M.SC MATHEMATICS  
II-SEMESTER

2005 - 2006 AB

M 203 TOPOLOGY -II

UNIT I

The countability axioms-the separation axioms, Normal Spaces, the Urysohn lemma-

Sections 30 to 33 of Chapter 4.

UNIT II

The Urysohn metrization theorem- the Tietze extension theorem. - The Tychonoff's theorem- the stone-cech compactification

Sections 34 to 35 of Chapter 4 and 37 and 38 of Chapter 5.

UNIT III

Local finiteness-The Nagata-Smirnov Metrization theorem - Complete metric spaces

Sections 39, 40<sup>and 43</sup> of chapter 6.

UNIT IV

Compactness in metric spaces-Point wise and compact convergence- Ascoli's theorem - Baire space

Sections 45, 46 and 47 of chapter 7 and Section 48 of Chapter 8.

Content and extent as in the book

Topology by James R. Munkres, Second edition, Pearson education, Asia-low price edition

SX-S 213

ANDHRA UNIVERSITY  
DEPT. OF MATHEMATICS  
M.Sc. Mathematics

W. e f. 2003 - 2004 AB

MI 204. COMPLEX ANALYSIS - 1

UNIT - I

Elementary properties and examples of analytic functions: Power series - Analytic functions - Analytic functions as mappings, mobius transformations,  
(§ 1, §2, §3 of chapter - III of prescribed text book)

UNIT - II

Complex integration: Riemann - stieltjes integrals - Power series representation of analytic functions - zeros of an analytic functions - The index of a closed curve

(§ 1, §2, §3, § 4 of chapter -IV of prescribed text book)

UNIT - III

Cauchy's theorem and integral formula - The homotopic version of cauchy's theorem and simple connectivity - Counting zeros; the open mapping theorem.

(§5, §6 §7 of chapter -IV of prescribed text book)

UNIT - IV

Singularities: Classifications of singularities - Residues - The argument principle.

(§ 1, §2, §3 of chapter - V of prescribed text book)

Prescribed text book:

Functions of one complex variables by J.B. Conway : Second edition , Springer International Student Edition, Narosa Publishing House , NEW DELHI.

SX -S 270

2009-10 AB

M205: C B C S: DISCRETE MATHEMATICS AND CODING THEORY

UNIT I

Graphs, digraphs, network, multi graph, elementary results, structure based on connectivity, characterisation, theorems on trees, tree distances, binary trees

Chapters 1, 2 and 3 of text book I

UNIT II: Eulerian graphs, Hamiltonian graphs, Spanning trees, Fundamental cycles,

Minimal spanning trees,

(Chapter 4 of text book I)

Kruskal algorithm, Prims algorithm (8.5 of text book II)

UNIT III

Introduction to Coding Theory: Introduction, Basic assumptions, correcting and detecting codes, Information rate, The effects of error detection and correction, Finding the most likely code word transmitted, Some basic algebra, Weight and distance, Maximum likelihood decoding, Reliability of M L D, Error detecting codes, Error corer correcting codes

Articles 1.1 to 1.12 of Chapter 1 of TEXT BOOK IV

UNIT IV

Linear codes: Linear codes, Two Important subspaces, Independence, Basis, Dimension, Matrices, Bases for  $C=\langle S \rangle$  and  $C$ , Generating matrices and Encoding, Parity check matrices, Equivalent codes, Distance of a Linear code, Cosets, M L D for Linear codes, Reliability of Linear codes

Articles 2.1 to 2.12 of TEXT BOOK IV

TEXT BOOK I: Graph Theory applications By L.R.Foulds, Narosa publishing House, New Delhi

TEXT BOOK II: Discrete mathematical structures by Kolman and Busby and Sharon Ross Prentice Hall of India-2000, (Third Edition)

TEXT BOOK III: Applied Abstract Algebra by Rudolf Lidl and Gunther Pilz, Published by Springer Verlag

TEXT BOOK IV: Coding Theory by D. G. Hoffman, D. A. Lanonard, C. C. Lindroes

P. Ramesh  
BOARD OF STUDIES  
IN MATHEMATICS

*Textbook* : Differential Equations (with Applications and Historical Notes).  
by G.F. Simmons, Published TMH, 1994.

#### M203 - FUNCTIONAL ANALYSIS SX-5203

UNIT I : Banach Spaces : The definition and some examples, continuous linear transformation, The Hahn Banach theorem, The natural embedding of  $N$  in  $N^{**}$ . The open mapping theorem (Chapter 9, Sections 46-50).

UNIT II : The conjugate of an operator, Hilbert Spaces : The definition and some simple properties, Orthogonal complements, Orthonormal sets. (Chapter 9, Sections 51, Chapter 10, Sections 52-54).

UNIT III : The Conjugate space  $H^*$ , the adjoint of an operator, Self-adjoint operators and Unitary operators, projections (chapter 10, Sections 55-59).

UNIT IV : Finite - dimensional Spectral Theory : Matrices, Determinants and the spectrum of an operator, The spectral theorem, A survey of the situation. (Chapter 11, Sections 60-63).

*Textbook* : Introduction to Topology and Modern Analysis, by G.F. Simmons, McGraw Hill book Company, Inc. - International Student Edition.

*Reference* :

1. Functional Analysis, by B.V. Limaye, Wiley Eastern Limited, Bombay, 1981.
2. First course in Functional Analysis, C. Goffman and George Pedrick, Prentice-Hall of India Private Limited, New Delhi - 110 001, 1919.

#### M204 - MEASURE AND INTEGRATION SX-5204

UNIT I : Outer Measure - Measurable sets - A Non-measurable set - Lebesgue Measure - Measurable functions - Little woods three principles - (Chapter 3 of Textbook).

UNIT II : Measure spaces - Measurable functions - Integration - General convergence theorems - Signed Measure - Radon Nikodym theorem and its applications. (11.1 to 11.6 of Textbook).

UNIT III :  $L_p$  - Spaces - Minkowski - Holder inequalities Convergence and completeness - Approximation in  $L_p$  - Bounded Linear functionals (6.1 to 6.5 of Textbook).

*Textbook* : H.L. Royden, Measure Theory, Macmillan publishing Company, 3rd edition.

*Reference Books* :

- P.R. Halmos, Measure Theory, Graduate texts in Maths, Springer Verlag - 1979.  
W. Rudin : Real and Complex Analysis, Tata - McGraw Hill 1987, 3rd edition.

#### M205 - COMPLEX ANALYSIS SX-5205

UNIT I : The field of Complex Numbers, Complex Plane, polar representation and roots of Complex numbers, Lines and half-lines in the Complex plane,



SXS-321

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ANDHRA UNIVERSITY  
DEPT. OF MATHEMATICS  
A.Sc. Mathematics, III Semester

M 302: COMPLEX ANALYSIS - II

UNIT - I

The maximum modulus theorem: The maximum principle - Schwarz's lemma - Convex functions and Hadamard's three circles theorem - Phragmen - Lindelof theorem.

(§ 1, §2, §3, § 4 of chapter - VI of the prescribed text book)

UNIT - II

Compactness and convergence in the Spaces of Analytic Functions: The space of continuous functions  $C(G, \Omega)$  - Spaces of analytic functions - Spaces of meromorphic functions - The Riemann Mapping Theorem - Weierstrass Factorization theorem - Factorization of sign functions.

(§ 1, §2, §3, § 4, § 5, §6 of chapter -VII of the prescribed text book)

UNIT - III

Runge's Theorem: Runge's Theorem - Simple connectedness - Mittag-Leffler's Theorem, Analytic Continuation and Riemann Surfaces, Schwarz Reflection Principle - Analytic Continuation Along A Path - Mondromy Theorem.

(§1, §2, §3 of chapter -VIII, §1, §2, §3 of chapter -IX of the prescribed text book)

UNIT - IV

Harmonic Functions: Basic Properties of Harmonic functions - Harmonic functions on a disk. Jensen's formula, The genus and the order of an entire function Hadamard's factorization theorem.

(§ 1, §2 of chapter - X and §1, §2, §3 of chapter -XI of the prescribed text book)

Prescribed textbook:

Functions of one complex variables by J.B. Conway: Second edition, Springer International Student Edition, Narosa Publishing House, NEW DELHI

ST 5-328

M 309 --- NUMBER THEORY-I

18/19  
2005-06 AB

UNIT—I: ARITHMETICAL FUNCTIONS AND DIRICHLET MULTIPLICATION

Introduction , The Mobius function  $\mu(n)$ , The Euler totient function  $\varphi(n)$ , A relation connecting  $\varphi$  and  $\mu$  , A product formula for  $\varphi(n)$ , The Dirichlet product of arithmetical functions ,Dirichlet inverses and Mobius Inversions formula, The Mangoldt function  $\Lambda(n)$  , Multiplicative functions, Multiplicative functions and Dirichlet multiplication, The inverse of a completely multiplicative function, Liouville's function  $\lambda(n)$  , The divisor functions  $\sigma$   $\alpha(n)$ , Generalised convolutions.

UNIT—II AVERAGES OF ARITHMETICAL FUNCTIONS

Introduction, The big oh notation Asymptotic equality of functions, Euler's summation formula, some elementary asymptotic formulas, the average order of  $d(n)$ , the average order of divisor functions  $\sigma_{\alpha}(n)$  , the average order of  $\varphi(n)$ , An application to the distribution of lattice points visible from the origin, The average order of  $\mu(n)$  and  $\Lambda(n)$  , The partial sums of a Dirichlet product, Applications to  $\mu(n)$  and  $\Lambda(n)$  , Another identity for the partial sums of a Dirichlet product.

UNIT—III SOME ELEMENTARY THEOREMS ON THE DISTRIBUTION OF PRIME NUMBERS

Introduction ,Chebyshev's functions  $\psi(x)$  and  $\vartheta(x)$ , Relations connecting  $\psi(x)$  and  $\vartheta(x)$ , some equivalent forms of the prime number theorem, Inequalities of  $\pi(n)$  and  $P_n$  , Shapiro's Tauberian theorem , Application of Shapiro's theorem, An asymptotic formulae for the partial sums  $\sum_{p \leq x} (1/p)$  ,

UNIT—IV CONGRUENCES

Definition and basic properties of congruences , Residue classes and complete residue systems ,Linear congruences, Reduced residue systems and Euler- Fermat theorem, Polynomial congruences modulo  $p$ . Lagrange's theorem, Simultaneous linear congruences, the Chinese remainder theorem , Applications of the Chinese remainder theorem, Polynomial congruences with prime power moduli.

CONTENT AND EXTENT AS IN THE TEXT BOOK.

INTRODUCTION TO ANALYTIC NUMBER THEORY - BY TOM M. APOSTOL,  
NAROSA PUBLISHING HOUSE, NEW DELHI

(Sections 2.2 to 2.14 , 3.1 to 3.12 , 4.1 to 4.9 , 5.1 to 5.9.)

SXS-325

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2005-2006 AB

Department of Mathematics  
Andhra University  
M.Sc Mathematics: III Semester

M-306. LATTICE THEORY - I

UNIT - I

Partly ordered sets - Diagrams - Special subsets of a poset - length - lower and upper bounds - the minimum and maximum condition - the Jordan chain conditions - Dimension functions.

( sections 1 to 9 of chapter I the prescribed text book )

UNIT - II

Algebras - lattices - the lattice theoretic duality principle - semi lattices - lattices as posets - diagrams of lattices - semi lattices, ideals - bound elements of Lattices - atoms and dual atoms - complements, relative complements, semi complements - irreducible and prime elements of a lattice - the homomorphism of a lattice - axioms systems of lattices.

( sections 10 to 21 of chapter II of the prescribed text book )

UNIT - III

Complete lattices - complete sublattices of a complete lattice - conditionally complete lattices, -lattices - compact elements, compactly generated lattices - subalgebra lattice of an algebra - closure operations - Galois connections, Dedekind cuts - partly ordered sets as topological spaces.

( sections 22 to 29 of chapter III of the prescribed text book )

UNIT - IV

Distributive lattices - infinitely distributive and completely distributive lattices - modular lattices - characterization of modular and distributive lattices by their sublattices - distributive sublattices of modular lattices - the isomorphism theorem of modular lattices, covering conditions - meet representations in modular and distributive lattices - some special subclasses of the class of modular lattices - preliminary theorems - modular lattices of locally finite length - the valuation of a lattice, metric and quasi metric lattices - complemented modular lattices .

( sections 30 to 40 of chapters IV and V of the prescribed text book )

**Prescribed Text Book:**

Introduction to Lattice Theory, by Gabor Szasz, Academic Press, New York.

**Books for reference:**

General Lattice Theory by G. Gratzer, Academic Press, New York.

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SXS-323

Audhra University  
 Department of Mathematics  
 M.Sc Mathematics  
 III Semester - Special Paper  
 Syllabus  
 M304 COMMUTATIVE ALGEBRA I

2005-06 AB

UNIT I

Rings and ring homomorphism, ideals, quotient rings, zero divisors, Nilpotent elements, units, prime ideals and Maximal ideals, nil radical and Jacobson radical, operations on ideals, Extensions and contractions.

UNIT II

Modules and module homomorphisms, Sub modules and quotient modules, operations on submodules, Direct sum and product; finitely generated modules, exact sequences, Tensor product of modules, Restriction and extension of scalars, Exactness properties of the tensor product, algebras, tensor product of algebras.

UNIT III

Local properties, Extended and contracted ideals in rings of fractions.

UNIT IV

Primary decompositions

Content and extent of chapters 1 to 4 of the prescribed textbook.

Prescribed text book: Introduction to commutative algebra, By M.F. ATIYAH AND I.G. MACDONALD, Addison- Wesley publishing company, London

SX-S 454

**SYLLABUS**

ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
M.A/M.SC MATHEMATICS  
IV SEMESTER

PLEASE SEE THE  
QUESTION PAPER  
\*KINDLY ADHERE TO  
SYLLABUS STRICTLY

2008-09 AB

**M. 401 Measure and Integration**

UNIT I: Lebesgue measure: Introduction, Outer measure, measurable sets and Lebesgue measure, A non measurable set, measurable functions, Little woods three principles. Chapter 3 of the text book

UNIT II: The Lebesgue Integral: The Riemann integral, The Lebesgue integral of a bounded function over a set of finite measure, the integral of a nonnegative function, the general Lebesgue integral, convergences in measure. Chapter 4 of the textbook

UNIT III: Differentiation and integration: Differentiation of monotone functions, Functions of bounded variation and differentiation of an integral, Absolute continuity, and convex functions. Chapter 5 of the textbook

UNIT IV: The classical Banach spaces: The  $L^p$ -spaces, The Holder's and Minkowski's inequality, convergences and completeness, approximations in  $L^p$  spaces, Linear functionals on  $L^p$  spaces. Chapter 6 of the textbook

Textbook: Real analysis by H. L. Royden, Macmillan publishing co. inc. 3<sup>rd</sup> edition, New York, 1988.

SX'S-421

22

2003-2004 AB

ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
M.Sc MATHEMATICS  
IV SEMESTER  
M 402 PARTIAL DIFFERENTIAL EQUATIONS

Syllabus

UNIT I: First order partial differential equations in two independent variables and the Cauchy problem - semilinear equations - Quasilinear equations - The Characteristic Cauchy Problem - General solution - Monge strip and Charpit equations - solution of a Cauchy problem - Solution of a Characteristic Cauchy Problem - Determination of a complete integral - New solutions from a complete integral - solution of a Cauchy problem.

Sections 1.1, 2.1-2.4, 3.1-3.3, 4.1-4.3 in Chapter 1 of the Text Book.

UNIT II: Linear equation in two independent variables - Linear equation in more than two independent variables - The Cauchy Problem - Propagation of discontinuities - Boundary value problems and Cauchy Problem - singularity functions and the fundamental solutions: Green's function - Poisson's theorem - the mean value and the maximum and minimum properties.

Sections 1.1-1.4, 2.1-2.4 in Chapter 2 of the Text Book.

UNIT III: Existence and uniqueness theorems for the initial value problem in an infinite domain - Initial - boundary value problems for a semi infinite domain - Initial boundary value problems for heat conduction in a finite bar - the one dimensional wave equation.

Sections 3.1-3.3, 4.1 in Chapter 2 of the Text Book.

UNIT IV: The three dimensional Wave equation - Method of Spherical Means - the two dimensional wave equation: Hadamard's method of Descent - propagation of confined initial disturbances - Continuable initial conditions - Duhamel's principle, solution of the inhomogeneous wave equation, Retarded potential - Boundary value problem for the one dimensional wave equation.

Sections 4.2-4.8 in Chapter 2 of the Text Book.

Text book: Phoolan Prasad and Renuka Ravindran, Partial Differential Equations, New age International Publishers, New Delhi, 1985.

SX-5 443

STREAM - A

ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
M.A/M.SC MATHEMATICS  
IV-SEMESTER

2005-2006 AB

M 403(1) NUMBER THEORY- II

UNIT-I :- FINITE ABELIAN GROUPS AND THEIR CHARACTERS:-

Characters of finite abelian groups- The character group- The orthogonality relations- for characters- Dirichlet characters- Sums involving Dirichlet characters-The nonvanishing of  $L(1, \chi)$  for real nonprincipal  $\chi$ .

Introduction- Dirichlet's theorem for primes of the form  $4n-1$  and  $4n+1$ - The plan of the proof of Dirichlet's theorem- Proof of Lemma 7.4- Proof of Lemma 7.5- Proof of Lemma 7.6- Proof of Lemma 7.7- Proof of Lemma 7.8- Distribution of primes in arithmetic progressions.

Chapters 6 & 7:- Articles 6.5 to 6.10 and 7.1 to 7.9

UNIT-II:- PERIODIC ARITHMETICAL FUNCTIONS AND GAUSS SUMS:-

Functions periodic modulo  $k$ - Existence of finite Fourier series for periodic arithmetical functions- Ramanujan's sum and generalizations- Multiplicative properties of the sums  $s_k(n)$ - Gauss sums associated with Dirichlet characters-Dirichlet characters with nonvanishing Gauss sums- Induced moduli and primitive characters- Further properties of induced moduli- The conductor of a character- Primitive characters and separable Gauss sums- The finite Fourier series of the Dirichlet characters- Polya's inequality for the partial sums of primitive characters.

Chapter 8:- Articles 8.1 to 8.12.

UNIT-III:- QUADRATIC RESIDUES AND THE QUADRATIC RECIPROCITY LAW:-

Quadratic residues- Legendre's symbol and its properties- Evaluation of  $(-1/p)$  and  $(2/p)$ - Gauss Lemma-The quadratic reciprocity law-Applications of the reciprocity law- The Jacobi symbol- Applications to Diophantine equations- Gauss sums and the quadratic reciprocity law.

Chapter 9:- Articles 9.1 to 9.9

UNIT-IV:- PRIMITIVE ROOTS:-

The exponent of a number mod  $m$ . Primitive roots- Primitive roots and reduced residue systems- The nonexistence of primitive roots mod  $2^\alpha$  for  $\alpha \geq 3$ - The existence of primitive roots and  $p$  for odd primes  $p$ . Primitive roots and quadratic residues- The existence of primitive roots mod  $p^\alpha$ - The existence of primitive roots mod  $2p^\alpha$ - The non existence of primitive roots in the remaining cases- The number of primitive roots mod  $m$ . The index calculus- Primitive roots and Dirichlet characters-Real-valued Dirichlet characters mod  $p^\alpha$ -Primitive Dirichlet characters mod  $p^\alpha$ .

Chapter- 10:- Articles 10.1 to 10.13.

2003 - 2004 AB

M 406 - Lattice Theory

(Prerequisite M 306 - Lattice-Theory-II)

UNIT I : Boolean algebras, De Morgan formulae - Complete Boolean algebras - Boolean algebras and Boolean rings - The algebra of relations - The lattice of propositions - Valuations of Boolean algebras.

(Sections 42 to 47 of Chapters VI of the prescribed textbook)

UNIT II : Birkhoff lattices - Semimodular lattices - Equivalence lattices - Linear dependence - Complemented semimodular lattices.

(Sections 48 to 52 of Chapters VII of the prescribed textbook)

UNIT III : Ideals and dual ideals, Ideal chains - Ideal lattices - Distributive lattices and rings of sets.

(Sections 53 to 55 of Chapters VIII of the prescribed textbook)

UNIT IV : Congruence relations of an algebra - Permutable equivalence relations - The Schreier refinement theorem in arbitrary algebras - Congruence relations of lattices - Minimal congruence relations of some subsets of a distributive lattice - The connection between ideals and congruence relations of lattice.

(Sections 56 to 61 of Chapters IX of the prescribed textbook)

*Prescribed Textbook :*

Introduction to Lattice Theory, by Gabor Szasz, Academic Press, New York.

*Books for Reference :*

General Lattice Theory by G. Grätzer, Academic Press, New York.



Sx-S. 623

24

Andhra University  
Department of Mathematics

M.Sc Mathematics

IV Semester - Special Paper

Syllabus

M 404 COMMUTATIVE ALGEBRA II

(prerequisite: M 304 Commutative Algebra - I)

2003-2004 AB

UNIT I

Integral dependence, the going-up theorem - Integrally closed integral domains, the going - down theorem, valuation rings.

UNIT II

Chain conditions

UNIT III

Noetherian rings - Primary decomposition of Noetherian rings, Artin rings

UNIT IV

Discrete valuation rings, Dedekind domains, Fractional ideals

Content and extent of chapters 5 to 9 of the prescribed textbook.

Prescribed text book: Introduction to commutative algebra by  
M.F. Atiyah and I.G. Macdonald, Addison-Wesley publishing company,  
London

SX - S110 SYLLABUS  
Ne 2003 - 2004 AB

ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
/M.Sc MATHEMATICS  
I SEMISTER  
M 101 ALGEBRA - I

UNIT I

Normal subgroups- Quotient groups-Isomorphism theorems-  
Automorphisms- Conjugacy and G-Sets - Cyclic Decomposition -  
Alternating group  $A_n$ - Simplicity of  $A_n$ .

Chapters 5 and 7 of the Prescribed text book.

UNIT II

Direct Products- finitely generated abelian groups - Invariants of a finite  
abelian group-Sylow theorems - Groups of orders  $p^2$ ,  $pq$ .

Chapter 8 of the Prescribed text book.

UNIT III

Ideals, Homomorphisms, Sum and direct sum of ideals, Maximal and  
Prime Ideals

Chapter 10.1, 10.2, 10.3, 10.4 of the Prescribed text book.

UNIT IV

Nilpotent and Nil Ideals, Zorn's Lemma, unique factorization domains,  
Principal ideal domains, Polynomial rings over UFD

Chapter 10.5, 10.6 and Chapter 11 of the Prescribed text book.

Prescribed Book:

Basic Abstract Algebra: P.B. Bhattacharya, S.K.Jain and S.R.Nagpaul,  
Second edition, reprinted in India 1997,2000,2001

W.e.f 2003-2004 AB

M 102 - Real Analysis

SX-5111 ✓

UNIT I : Definition and existence of the Riemann Stieltjes integral, Properties of the integral, integration and differentiation - the fundamental theorem of calculus-integration of vector values functions -Rectifiable curves.

Chapter 6 of the textbook.

UNIT II : Sequences and series of the functions - Pointwise and uniform convergences - Uniform convergences and continuity - Uniform convergence and integration - Uniform convergence and differentiation.

Sections 7.1 to 7.18 of the textbook.

UNIT III : The Stone Wierstrass Theorem 7.26 to 7.33 of the textbook Power series - Abel's theorem - inversion in the order of summation - Taylor's theorem - uniqueness of power series.

Sections 8.1 to 8.5 of the textbook.

UNIT IV : Functions of several variables - linear transformation - Derivatives in an open subset of  $\mathbb{R}^n$  - Chain rule - Partial derivatives - The contraction principles - The inverse function theorem - the implicit functions theorem.

Textbook :

Walter Rudin : Principles of Mathematical Analysis (3rd edition) McGraw-Hill, Kogakusha, 1976, International Student Edition.

N.e.f. 2003-2004 AB 3-~~6~~  
SX-S112 SYLLABUS

ANDHRA UNUIVERSITY  
DEPARTMENT OF MATHEMATICS  
M.Sc MATHEMATICS  
I SEMISTER

M 103 TOPOLOGY - I

UNIT I

Finite sets- Countable and uncountable sets-infinite sets and the axiom of choice -well ordered sets- the maximum principle  
Sections 6,7,9,10 and 11 of Chapter 1

UNIT II

Topological spaces- Basis for a Topology- The order topology-The product topology on  $X \times Y$ -the subspace topology- closed sets and limit points  
Sections 12 to 17 of Chapter 2

UNIT III

Continuous functions - the product topology-Metric spaces- the metric topology  
Sections 18 to 21 of Chapter 2

UNIT IV

Connected spaces-connected subspaces of the real line-Compact spaces-compact subspaces of the real line-limit point compactness - Local compactness  
Sections 23,24,26 to 29 of Chapter 3

Extent and content as in the book: Topology by James R.Munkers,Second edition,Pearson education Asia-Low price edition

SX-S 118

W. e f 2005 - 2006 AB

B-A

ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
M. A / M. SC MATHEMATICS  
I SEMESTER  
M 104 DIFFERENTIAL EQUATIONS - I

Syllabus

UNIT I: Linear Differential equations of Higher Order: Preliminaries - Higher order linear differential equations - a modelling problem - Linear independence - equations with constant coefficients - equations with variable coefficients - Wronskian - variation of parameters - some standard methods - method of Laplace transforms.

Chapter 2 of prescribed text book.

UNIT II: Solutions of Differential equations in Power Series: Preliminaries - Second order linear equations with Ordinary points - Legendre equations with Legendre Polynomials - Second order equations with regular singular points - Properties of Bessel functions.

Chapter 3 of prescribed text book.

UNIT III: Systems of Linear Differential Equations: Preliminaries - Systems of First order equations - Model for arms competitions between two nations - Existence and uniqueness theorem - Fundamental matrix - Non homogeneous linear systems - Linear systems with constant coefficients - Linear systems with periodic coefficients.

Chapter 4 of prescribed text book.

UNIT IV: Existence and Uniqueness of solutions: Preliminaries - Successive approximations - Picard's theorem - Some examples - Continuation and dependence on initial conditions - Existence of solutions in the Large - Existence and Uniqueness of solutions of systems - Fixed point method.

Chapter 5 of prescribed text book.

Text book: S.G. Deo, V. Lakshmikantham and V Raghavendra: Text book of Ordinary Differential Equations, Second edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1997.

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\*RIGIDLY ALPHABETICALLY

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SX - S 114  
ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
M.Sc MATHEMATICS  
I SEMESTER

M 105 DISCRETE MATHEMATICS  
W. e. f. 2003 - 2004 AB

UNIT I

Graphs, digraphs, network, multigraph, Elementary results, structure based on connectivity, characterization, theorems on trees, tree distances, binary trees

Chapters 1, 2, and 3 of textbook I

UNIT II

Eulerian graphs, Hamiltonian graphs, Spanning trees, Fundamental cycles, unrestricted graphs, minimal spanning trees, kruskal algorithm, prim's algorithm

Chapter 4 of text book I and 8.5 of text book II

UNIT III

Definition of lattices, Modular lattices and distributive lattices

Chapter 1 of text book of III

UNIT IV

Basic properties: Boolean polynomials, ideals, minimal forms of Boolean polynomials, Application of Lattices, Switching circuits

Chapter 2 of Text Book III

Text Book I: Graph Theory applications By L.R. Foulds, Narosa publishing House, and New Delhi

Text Book II: Discrete Mathematical Structures by Kolman and Busby and Sharon Ross, Prentice Hall of India-2000 3rd Edn.

Text Book III: Applied Abstract Algebra by Rudolf Lidl and Gunter Pilz, Published by Springer verlag.

5X-S 210  
W. e. f. 2003-2004 AB

ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
M.Sc MATHEMATICS  
II SEMESTER  
M 201 ALGEBRA II

UNIT I

Algebraic extension of fields: Irreducible polynomials and Eisenstein's criterion. Adjunction of roots. Algebraic extensions, Algebraically closed fields.

Chapter 15 of the prescribed text book

UNIT II

Normal and separable extensions: splitting fields, Normal extensions, multiple roots, finite fields, separable extensions

Chapter 16 of the prescribed text book

UNIT III

Galois theory: Automorphism groups and fixed fields, fundamental theorem of Galois theory, Fundamental theorem of algebra

Chapter 17 of the prescribed text book

UNIT IV

Applications of Galois theory to classical problems: Roots of unity and cyclotomic polynomials, cyclic extensions, polynomials solvable by radicals, symmetric functions, Ruler and compass constructions

Chapter 18 of the prescribed text book

Prescribed Book;

**Basic Abstract Algebra** : P.B. Bhattacharya, S.K.Jain and S.R.Nagpaul ,  
Second edition, Cambridge University Press, printed and bound in India at  
Replika Press Pvt. Ltd.,2001.

SX.5216

ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
M.A/M.SC MATHEMATICS  
II-SEMESTER

2005-2006 AB

M 202 REAL ANALYSIS-II

UNIT I

Lebesgue measure: Introduction, Outer measure, measurable sets and Lebesgue measure, A non measurable set, measurable functions, Little woods three principles.

Chapter 3 of the text book

UNIT II

The Lebesgue Integral: The Riemann integral, The Lebesgue integral of a bounded function over a set of finite measure, the integral of a nonnegative function, the general Lebesgue integral, convergences in measure.

Chapter 4 of the textbook

UNIT III

Differentiation and integration: Differentiation of monotone functions, Functions of bounded variation and differentiation of an integral, Absolute continuity, and convex functions.

Chapter 5 of the textbook

UNIT IV

The classical Banach spaces: The  $L^p$ -spaces, The Holder's and Minkowski's inequality, convergences and completeness, approximations in  $L^p$  spaces, Linear functionals on  $L^p$  spaces.

Chapter 6 of the textbook

Textbook: Real analysis by H. L. Royden, Macmillan publishing co.inc. 3<sup>rd</sup> edition, New York, 1988.



SX-527

ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
M.A/M.SC MATHEMATICS  
II-SEMESTER

2005 - 2006 AB

M 203 TOPOLOGY -II

UNIT I

The countability axioms-the separation axioms, Normal Spaces, the Urysohn lemma-

Sections 30 to 33 of Chapter 4.

UNIT II

The Urysohn metrization theorem- the Tietze extension theorem. - The Tychonoff's theorem- the stone-cech compactification

Sections 34 to 35 of Chapter 4 and 37 and 38 of Chapter 5.

UNIT III

Local finiteness-The Nagata-Smirnov Metrization theorem - Complete metric spaces

Sections 39, 40<sup>and 43</sup> of chapter 6.

UNIT IV

Compactness in metric spaces-Point wise and compact convergence- Ascoli's theorem - Baire space

Sections 45, 46 and 47 of chapter 7 and Section 48 of Chapter 8.

Content and extent as in the book

Topology by James R. Munkres, Second edition, Pearson education, Asia-low price edition

SX-S 213

ANDHRA UNIVERSITY  
DEPT. OF MATHEMATICS  
M.Sc. Mathematics

W. e f. 2003 - 2004 AB

MI 204. COMPLEX ANALYSIS - 1

UNIT - I

Elementary properties and examples of analytic functions: Power series - Analytic functions - Analytic functions as mappings, mobius transformations,  
(§ 1, § 2, § 3 of chapter - III of prescribed text book)

UNIT - II

Complex integration: Riemann - stieltjes integrals - Power series representation of analytic functions - zeros of an analytic functions - The index of a closed curve

(§ 1, § 2, § 3, § 4 of chapter - IV of prescribed text book)

UNIT - III

Cauchy's theorem and integral formula - The homotopic version of Cauchy's theorem and simple connectivity - Counting zeros; the open mapping theorem.

(§ 5, § 6 § 7 of chapter - IV of prescribed text book)

UNIT - IV

Singularities: Classifications of singularities - Residues - The argument principle.

(§ 1, § 2, § 3 of chapter - V of prescribed text book)

Prescribed text book:

Functions of one complex variables by J.B. Conway : Second edition , Springer International Student Edition, Narosa Publishing House , NEW DELHI.

SX -S 270

2009-10 AB

M205: C B C S: DISCRETE MATHEMATICS AND CODING THEORY

UNIT I

Graphs, digraphs, network, multi graph, elementary results, structure based on connectivity, characterisation, theorems on trees, tree distances, binary trees

Chapters 1, 2 and 3 of text book I

UNIT II: Eulerian graphs, Hamiltonian graphs, Spanning trees, Fundamental cycles,

Minimal spanning trees,

(Chapter 4 of text book I)

Kruskal algorithm, Prims algorithm (8.5 of text book II)

UNIT III

Introduction to Coding Theory: Introduction, Basic assumptions, correcting and detecting codes, Information rate, The effects of error detection and correction, Finding the most likely code word transmitted, Some basic algebra, Weight and distance, Maximum likelihood decoding, Reliability of M L D, Error detecting codes, Error corer correcting codes

Articles 1.1 to 1.12 of Chapter 1 of TEXT BOOK IV

UNIT IV

Linear codes: Linear codes, Two Important subspaces, Independence, Basis, Dimension, Matrices, Bases for  $C=\langle S \rangle$  and  $C$ , Generating matrices and Encoding, Parity check matrices, Equivalent codes, Distance of a Linear code, Cosets, M L D for Linear codes, Reliability of Linear codes

Articles 2.1 to 2.12 of TEXT BOOK IV

TEXT BOOK I: Graph Theory applications By L.R.Foulds, Narosa publishing House, New Delhi

TEXT BOOK II: Discrete mathematical structures by Kolman and Busby and Sharon Ross Prentice Hall of India-2000, (Third Edition)

TEXT BOOK III: Applied Abstract Algebra by Rudolf Lidl and Gunther Pilz, Published by Springer Verlag

TEXT BOOK IV: Coding Theory by D. G. Hoffman, D. A. Lanonard, C. C. Lindroes

P. Ramesh  
BOARD OF STUDIES  
IN MATHEMATICS

*Textbook* : Differential Equations (with Applications and Historical Notes).  
by G.F. Simmons, Published TMH, 1994.

#### M203 - FUNCTIONAL ANALYSIS SX-5203

UNIT I : Banach Spaces : The definition and some examples, continuous linear transformation, The Hahn Banach theorem, The natural embedding of  $N$  in  $N^{**}$ . The open mapping theorem (Chapter 9, Sections 46-50).

UNIT II : The conjugate of an operator, Hilbert Spaces : The definition and some simple properties, Orthogonal complements, Orthonormal sets. (Chapter 9, Sections 51, Chapter 10, Sections 52-54).

UNIT III : The Conjugate space  $H^*$ , the adjoint of an operator, Self-adjoint operators and Unitary operators, projections (chapter 10, Sections 55-59).

UNIT IV : Finite - dimensional Spectral Theory : Matrices, Determinants and the spectrum of an operator, The spectral theorem, A survey of the situation. (Chapter 11, Sections 60-63).

*Textbook* : Introduction to Topology and Modern Analysis, by G.F. Simmons, McGraw Hill book Company, Inc. - International Student Edition.

*Reference* :

1. Functional Analysis, by B.V. Limaye, Wiley Eastern Limited, Bombay, 1981.
2. First course in Functional Analysis, C. Goffman and George Pedrick, Prentice-Hall of India Private Limited, New Delhi - 110 001, 1919.

#### M204 - MEASURE AND INTEGRATION SX-5204

UNIT I : Outer Measure - Measurable sets - A Non-measurable set - Lebesgue Measure - Measurable functions - Little woods three principles - (Chapter 3 of Textbook).

UNIT II : Measure spaces - Measurable functions - Integration - General convergence theorems - Signed Measure - Radon Nikodym theorem and its applications. (11.1 to 11.6 of Textbook).

UNIT III :  $L_p$  - Spaces - Minkowski - Holder inequalities Convergence and completeness - Approximation in  $L_p$  - Bounded Linear functionals (6.1 to 6.5 of Textbook).

*Textbook* : H.L. Royden, Measure Theory, Macmillan publishing Company, 3rd edition.

*Reference Books* :

- P.R. Halmos, Measure Theory, Graduate texts in Maths, Springer Verlag - 1979.  
W. Rudin : Real and Complex Analysis, Tata - McGraw Hill 1987, 3rd edition.

#### M205 - COMPLEX ANALYSIS SX-5205

UNIT I : The field of Complex Numbers, Complex Plane, polar representation and roots of Complex numbers, Lines and half-lines in the Complex plane,

SXS-321

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ANDHRA UNIVERSITY  
DEPT. OF MATHEMATICS  
A.Sc. Mathematics, III Semester

M 302: COMPLEX ANALYSIS - II

UNIT - I

The maximum modulus theorem: The maximum principle - Schwarz's lemma - Convex functions and Hadamard's three circles theorem - Phragmen - Lindelof theorem.

(§ 1, §2, §3, § 4 of chapter - VI of the prescribed text book)

UNIT - II

Compactness and convergence in the Spaces of Analytic Functions: The space of continuous functions  $C(G, \Omega)$  - Spaces of analytic functions - Spaces of meromorphic functions - The Riemann Mapping Theorem - Weierstrass Factorization theorem - Factorization of sign functions.

(§ 1, §2, §3, § 4, § 5, §6 of chapter -VII of the prescribed text book)

UNIT - III

Runge's Theorem: Runge's Theorem - Simple connectedness - Mittag-Leffler's Theorem, Analytic Continuation and Riemann Surfaces, Schwarz Reflection Principle - Analytic Continuation Along A Path - Mondromy Theorem.

(§1, §2, §3 of chapter -VIII, §1, §2, §3 of chapter -IX of the prescribed text book)

UNIT - IV

Harmonic Functions: Basic Properties of Harmonic functions - Harmonic functions on a disk. Jensen's formula, The genus and the order of an entire function Hadamard's factorization theorem.

(§ 1, §2 of chapter - X and §1, §2, §3 of chapter -XI of the prescribed text book)

Prescribed textbook:

Functions of one complex variables by J.B. Conway: Second edition, Springer International Student Edition, Narosa Publishing House, NEW DELHI

ST 5-328

M 309 --- NUMBER THEORY-I

18/19  
2005-06 AB

UNIT—I: ARITHMETICAL FUNCTIONS AND DIRICHLET MULTIPLICATION

Introduction , The Mobius function  $\mu(n)$ , The Euler totient function  $\phi(n)$ , A relation connecting  $\phi$  and  $\mu$  , A product formula for  $\phi(n)$ , The Dirichlet product of arithmetical functions ,Dirichlet inverses and Mobius Inversions formula, The Mangoldt function  $\Lambda(n)$  , Multiplicative functions, Multiplicative functions and Dirichlet multiplication, The inverse of a completely multiplicative function, Liouville's function  $\lambda(n)$  , The divisor functions  $\sigma$   $\alpha(n)$ , Generalised convolutions.

UNIT—II AVERAGES OF ARITHMETICAL FUNCTIONS

Introduction, The big oh notation Asymptotic equality of functions, Euler's summation formula, some elementary asymptotic formulas, the average order of  $d(n)$ , the average order of divisor functions  $\sigma_{\alpha}(n)$  , the average order of  $\phi(n)$ , An application to the distribution of lattice points visible from the origin, The average order of  $\mu(n)$  and  $\Lambda(n)$  , The partial sums of a Dirichlet product, Applications to  $\mu(n)$  and  $\Lambda(n)$  , Another identity for the partial sums of a Dirichlet product.

UNIT—III SOME ELEMENTARY THEOREMS ON THE DISTRIBUTION OF PRIME NUMBERS

Introduction ,Chebyshev's functions  $\psi(x)$  and  $\theta(x)$ , Relations connecting  $\psi(x)$  and  $\theta(x)$ , some equivalent forms of the prime number theorem, Inequalities of  $\pi(n)$  and  $P_n$  , Shapiro's Tauberian theorem , Application of Shapiro's theorem, An asymptotic formulae for the partial sums  $\sum_{p \leq x} (1/p)$  ,

UNIT—IV CONGRUENCES

Definition and basic properties of congruences , Residue classes and complete residue systems ,Linear congruences, Reduced residue systems and Euler- Fermat theorem, Polynomial congruences modulo  $p$ . Lagrange's theorem, Simultaneous linear congruences, the Chinese remainder theorem , Applications of the Chinese remainder theorem, Polynomial congruences with prime power moduli.

CONTENT AND EXTENT AS IN THE TEXT BOOK.

INTRODUCTION TO ANALYTIC NUMBER THEORY - BY TOM M. APOSTOL,  
NAROSA PUBLISHING HOUSE, NEW DELHI

(Sections 2.2 to 2.14 , 3.1 to 3.12 , 4.1 to 4.9 , 5.1 to 5.9.)

SXS-325

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2005-2006 AB

Department of Mathematics  
Andhra University  
M.Sc Mathematics: III Semester

M-306. LATTICE THEORY - I

UNIT - I

Partly ordered sets - Diagrams - Special subsets of a poset - length - lower and upper bounds - the minimum and maximum condition - the Jordan chain conditions - Dimension functions.

( sections 1 to 9 of chapter I the prescribed text book )

UNIT - II

Algebras - lattices - the lattice theoretic duality principle - semi lattices - lattices as posets - diagrams of lattices - semi lattices, ideals - bound elements of Lattices - atoms and dual atoms - complements, relative complements, semi complements - irreducible and prime elements of a lattice - the homomorphism of a lattice - axioms systems of lattices.

( sections 10 to 21 of chapter II of the prescribed text book )

UNIT - III

Complete lattices - complete sublattices of a complete lattice - conditionally complete lattices,  $\sigma$ -lattices - compact elements, compactly generated lattices - subalgebra lattice of an algebra - closure operations - Galois connections, Dedekind cuts - partly ordered sets as topological spaces.

( sections 22 to 29 of chapter III of the prescribed text book )

UNIT - IV

Distributive lattices - infinitely distributive and completely distributive lattices - modular lattices - characterization of modular and distributive lattices by their sublattices - distributive sublattices of modular lattices - the isomorphism theorem of modular lattices, covering conditions - meet representations in modular and distributive lattices - some special subclasses of the class of modular lattices - preliminary theorems - modular lattices of locally finite length - the valuation of a lattice, metric and quasi metric lattices - complemented modular lattices .

( sections 30 to 40 of chapters IV and V of the prescribed text book )

**Prescribed Text Book:**

Introduction to Lattice Theory, by Gabor Szasz, Academic Press, New York.

**Books for reference:**

General Lattice Theory by G. Gratzer, Academic Press, New York.

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SXS-323

Audhra University  
 Department of Mathematics  
 M.Sc Mathematics  
 III Semester - Special Paper  
 Syllabus  
 M304 COMMUTATIVE ALGEBRA I

2005-06 AB

UNIT I

Rings and ring homomorphism, ideals, quotient rings, zero divisors, Nilpotent elements, units, prime ideals and Maximal ideals, nil radical and Jacobson radical, operations on ideals, Extensions and contractions.

UNIT II

Modules and module homomorphisms, Sub modules and quotient modules, operations on submodules, Direct sum and product; finitely generated modules, exact sequences, Tensor product of modules, Restriction and extension of scalars, Exactness properties of the tensor product, algebras, tensor product of algebras.

UNIT III

Local properties, Extended and contracted ideals in rings of fractions.

UNIT IV

Primary decompositions

Content and extent of chapters 1 to 4 of the prescribed textbook.

**Prescribed text book:** Introduction to commutative algebra, By M.F. ATIYAH AND I.G. MACDONALD, Addison- Wesley publishing company, London



SX-S 454

**SYLLABUS**

ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
M.A/M.SC MATHEMATICS  
IV SEMESTER

PLEASE SEE THE  
QUESTION PAPER  
\* KINDLY ADHERE TO  
SYLLABUS STRICTLY

2008-09 AB

**M. 401 Measure and Integration**

UNIT I: Lebesgue measure: Introduction, Outer measure, measurable sets and Lebesgue measure, A non measurable set, measurable functions, Little woods three principles. Chapter 3 of the text book

UNIT II: The Lebesgue Integral: The Riemann integral, The Lebesgue integral of a bounded function over a set of finite measure, the integral of a nonnegative function, the general Lebesgue integral, convergences in measure. Chapter 4 of the textbook

UNIT III: Differentiation and integration: Differentiation of monotone functions, Functions of bounded variation and differentiation of an integral, Absolute continuity, and convex functions. Chapter 5 of the textbook

UNIT IV: The classical Banach spaces: The  $L^p$ -spaces, The Holder's and Minkowski's inequality, convergences and completeness, approximations in  $L^p$  spaces, Linear functionals on  $L^p$  spaces. Chapter 6 of the textbook

Textbook: Real analysis by H. L. Royden, Macmillan publishing co. inc. 3<sup>rd</sup> edition, New York, 1988.

SX'S-421

22

2003-2004 AB

ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
M.Sc MATHEMATICS  
IV SEMESTER  
M 402 PARTIAL DIFFERENTIAL EQUATIONS

Syllabus

UNIT I: First order partial differential equations in two independent variables and the Cauchy problem - semilinear equations - Quasilinear equations - The Characteristic Cauchy Problem - General solution - Monge strip and Charpit equations - solution of a Cauchy problem - Solution of a Characteristic Cauchy Problem - Determination of a complete integral - New solutions from a complete integral - solution of a Cauchy problem.

Sections 1.1, 2.1-2.4, 3.1-3.3, 4.1-4.3 in Chapter 1 of the Text Book.

UNIT II: Linear equation in two independent variables - Linear equation in more than two independent variables - The Cauchy Problem - Propagation of discontinuities - Boundary value problems and Cauchy Problem - singularity functions and the fundamental solutions: Green's function - Poisson's theorem - the mean value and the maximum and minimum properties.

Sections 1.1-1.4, 2.1-2.4 in Chapter 2 of the Text Book.

UNIT III: Existence and uniqueness theorems for the initial value problem in an infinite domain - Initial - boundary value problems for a semi infinite domain - Initial boundary value problems for heat conduction in a finite bar - the one dimensional wave equation.

Sections 3.1-3.3, 4.1 in Chapter 2 of the Text Book.

UNIT IV: The three dimensional Wave equation - Method of Spherical Means - the two dimensional wave equation: Hadamard's method of Descent - propagation of confined initial disturbances - Continuable initial conditions - Duhamel's principle, solution of the inhomogeneous wave equation, Retarded potential - Boundary value problem for the one dimensional wave equation.

Sections 4.2-4.8 in Chapter 2 of the Text Book.

Text book: Phoolan Prasad and Renuka Ravindran, Partial Differential Equations, New age International Publishers, New Delhi, 1985.

SX-5443

STREAM - A

ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
M.A/M.SC MATHEMATICS  
IV-SEMESTER

2005-2006 AB

M 403(1) NUMBER THEORY- II

UNIT-I :- FINITE ABELIAN GROUPS AND THEIR CHARACTERS:-

Characters of finite abelian groups- The character group- The orthogonality relations- for characters- Dirichlet characters- Sums involving Dirichlet characters-The nonvanishing of  $L(1, \chi)$  for real nonprincipal  $\chi$ .

Introduction- Dirichlet's theorem for primes of the form  $4n-1$  and  $4n+1$ - The plan of the proof of Dirichlet's theorem- Proof of Lemma 7.4- Proof of Lemma 7.5- Proof of Lemma 7.6- Proof of Lemma 7.7- Proof of Lemma 7.8- Distribution of primes in arithmetic progressions.

Chapters 6 & 7:- Articles 6.5 to 6.10 and 7.1 to 7.9

UNIT-II:- PERIODIC ARITHMETICAL FUNCTIONS AND GAUSS SUMS:-

Functions periodic modulo  $k$ - Existence of finite Fourier series for periodic arithmetical functions- Ramanujan's sum and generalizations- Multiplicative properties of the sums  $s_k(n)$ - Gauss sums associated with Dirichlet characters-Dirichlet characters with nonvanishing Gauss sums- Induced moduli and primitive characters- Further properties of induced moduli- The conductor of a character- Primitive characters and separable Gauss sums- The finite Fourier series of the Dirichlet characters- Polya's inequality for the partial sums of primitive characters.

Chapter 8:- Articles 8.1 to 8.12.

UNIT-III:- QUADRATIC RESIDUES AND THE QUADRATIC RECIPROCITY LAW:-

Quadratic residues- Legendre's symbol and its properties- Evaluation of  $(-1/p)$  and  $(2/p)$ - Gauss Lemma-The quadratic reciprocity law-Applications of the reciprocity law- The Jacobi symbol- Applications to Diophantine equations- Gauss sums and the quadratic reciprocity law.

Chapter 9:- Articles 9.1 to 9.9

UNIT-IV:- PRIMITIVE ROOTS:-

The exponent of a number mod  $m$ . Primitive roots- Primitive roots and reduced residue systems- The nonexistence of primitive roots mod  $2^\alpha$  for  $\alpha \geq 3$ - The existence of primitive roots and  $p$  for odd primes  $p$ . Primitive roots and quadratic residues- The existence of primitive roots mod  $p^\alpha$ - The existence of primitive roots mod  $2p^\alpha$ - The non existence of primitive roots in the remaining cases- The number of primitive roots mod  $m$ . The index calculus- Primitive roots and Dirichlet characters-Real-valued Dirichlet characters mod  $p^\alpha$ -Primitive Dirichlet characters mod  $p^\alpha$ .

Chapter- 10:- Articles 10.1 to 10.13.

2003 - 2004 AB

M 406 - Lattice Theory

(Prerequisite M 306 - Lattice Theory-II)

UNIT I : Boolean algebras, De Morgan formulae - Complete Boolean algebras - Boolean algebras and Boolean rings - The algebra of relations - The lattice of propositions - Valuations of Boolean algebras.

(Sections 42 to 47 of Chapters VI of the prescribed textbook)

UNIT II : Birkhoff lattices - Semimodular lattices - Equivalence lattices - Linear dependence - Complemented semimodular lattices.

(Sections 48 to 52 of Chapters VII of the prescribed textbook)

UNIT III : Ideals and dual ideals, Ideal chains - Ideal lattices - Distributive lattices and rings of sets.

(Sections 53 to 55 of Chapters VIII of the prescribed textbook)

UNIT IV : Congruence relations of an algebra - Permutable equivalence relations - The Schreier refinement theorem in arbitrary algebras - Congruence relations of lattices - Minimal congruence relations of some subsets of a distributive lattice - The connection between ideals and congruence relations of lattice.

(Sections 56 to 61 of Chapters IX of the prescribed textbook)

*Prescribed Textbook :*

Introduction to Lattice Theory, by Gabor Szasz, Academic Press, New York.

*Books for Reference :*

General Lattice Theory by G. Grätzer, Academic Press, New York.

Sx-S. 623

24

Andhra University  
Department of Mathematics  
M.Sc Mathematics

2003-2004 AB

IV Semester - Special Paper  
Syllabus

M 404 COMMUTATIVE ALGEBRA II  
(prerequisite: M 304 Commutative Algebra - I)

UNIT I

Integral dependence, the going-up theorem - Integrally closed integral domains, the going - down theorem, valuation rings.

UNIT II

Chain conditions

UNIT III

Noetherian rings - Primary decomposition of Noetherian rings, Artin rings

UNIT IV

Discrete valuation rings, Dedekind domains, Fractional ideals

Content and extent of chapters 5 to 9 of the prescribed textbook.

Prescribed text book: Introduction to commutative algebra by  
M.F. Atiyah and I.G. Macdonald, Addison- Wesley publishing company,  
London

SX - S110 SYLLABUS  
Ne 2003 - 2004 AB

ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
/M.Sc MATHEMATICS  
I SEMISTER  
M 101 ALGEBRA - I

UNIT I

Normal subgroups- Quotient groups-Isomorphism theorems-  
Automorphisms- Conjugacy and G-Sets - Cyclic Decomposition -  
Alternating group  $A_n$ - Simplicity of  $A_n$ .

Chapters 5 and 7 of the Prescribed text book.

UNIT II

Direct Products- finitely generated abelian groups - Invariants of a finite  
abelian group-Sylow theorems - Groups of orders  $p^2$ ,  $pq$ .

Chapter 8 of the Prescribed text book.

UNIT III

Ideals, Homomorphisms, Sum and direct sum of ideals, Maximal and  
Prime Ideals

Chapter 10.1, 10.2, 10.3, 10.4 of the Prescribed text book.

UNIT IV

Nilpotent and Nil Ideals, Zorn's Lemma, unique factorization domains,  
Principal ideal domains, Polynomial rings over UFD

Chapter 10.5, 10.6 and Chapter 11 of the Prescribed text book.

Prescribed Book:

Basic Abstract Algebra: P.B. Bhattacharya, S.K.Jain and S.R.Nagpaul,  
Second edition, reprinted in India 1997,2000,2001

W.e.f 2003-2004 AB

M 102 - Real Analysis

SX-5111 ✓

UNIT I : Definition and existence of the Riemann Stieltjes integral, Properties of the integral, integration and differentiation - the fundamental theorem of calculus-integration of vector values functions -Rectifiable curves.

Chapter 6 of the textbook.

UNIT II : Sequences and series of the functions - Pointwise and uniform convergences - Uniform convergences and continuity - Uniform convergence and integration - Uniform convergence and differentiation.

Sections 7.1 to 7.18 of the textbook.

UNIT III : The Stone Wierstrass Theorem 7.26 to 7.33 of the textbook Power series - Abel's theorem - inversion in the order of summation - Taylor's theorem - uniqueness of power series.

Sections 8.1 to 8.5 of the textbook.

UNIT IV : Functions of several variables - linear transformation - Derivatives in an open subset of  $\mathbb{R}^n$  - Chain rule - Partial derivatives - The contraction principles - The inverse function theorem - the implicit functions theorem.

Textbook :

Walter Rudin : Principles of Mathematical Analysis (3rd edition) McGraw-Hill, Kogakusha, 1976, International Student Edition.

W.e.f. 2003-2004 AB 3-~~6~~  
SX-S112 SYLLABUS

ANDHRA UNUIVERSITY  
DEPARTMENT OF MATHEMATICS  
M.Sc MATHEMATICS  
I SEMISTER

M 103 TOPOLOGY - I

UNIT I

Finite sets- Countable and uncountable sets-infinite sets and the axiom of choice -well ordered sets- the maximum principle  
Sections 6,7,9,10 and 11 of Chapter 1

UNIT II

Topological spaces- Basis for a Topology- The order topology-The product topology on  $X \times Y$ -the subspace topology- closed sets and limit points  
Sections 12 to 17 of Chapter 2

UNIT III

Continuous functions - the product topology-Metric spaces- the metric topology  
Sections 18 to 21 of Chapter 2

UNIT IV

Connected spaces-connected subspaces of the real line-Compact spaces-compact subspaces of the real line-limit point compactness - Local compactness  
Sections 23,24,26 to 29 of Chapter 3

Extent and content as in the book: Topology by James R.Munkers,Second edition,Pearson education Asia-Low price edition



SX-S 118

W. e f 2005 - 2006 AB

B-A

ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
M. A / M. SC MATHEMATICS  
I SEMESTER  
M 104 DIFFERENTIAL EQUATIONS - I

Syllabus

UNIT I: Linear Differential equations of Higher Order: Preliminaries - Higher order linear differential equations - a modelling problem - Linear independence - equations with constant coefficients - equations with variable coefficients - Wronskian - variation of parameters - some standard methods - method of Laplace transforms.

Chapter 2 of prescribed text book.

UNIT II: Solutions of Differential equations in Power Series: Preliminaries - Second order linear equations with Ordinary points - Legendre equations with Legendre Polynomials - Second order equations with regular singular points - Properties of Bessel functions.

Chapter 3 of prescribed text book.

UNIT III: Systems of Linear Differential Equations: Preliminaries - Systems of First order equations - Model for arms competitions between two nations - Existence and uniqueness theorem - Fundamental matrix - Non homogeneous linear systems - Linear systems with constant coefficients - Linear systems with periodic coefficients.

Chapter 4 of prescribed text book.

UNIT IV: Existence and Uniqueness of solutions: Preliminaries - Successive approximations - Picard's theorem - Some examples - Continuation and dependence on initial conditions - Existence of solutions in the Large - Existence and Uniqueness of solutions of systems - Fixed point method.

Chapter 5 of prescribed text book.

Text book: S.G. Deo, V. Lakshmikantham and V Raghavendra: Text book of Ordinary Differential Equations, Second edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1997.

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SX - S 114  
ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
M.Sc MATHEMATICS  
I SEMESTER

M 105 DISCRETE MATHEMATICS  
W. e. f. 2003 - 2004 AB

UNIT I

Graphs, digraphs, network, multigraph, Elementary results, structure based on connectivity, characterization, theorems on trees, tree distances, binary trees

Chapters 1, 2, and 3 of textbook I

UNIT II

Eulerian graphs, Hamiltonian graphs, Spanning trees, Fundamental cycles, unrestricted graphs, minimal spanning trees, kruskal algorithm, prim's algorithm

Chapter 4 of text book I and 8.5 of text book II

UNIT III

Definition of lattices, Modular lattices and distributive lattices

Chapter 1 of text book of III

UNIT IV

Basic properties: Boolean polynomials, ideals, minimal forms of Boolean polynomials, Application of Lattices, Switching circuits

Chapter 2 of Text Book III

Text Book I: Graph Theory applications By L.R. Foulds, Narosa publishing House, and New Delhi

Text Book II: Discrete Mathematical Structures by Kolman and Busby and Sharon Ross, Prentice Hall of India-2000 3rd Edn.

Text Book III: Applied Abstract Algebra by Rudolf Lidl and Gunter Pilz, Published by Springer verlag.

5X-S 210  
W. e. f. 2003-2004 AB

ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
M.Sc MATHEMATICS  
II SEMESTER  
M 201 ALGEBRA II

UNIT I

Algebraic extension of fields: Irreducible polynomials and Eisenstein's criterion. Adjunction of roots. Algebraic extensions, Algebraically closed fields.

Chapter 15 of the prescribed text book

UNIT II

Normal and separable extensions: splitting fields, Normal extensions, multiple roots, finite fields, separable extensions

Chapter 16 of the prescribed text book

UNIT III

Galois theory: Automorphism groups and fixed fields, fundamental theorem of Galois theory, Fundamental theorem of algebra

Chapter 17 of the prescribed text book

UNIT IV

Applications of Galois theory to classical problems: Roots of unity and cyclotomic polynomials, cyclic extensions, polynomials solvable by radicals, symmetric functions, Ruler and compass constructions

Chapter 18 of the prescribed text book

Prescribed Book;

**Basic Abstract Algebra** : P.B. Bhattacharya, S.K.Jain and S.R.Nagpaul ,  
Second edition, Cambridge University Press, printed and bound in India at  
Replika Press Pvt. Ltd.,2001.

SX.5216

ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
M.A/M.SC MATHEMATICS  
II-SEMESTER

2005-2006 AB

M 202 REAL ANALYSIS-II

UNIT I

Lebesgue measure: Introduction, Outer measure, measurable sets and Lebesgue measure, A non measurable set, measurable functions, Little woods three principles.

Chapter 3 of the text book

UNIT II

The Lebesgue Integral: The Riemann integral, The Lebesgue integral of a bounded function over a set of finite measure, the integral of a nonnegative function, the general Lebesgue integral, convergences in measure.

Chapter 4 of the textbook

UNIT III

Differentiation and integration: Differentiation of monotone functions, Functions of bounded variation and differentiation of an integral, Absolute continuity, and convex functions.

Chapter 5 of the textbook

UNIT IV

The classical Banach spaces: The  $L^p$ -spaces, The Holder's and Minkowski's inequality, convergences and completeness, approximations in  $L^p$  spaces, Linear functionals on  $L^p$  spaces.

Chapter 6 of the textbook

Textbook: Real analysis by H. L. Royden, Macmillan publishing co.inc. 3<sup>rd</sup> edition, New York, 1988.

SX-527

ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
M.A/M.SC MATHEMATICS  
II-SEMESTER

2005 - 2006 AB

**M 203 TOPOLOGY -II**

UNIT I

The countability axioms-the separation axioms, Normal Spaces, the Urysohn lemma-

Sections 30 to 33 of Chapter 4.

UNIT II

The Urysohn metrization theorem- the Tietze extension theorem. - The Tychonoff's theorem- the stone-cech compactification

Sections 34 to 35 of Chapter 4 and 37 and 38 of Chapter 5.

UNIT III

Local finiteness-The Nagata-Smirnov Metrization theorem - Complete metric spaces

Sections 39, 40<sup>and 43</sup> of chapter 6.

UNIT IV

Compactness in metric spaces-Point wise and compact convergence- Ascoli's theorem - Baire space

Sections 45, 46 and 47 of chapter 7 and Section 48 of Chapter 8.

Content and extent as in the book

Topology by James R. Munkres, Second edition, Pearson education, Asia-low price edition

SX-S 213

ANDHRA UNIVERSITY  
DEPT. OF MATHEMATICS  
M.Sc. Mathematics

w.e.f. 2003-2004 AB

MI 204. COMPLEX ANALYSIS - 1

UNIT - I

Elementary properties and examples of analytic functions: Power series - Analytic functions - Analytic functions as mappings, mobius transformations,

(§ 1, §2, §3 of chapter - III of prescribed text book)

UNIT - II

Complex integration: Riemann - stieltjes integrals - Power series representation of analytic functions - zeros of an analytic functions - The index of a closed curve

(§ 1, §2, §3, § 4 of chapter -IV of prescribed text book)

UNIT - III

Cauchy's theorem and integral formula - The homotopic version of cauchy's theorem and simple connectivity - Counting zeros; the open mapping theorem.

(§5, §6 §7 of chapter -IV of prescribed text book)

UNIT - IV

Singularities: Classifications of singularities - Residues - The argument principle.

(§ 1, §2, §3 of chapter - V of prescribed text book)

Prescribed text book:

Functions of one complex variables by J.B. Conway : Second edition , Springer International Student Edition, Narosa Publishing House , NEW DELHI.

SX -S 270

2009-10 AB

M205: C B C S: DISCRETE MATHEMATICS AND CODING THEORY

UNIT I

Graphs, digraphs, network, multi graph, elementary results, structure based on connectivity, characterisation, theorems on trees, tree distances, binary trees

Chapters 1, 2 and 3 of text book I

UNIT II: Eulerian graphs, Hamiltonian graphs, Spanning trees, Fundamental cycles, Minimal spanning trees,

(Chapter 4 of text book I)

Kruskal algorithm, Prims algorithm (8.5 of text book II)

UNIT III

Introduction to Coding Theory: Introduction, Basic assumptions, correcting and detecting codes, Information rate, The effects of error detection and correction, Finding the most likely code word transmitted, Some basic algebra, Weight and distance, Maximum likelihood decoding, Reliability of M L D, Error detecting codes, Error corer correcting codes

Articles 1.1 to 1.12 of Chapter 1 of TEXT BOOK IV

UNIT IV

Linear codes: Linear codes, Two Important subspaces, Independence, Basis, Dimension, Matrices, Bases for  $C=\langle S \rangle$  and  $C$ , Generating matrices and Encoding, Parity check matrices, Equivalent codes, Distance of a Linear code, Cosets, M L D for Linear codes, Reliability of Linear codes

Articles 2.1 to 2.12 of TEXT BOOK IV

TEXT BOOK I: Graph Theory applications By L.R.Foulds, Narosa publishing House, New Delhi

TEXT BOOK II: Discrete mathematical structures by Kolman and Busby and Sharon Ross Prentice Hall of India-2000, (Third Edition)

TEXT BOOK III: Applied Abstract Algebra by Rudolf Lidl and Gunther Pilz, Published by Springer Verlag

TEXT BOOK IV: Coding Theory by D. G. Hoffman, D. A. Lanonard, C. C. Lindroes

P. Ramesh  
BOARD OF STUDIES  
IN MATHEMATICS

*Textbook* : Differential Equations (with Applications and Historical Notes).  
by G.F. Simmons, Published TMH, 1994.

#### M203 - FUNCTIONAL ANALYSIS SX-5203

UNIT I : Banach Spaces : The definition and some examples, continuous linear transformation, The Hahn Banach theorem, The natural embedding of  $N$  in  $N^{**}$ . The open mapping theorem (Chapter 9, Sections 46-50).

UNIT II : The conjugate of an operator, Hilbert Spaces : The definition and some simple properties, Orthogonal complements, Orthonormal sets. (Chapter 9, Sections 51, Chapter 10, Sections 52-54).

UNIT III : The Conjugate space  $H^*$ , the adjoint of an operator, Self-adjoint operators and Unitary operators, projections (chapter 10, Sections 55-59).

UNIT IV : Finite - dimensional Spectral Theory : Matrices, Determinants and the spectrum of an operator, The spectral theorem, A survey of the situation. (Chapter 11, Sections 60-63).

*Textbook* : Introduction to Topology and Modern Analysis, by G.F. Simmons, McGraw Hill book Company, Inc. - International Student Edition.

*Reference* :

1. Functional Analysis, by B.V. Limaye, Wiley Eastern Limited, Bombay, 1981.
2. First course in Functional Analysis, C. Goffman and George Pedrick, Prentice-Hall of India Private Limited, New Delhi - 110 001, 1919.

#### M204 - MEASURE AND INTEGRATION SX-5204

UNIT I : Outer Measure - Measurable sets - A Non-measurable set - Lebesgue Measure - Measurable functions - Little woods three principles - (Chapter 3 of Textbook).

UNIT II : Measure spaces - Measurable functions - Integration - General convergence theorems - Signed Measure - Radon Nikodym theorem and its applications. (11.1 to 11.6 of Textbook).

UNIT III :  $L_p$  - Spaces - Minkowski - Holder inequalities Convergence and completeness - Approximation in  $L_p$  - Bounded Linear functionals (6.1 to 6.5 of Textbook).

*Textbook* : H.L. Royden, Measure Theory, Macmillan publishing Company, 3rd edition.

*Reference Books* :

- P.R. Halmos, Measure Theory, Graduate texts in Maths, Springer Verlag - 1979.  
W. Rudin : Real and Complex Analysis, Tata - McGraw Hill 1987, 3rd edition.

#### M205 - COMPLEX ANALYSIS SX-5205

UNIT I : The field of Complex Numbers, Complex Plane, polar representation and roots of Complex numbers, Lines and half-lines in the Complex plane,



SXS-321

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ANDHRA UNIVERSITY  
DEPT. OF MATHEMATICS  
A.Sc. Mathematics, III Semester

M 302: COMPLEX ANALYSIS - II

UNIT - I

The maximum modulus theorem: The maximum principle - Schwarz's lemma - Convex functions and Hadamard's three circles theorem - Phragmen - Lindelof theorem.

(§ 1, §2, §3, § 4 of chapter - VI of the prescribed text book)

UNIT - II

Compactness and convergence in the Spaces of Analytic Functions: The space of continuous functions  $C(G, \Omega)$  - Spaces of analytic functions - Spaces of meromorphic functions - The Riemann Mapping Theorem - Weierstrass Factorization theorem - Factorization of sign functions.

(§ 1, §2, §3, § 4, § 5, §6 of chapter -VII of the prescribed text book)

UNIT - III

Runge's Theorem: Runge's Theorem - Simple connectedness - Mittag-Leffler's Theorem, Analytic Continuation and Riemann Surfaces, Schwarz Reflection Principle - Analytic Continuation Along A Path - Mondromy Theorem.

(§1, §2, §3 of chapter -VIII, §1, §2, §3 of chapter -IX of the prescribed text book)

UNIT - IV

Harmonic Functions: Basic Properties of Harmonic functions - Harmonic functions on a disk. Jensen's formula, The genus and the order of an entire function Hadamard's factorization theorem.

(§ 1, §2 of chapter - X and §1, §2, §3 of chapter -XI of the prescribed text book)

Prescribed textbook:

Functions of one complex variables by J.B. Conway: Second edition, Springer International Student Edition, Narosa Publishing House, NEW DELHI

ST 5-328

M 309 --- NUMBER THEORY-I

18/19  
2005-06 AB

UNIT—I: ARITHMETICAL FUNCTIONS AND DIRICHLET MULTIPLICATION

Introduction , The Mobius function  $\mu(n)$ , The Euler totient function  $\varphi(n)$ , A relation connecting  $\varphi$  and  $\mu$  , A product formula for  $\varphi(n)$ , The Dirichlet product of arithmetical functions ,Dirichlet inverces and Mobius Inversions formula, The Mangoldt function  $\Lambda(n)$  , Multiplicative functions, Multiplicative functions and Dirichlet multiplication, The inverse of a completely multiplicative function, Liouville's fuction  $\lambda(n)$  , The devisor functions  $\sigma$   $\alpha(n)$ , Generalised convolutions.

UNIT—II AVERAGES OF ARITHMETICAL FUNCTIONS

Introduction, The big oh notation Asymptotic equality of functions, Euler's summation foomula, some elementary asymptotic formulas, the average order of  $d(n)$ , the average order of devisor functions  $\sigma_{\alpha}(n)$  , the average order of  $\varphi(n)$ , An application to the distribution of lattice points visible from the origin, The average order of  $\mu(n)$  and  $\Lambda(n)$  , The partical sums of a Dirichlet product, Applications to  $\mu(n)$  and  $\Lambda(n)$  , Another identity for the partial sums of a Dirichelt product.

UNIT—III SOME ELEMENTARY THEOREMS ON THE DISTRIBUTION OF PRIME NUMBERS

Introduction ,Chebyshev's functions  $\psi(x)$  and  $\vartheta(x)$ , Relations connecting  $\psi(x)$  and  $\vartheta(x)$ , some equivalent forms of the prime number theorem, Ineqlities of  $\pi(n)$  and  $P_n$  , Shapiro's Tauberian theorem , Application of Shapiro's theorem, An asymptotic formulae for the partial sums  $\sum_{p \leq x} (1/p)$  ,

UNIT—IV CONGRUENCES

Definition and basic properties of congruences , Residue classes and complete residue systems ,Linear congruences, Reduced residue systems and Euler- Fermat theorem, Polynomial congruences modulo  $p$ . Lagrange's theorem, Simultaneous linear congruences, the Chinese remainder theorem , Applications of the Chinese remainder theorem, Polynomial congruences with prime power moduli.

CONTENT AND EXTENT AS IN THE TEXT BOOK.

INTRODUCTION TO ANALYTIC NUMBER THEORY - BY TOM M. APOSTOL,  
NAROSA PUBLISHING HOUSE, NEW DELHI

(Sections 2.2 to 2.14 , 3.1 to 3.12 , 4.1 to 4.9 , 5.1 to 5.9.)

SXS-325

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2005-2006 AB

Department of Mathematics  
Andhra University  
M.Sc Mathematics: III Semester

M-306. LATTICE THEORY - I

UNIT - I

Partly ordered sets - Diagrams - Special subsets of a poset - length - lower and upper bounds - the minimum and maximum condition - the Jordan chain conditions - Dimension functions.

( sections 1 to 9 of chapter I the prescribed text book )

UNIT - II

Algebras - lattices - the lattice theoretic duality principle - semi lattices - lattices as posets - diagrams of lattices - semi lattices, ideals - bound elements of Lattices - atoms and dual atoms - complements, relative complements, semi complements - irreducible and prime elements of a lattice - the homomorphism of a lattice - axioms systems of lattices.

( sections 10 to 21 of chapter II of the prescribed text book )

UNIT - III

Complete lattices - complete sublattices of a complete lattice - conditionally complete lattices, -lattices - compact elements, compactly generated lattices - subalgebra lattice of an algebra - closure operations - Galois connections, Dedekind cuts - partly ordered sets as topological spaces.

( sections 22 to 29 of chapter III of the prescribed text book )

UNIT - IV

Distributive lattices - infinitely distributive and completely distributive lattices - modular lattices - characterization of modular and distributive lattices by their sublattices - distributive sublattices of modular lattices - the isomorphism theorem of modular lattices, covering conditions - meet representations in modular and distributive lattices - some special subclasses of the class of modular lattices - preliminary theorems - modular lattices of locally finite length - the valuation of a lattice, metric and quasi metric lattices - complemented modular lattices .

( sections 30 to 40 of chapters IV and V of the prescribed text book )

**Prescribed Text Book:**

Introduction to Lattice Theory, by Gabor Szasz, Academic Press, New York.

**Books for reference:**

General Lattice Theory by G. Gratzer, Academic Press, New York.

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SXS-323

Audhra University  
 Department of Mathematics  
 M.Sc Mathematics  
 III Semester - Special Paper  
 Syllabus  
 M304 COMMUTATIVE ALGEBRA I

2005-06 AB

UNIT I

Rings and ring homomorphism, ideals, quotient rings, zero divisors, Nilpotent elements, units, prime ideals and Maximal ideals, nil radical and Jacobson radical, operations on ideals, Extensions and contractions.

UNIT II

Modules and module homomorphisms, Sub modules and quotient modules, operations on submodules, Direct sum and product; finitely generated modules, exact sequences, Tensor product of modules, Restriction and extension of scalars, Exactness properties of the tensor product, algebras, tensor product of algebras.

UNIT III

Local properties, Extended and contracted ideals in rings of fractions.

UNIT IV

Primary decompositions

Content and extent of chapters 1 to 4 of the prescribed textbook.

**Prescribed text book:** Introduction to commutative algebra, By M.F. ATIYAH AND I.G. MACDONALD, Addison- Wesley publishing company, London

SX-S 454

**SYLLABUS**

ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
M.A/M.SC MATHEMATICS  
IV SEMESTER

PLEASE SEE THE  
QUESTION PAPER  
\* KINDLY ADHERE TO  
SYLLABUS STRICTLY

2008-09 AB

**M. 401 Measure and Integration**

UNIT I: Lebesgue measure: Introduction, Outer measure, measurable sets and Lebesgue measure, A non measurable set, measurable functions, Little woods three principles. Chapter 3 of the text book

UNIT II: The Lebesgue Integral: The Riemann integral, The Lebesgue integral of a bounded function over a set of finite measure, the integral of a nonnegative function, the general Lebesgue integral, convergences in measure. Chapter 4 of the textbook

UNIT III: Differentiation and integration: Differentiation of monotone functions, Functions of bounded variation and differentiation of an integral, Absolute continuity, and convex functions. Chapter 5 of the textbook

UNIT IV: The classical Banach spaces: The  $L^p$ -spaces, The Holder's and Minkowski's inequality, convergences and completeness, approximations in  $L^p$  spaces, Linear functionals on  $L^p$  spaces. Chapter 6 of the textbook

Textbook: Real analysis by H. L. Royden, Macmillan publishing co. inc. 3<sup>rd</sup> edition, New York, 1988.

SX'S-421

22

2003-2004 AB

ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
M.Sc MATHEMATICS  
IV SEMESTER  
M 402 PARTIAL DIFFERENTIAL EQUATIONS

Syllabus

UNIT I: First order partial differential equations in two independent variables and the Cauchy problem - semilinear equations - Quasilinear equations - The Characteristic Cauchy Problem - General solution - Monge strip and Charpit equations - solution of a Cauchy problem - Solution of a Characteristic Cauchy Problem - Determination of a complete integral - New solutions from a complete integral - solution of a Cauchy problem.

Sections 1.1, 2.1-2.4, 3.1-3.3, 4.1-4.3 in Chapter 1 of the Text Book.

UNIT II: Linear equation in two independent variables - Linear equation in more than two independent variables - The Cauchy Problem - Propagation of discontinuities - Boundary value problems and Cauchy Problem - singularity functions and the fundamental solutions: Green's function - Poisson's theorem - the mean value and the maximum and minimum properties.

Sections 1.1-1.4, 2.1-2.4 in Chapter 2 of the Text Book.

UNIT III: Existence and uniqueness theorems for the initial value problem in an infinite domain - Initial - boundary value problems for a semi infinite domain - Initial boundary value problems for heat conduction in a finite bar - the one dimensional wave equation.

Sections 3.1-3.3, 4.1 in Chapter 2 of the Text Book.

UNIT IV: The three dimensional Wave equation - Method of Spherical Means - the two dimensional wave equation: Hadamard's method of Descent - propagation of confined initial disturbances - Continuable initial conditions - Duhamel's principle, solution of the inhomogeneous wave equation, Retarded potential - Boundary value problem for the one dimensional wave equation.

Sections 4.2-4.8 in Chapter 2 of the Text Book.

Text book: Phoolan Prasad and Renuka Ravindran, Partial Differential Equations, New age International Publishers, New Delhi, 1985.

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STREAM - A

ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
M.A/M.SC MATHEMATICS  
IV-SEMESTER

2005-2006 AB

M 403(1) NUMBER THEORY- II

UNIT-I :- FINITE ABELIAN GROUPS AND THEIR CHARACTERS:-

Characters of finite abelian groups- The character group- The orthogonality relations- for characters- Dirichlet characters- Sums involving Dirichlet characters-The nonvanishing of  $L(1, \chi)$  for real nonprincipal  $\chi$ .

Introduction- Dirichlet's theorem for primes of the form  $4n-1$  and  $4n+1$ - The plan of the proof of Dirichlet's theorem- Proof of Lemma 7.4- Proof of Lemma 7.5- Proof of Lemma 7.6- Proof of Lemma 7.7- Proof of Lemma 7.8- Distribution of primes in arithmetic progressions.

Chapters 6 & 7:- Articles 6.5 to 6.10 and 7.1 to 7.9

UNIT-II:- PERIODIC ARITHMETICAL FUNCTIONS AND GAUSS SUMS:-

Functions periodic modulo  $k$ - Existence of finite Fourier series for periodic arithmetical functions- Ramanujan's sum and generalizations- Multiplicative properties of the sums  $s_k(n)$ - Gauss sums associated with Dirichlet characters-Dirichlet characters with nonvanishing Gauss sums- Induced moduli and primitive characters- Further properties of induced moduli- The conductor of a character- Primitive characters and separable Gauss sums- The finite Fourier series of the Dirichlet characters- Polya's inequality for the partial sums of primitive characters.

Chapter 8:- Articles 8.1 to 8.12.

UNIT-III:- QUADRATIC RESIDUES AND THE QUADRATIC RECIPROCITY LAW:-

Quadratic residues- Legendre's symbol and its properties- Evaluation of  $(-1/p)$  and  $(2/p)$ - Gauss Lemma-The quadratic reciprocity law-Applications of the reciprocity law- The Jacobi symbol- Applications to Diophantine equations- Gauss sums and the quadratic reciprocity law.

Chapter 9:- Articles 9.1 to 9.9

UNIT-IV:- PRIMITIVE ROOTS:-

The exponent of a number mod  $m$ . Primitive roots- Primitive roots and reduced residue systems- The nonexistence of primitive roots mod  $2^\alpha$  for  $\alpha \geq 3$ - The existence of primitive roots and  $p$  for odd primes  $p$ . Primitive roots and quadratic residues- The existence of primitive roots mod  $p^\alpha$ - The existence of primitive roots mod  $2p^\alpha$ - The non existence of primitive roots in the remaining cases- The number of primitive roots mod  $m$ . The index calculus- Primitive roots and Dirichlet characters-Real-valued Dirichlet characters mod  $p^\alpha$ -Primitive Dirichlet characters mod  $p^\alpha$ .

Chapter- 10:- Articles 10.1 to 10.13.

2003 - 2004 AB

M 406 - Lattice Theory

(Prerequisite M 306 - Lattice-Theory-II)

UNIT I : Boolean algebras, De Morgan formulae - Complete Boolean algebras - Boolean algebras and Boolean rings - The algebra of relations - The lattice of propositions - Valuations of Boolean algebras.

(Sections 42 to 47 of Chapters VI of the prescribed textbook)

UNIT II : Birkhoff lattices - Semimodular lattices - Equivalence lattices - Linear dependence - Complemented semimodular lattices.

(Sections 48 to 52 of Chapters VII of the prescribed textbook)

UNIT III : Ideals and dual ideals, Ideal chains - Ideal lattices - Distributive lattices and rings of sets.

(Sections 53 to 55 of Chapters VIII of the prescribed textbook)

UNIT IV : Congruence relations of an algebra - Permutable equivalence relations - The Schreier refinement theorem in arbitrary algebras - Congruence relations of lattices - Minimal congruence relations of some subsets of a distributive lattice - The connection between ideals and congruence relations of lattice.

(Sections 56 to 61 of Chapters IX of the prescribed textbook)

*Prescribed Textbook :*

Introduction to Lattice Theory, by Gabor Szasz, Academic Press, New York.

*Books for Reference :*

General Lattice Theory by G. Grätzer, Academic Press, New York.



Sx-S. 623

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Andhra University  
Department of Mathematics

M.Sc Mathematics

IV Semester - Special Paper

Syllabus

M 404 COMMUTATIVE ALGEBRA II

(prerequisite: M 304 Commutative Algebra - I)

2003-2004 AB

UNIT I

Integral dependence, the going-up theorem - Integrally closed integral domains, the going - down theorem, valuation rings.

UNIT II

Chain conditions

UNIT III

Noetherian rings - Primary decomposition of Noetherian rings, Artin rings

UNIT IV

Discrete valuation rings, Dedekind domains, Fractional ideals

Content and extent of chapters 5 to 9 of the prescribed textbook.

Prescribed text book: Introduction to commutative algebra by  
M.F. Atiyah and I.G. Macdonald, Addison- Wesley publishing company,  
London



Department of Mathematics  
**ADIKAVI NANNAYA UNIVERSITY**

Rajamahendravaram – 533 296

**M.Sc. Mathematics**

Syllabus { w.e.f. 2016 – 17 Admitted Batch }

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**M101 ALGEBRA – I**

**Unit I**

Automorphisms- Conjugacy and G-sets- Normal series solvable groups- Nilpotent groups.  
(Sections 3& 4 of Chapter 5, Sections 1,2,3 of Chapter 6 )

**Unit II**

Structure theorems of groups: Direct product- Finitely generated abelian groups- Invariants of a finite abelian group- Sylow's theorems- Groups of orders  $p^2$ ,  $pq$ . (Sections 1 to 5 of Chapter 8)

**Unit III**

Ideals and homomorphisms- Sum and direct sum of ideals, Maximal and prime ideals- Nilpotent and nil ideals- Zorn's lemma (Sections 1 to 6 of Chapter 10)

**Unit-IV**

Unique factorization domains - Principal ideal domains- Euclidean domains-

Polynomial rings over UFD- Rings of fractions. (Sections 1 to 4 of Chapter 11, Sections 1 of Chapter 12)

TEXT BOOK: Basic Abstract Algebra , Second Edition by P.B. Bhattacharya, S.K. Jain and S.R. Nagpanl.

Reference: [1] Topics in Algebra by I.N. Herstein.



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**M.Sc. Mathematics**

Syllabus { w.e.f. 2016 – 17 Admitted Batch }

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**M102 REAL ANALYSIS-I**

**UNIT-I**

Basic Topology: Finite, Countable, and Uncountable Sets, Metric spaces, Compact sets, Connected sets.

(Chapter 2 of the text book)

**UNIT-II**

Numerical Sequences and Series: Convergent sequences, Subsequences, Cauchy sequences, Upper and Lower limits, Some special sequences, Series, Series of non-negative terms , number, The Root and Ratio tests, Power series , Summation by parts , Absolute Convergence , Addition and Multiplication of series, Rearrangements.

(Chapter 3 of the text book)

**UNIT-III**

Continuity: Limits of Functions, Continuous Functions, Continuity and Compactness, Continuity and Connectedness, Discontinuities, Monotone Functions, Infinite Limits and Limits at Infinity.

(Chapter 4 of the text book)

**UNIT-IV**

Differentiation: The Derivative of a Real Function, Mean Value Theorems, The Continuity of Derivatives, L' Hospital's Rule, Derivatives of Higher order, Taylor's theorem, Differentiation of Vector- valued Functions.

(Chapter 5 of the text book)

**TEXT BOOK:** Principles of Mathematical Analysis by Walter Rudin, International Student Edition, 3 rd Edition, 1985.

**REFERENCE:** Mathematical Analysis by Tom M. Apostol, Narosa Publishing House, 2 nd Edition, 1985.



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**M.Sc. Mathematics**

Syllabus { w.e.f. 2016 – 17 Admitted Batch }

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**M103 - DEFFERENTIAL EQUATIONS**

**UNIT-I**

Second order linear differential equations: Introduction-general solution of the homogeneous equation - Use of a known solution to find another - Homogeneous equation with constant coefficients - method of undetermined coefficients - method of variation of parameters.

Chapter 3 (Sec 14-19)

**UNIT-II**

Oscillation theory and boundary value problems: Qualitative properties of solutions - The Sturm comparison theorem - Eigen values, Eigen functions and the vibrating string.

Chapter 4 (Sec 22-24, Appendix A)

**UNIT-III**

Power series solutions: A review of power series-series solutions of first order equations-second order linear equations - ordinary points-regular singular points.

Chapter 5 (Sec 25-29)

**UNIT-IV**

Systems of first order equations: Linear systems - Homogeneous linear systems with constant coefficients - Existence and Uniqueness of solutions - successive approximations - Picard's theorem - Some examples.

Chapter 7 (Sec 36-38) and Chapter 11(Sec 55-56)

TEXT BOOK: George F. Simmons, Differential Equations, Tata McGraw-Hill Publishing  
Company Limited, New Delhi



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**M.Sc. Mathematics**

Syllabus { w.e.f. 2016 – 17 Admitted Batch }

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**M 104 - TOPOLOGY**

**UNIT-I**

Sets and Functions: Sets and Set inclusion – The algebra of sets – Functions – Products of sets – Partitions and equivalence relations – Countable sets – Uncountable sets – Partially ordered sets and lattices. (Chapter I: Sections 1 to 8.)

**UNIT-II**

Metric spaces: The definition and some examples – Open sets – Closed sets – Convergence, Completeness and Baire's theorem – Continuous mappings. (Chapter 2: Sections 9 to 13.)

**UNIT-III**

Metric spaces (Continued): Spaces of continuous functions – Euclidean and unitary spaces.

Topological spaces: The definition and some examples – Elementary concepts – Open bases and open sub bases – Weak topologies – The function algebras  $C(X, \mathbb{R})$  and  $C(X, \mathbb{C})$ .

(Chapter 2: Sections 14,15 and Chapter 3: 16 to 20.)

**UNIT-IV**

Compactness: Compact spaces – Product of Spaces – Tychonoff's theorem and locally Compact spaces – Compactness for metric spaces – Ascoli theorem.

(Chapter 4: Sections 21 to 25.)

TEXT BOOK: Introduction to Topology by G.F.Simmons, Mc.Graw-Hill book company.

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**ADIKAVI NANNAYA UNIVERSITY**  
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**M.Sc. Mathematics**

Syllabus { w.e.f. 2016 – 17 Admitted Batch }

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**M 105 - DISCRETE MATHEMATICS**

**UNIT-I:**

Graphs, digraphs, network, multi graph, elementary results , structure based on connectivity, characterization, theorems on trees, tree distances, binary trees.

Chapters 1, 2 and 3 of Text Book I

**UNIT-II:**

Eulerian graphs, Hamiltonian graphs, Spanning trees, Fundamental cycles, Minimal spanning trees. (Chapter 4 of text book I)

Kruskal algorithm, Prims algorithm. (8.5 of Text Book II)

**UNIT-III**

Definitions of lattices, Modular lattices and distributive lattices.

(Chapter I of text book of III)

**UNIT-IV**

Basic properties, Boolean polynomials, ideals, minimal forms of Boolean polynomials,

(Chapter 2 of text book III)

TEXT BOOK I: Graph Theory applications By L.R.Foulds, Narosa publishing House, New Delhi

TEXT BOOK II: Discrete mathematical structures by Kolman and Busby and Sharon Ross Prentice Hall of India-2000, (Third Edition)

TEXT BOOK III: Applied Abstract Algebra by Rudolf Lidl and Gunter Pilz, Published by Springer verlag.



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**M.Sc. Mathematics**

Syllabus { w.e.f. 2016 – 17 Admitted Batch }

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**M201 ALGEBRA – II**

**UNIT - I**

Algebraic extensions of fields: Irreducible polynomials and Eisenstein criterion- Adjunction of roots- Algebraic extensions-Algebraically closed fields. (Sections 1 to 4 of Chapter 15 )

**UNIT - II**

Normal and separable extensions: Splitting fields- Normal extensions- Multiple roots- Finite fields- Separable extensions (Sections 1 to 5 of Chapter 16 )

**UNIT - III**

Galois theory: Automorphism groups and fixed fields- Fundamental theorem of Galois theory- Fundamental theorem of Algebra (Sections 1 to 3 of Chapter 17 )

**UNIT - IV**

Applications of Galois theory to classical problems: Roots of unity and cyclotomic polynomials- Cyclic extensions- Polynomials solvable by radicals - Ruler and Compass constructions. (Sections 1 to 3 and 5 of Chapter 18 )

**TEXT BOOK:** Basic Abstract Algebra , Secound Editionby P.B. Bhattacharya, S.K. Jain and S.R. Nagpanl

**REFERENCE:** Topics in Algrbra By I. N. Herstein.



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**M.Sc. Mathematics**

**Syllabus { w.e.f. 2016 – 17 Admitted Batch }**

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**M202 REAL ANALYSIS-II**

**UNIT-I**

Riemann-Stieltjes Integral: Definition and existence of the Riemann Stieltjes Integral, Properties of the Integral, Integration and Differentiation, the fundamental theorem of calculus – Integral of Vector- valued Functions, Rectifiable curves.

(Chapter 6)

**UNIT-II**

Sequences and Series of the Functions: Discussion on the Main Problem, Uniform Convergence, Uniform Convergence and Continuity, Uniform Convergence and Integration, Uniform Convergence and Differentiation, Equicontinuous families of Functions, the Stone-Weierstrass Theorem.

(Chapter 7)

**UNIT-III**

Power Series: (A section in Chapter 8 of the text book)

Functions of Several Variables: Linear Transformations, Differentiation, The Contraction Principle, The Inverse Function theorem.

(First Four sections of chapter 9 of the text book)

**UNIT-IV**

Functions of several variables Continued: The Implicit Function theorem, The Rank theorem, Determinates, Derivatives of Higher Order, Differentiation of Integrals.

(5 th to 9 th sections of Chapter 9 of the text book)

**TEXT BOOK:** Principles of Mathematical Analysis by Walter Rudin, International Student Edition, 3 rd Edition, 1985.

**REFERENCE:** Mathematical Analysis by Tom M. Apostol, Narosa Publishing House, 2 nd Edition, 1985.





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**M.Sc. Mathematics**

Syllabus { w.e.f. 2016 – 17 Admitted Batch }

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**M203 COMPLEX ANALYSIS -I**

**UNIT-I**

Elementary properties and examples of analytic functions: Power series- Analytic functions- Analytic functions as mappings, Mobius transformations.

(1,2,3 of chapter-III)

**UNIT-II**

Complex Integration: Riemann- Stieltjes integrals- Power series representation of analytic functions- zeros of an analytic functions- The index of a closed curve.

(1,2,3,4 of chapter-IV)

**UNIT-III**

Cauchy's theorem and integral formula- the homotopic version of Cauchy's theorem and simple connectivity- Counting zeros; the open mapping theorem.

(5,6,7 of chapter-IV )

**UNIT-IV**

Singularities: Classifications of singularities- Residues- The argument principle.

(1,2,3 of chapter-V )

TEXT BOOK: Functions of one complex variables by J.B.Conway : Second edition,

Springer International student Edition, Narosa Publishing House, New Delhi.



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**ADIKAVI NANNAYA UNIVERSITY**

Rajamahendravaram – 533 296

**M.Sc. Mathematics**

Syllabus { w.e.f. 2016 – 17 Admitted Batch }

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**M204 LINEAR ALGEBRA**

**UNIT-I**

Elementary Canonical Forms : Introduction – Characteristic Values – Annihilating Polynomials –invariant subspaces – Simultaneous Triangulation – Simultaneous Diagonalization.

(Sections 6.1,6.2,6.3,6.4,6.5 of chapter-6)

**UNIT-II**

Direct – sum Decompositions – invariant direct sums – the primary decomposition theorem – cyclic subspaces and Annihilators – cyclic decompositions and the rational form.

(Sections 6.6,6.7,6.8 of chapter-6 and Sections 7.1,7.2 of chapter - 7)

**UNIT-III**

The Jordan Form – Computation of Invariant Factors – Semi Simple Operators.

(Sections 7.3,7.4,7.5 of chapter - 7)

**UNIT-IV**

Bilinear Forms : Bilinear Forms – Symmetric Bilinear Forms – Skew Symmetric Bilinear Forms – Group Preserving Bilinear Forms.

(Sections 10.1,10.2,10.3,10.4 of chapter - 10)

TEXT BOOK: Linear Algebra second edition By Kenneth Hoffman and Ray Kunze, Prentice Hall of india Private Limited, New Delhi.



Department of Mathematics  
**ADIKAVI NANNAYA UNIVERSITY**

Rajamahendravaram – 533 296

**M.Sc. Mathematics**

**Syllabus { w.e.f. 2016 – 17 Admitted Batch }**

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**M205 - PROBABILITY THEORY & STATISTICS**

**UNIT I**

Sample spaces and events, The Axioms of probability, some elementary Theorems, Boole's Inequality, Conditional Probability, Baye's Theorem. [Text Book: 1]

**UNIT II**

Discrete & Continuous Random variables, mathematical Expectation, variance, covariance, moment generating functions, characteristic functions, Binomial, Poisson, Normal and Uniform Distributions [Text Book: 1]

**UNIT III**

Populations and samples, sampling distribution of the Mean (  $\sigma$  is known/unknown), sampling distribution of the variance and F distributions. Point estimation, Interval estimation, Tests of Hypotheses, Hypotheses concerning one and two means.

**UNIT IV**

Estimation of proportions, Hypotheses concerning one proportion, Hypotheses concerning several proportions, The analysis of  $r \times c$  tables, Goodness of Fit.

Correlation & Regression, The method of least squares, inferences bases on the least – square estimators.

**TEXT BOOKS:**

1. Fundamentals of Mathematical Statistics, SC Gupta, VK Kapoor [Only for First Two Units]
2. Probability & Statistics for Engineers & Scientists, Walpole, Myers, Myers, Ye, Pearson Education

**REFERENCE:**

1. statistics and Random Processes by T. Veerarajan, Tata McGraw Hill
2. Probability & Statistics, T. K. V. Iyengar, B. Krishna Gandhi and Others, S. Chand & Co.

*Textbook* : Differential Equations (with Applications and Historical Notes).  
by G.F. Simmons, Published TMH, 1994.

#### M203 - FUNCTIONAL ANALYSIS SX-5203

UNIT I : Banach Spaces : The definition and some examples, continuous linear transformation, The Hahn Banach theorem, The natural embedding of  $N$  in  $N^{**}$ . The open mapping theorem (Chapter 9, Sections 46-50).

UNIT II : The conjugate of an operator, Hilbert Spaces : The definition and some simple properties, Orthogonal complements, Orthonormal sets. (Chapter 9, Sections 51, Chapter 10, Sections 52-54).

UNIT III : The Conjugate space  $H^*$ , the adjoint of an operator, Self-adjoint operators and Unitary operators, projections (chapter 10, Sections 55-59).

UNIT IV : Finite - dimensional Spectral Theory : Matrices, Determinants and the spectrum of an operator, The spectral theorem, A survey of the situation. (Chapter 11, Sections 60-63).

*Textbook* : Introduction to Topology and Modern Analysis, by G.F. Simmons, McGraw Hill book Company, Inc. - International Student Edition.

*Reference* :

1. Functional Analysis, by B.V. Limaye, Wiley Eastern Limited, Bombay, 1981.
2. First course in Functional Analysis, C. Goffman and George Pedrick, Prentice-Hall of India Private Limited, New Delhi - 110 001, 1919.

#### M204 - MEASURE AND INTEGRATION SX-5204

UNIT I : Outer Measure - Measurable sets - A Non-measurable set - Lebesgue Measure - Measurable functions - Little woods three principles - (Chapter 3 of Textbook).

UNIT II : Measure spaces - Measurable functions - Integration - General convergence theorems - Signed Measure - Radon Nikodym theorem and its applications. (11.1 to 11.6 of Textbook).

UNIT III :  $L_p$  - Spaces - Minkowski - Holder inequalities Convergence and completeness - Approximation in  $L_p$  - Bounded Linear functionals (6.1 to 6.5 of Textbook).

*Textbook* : H.L. Royden, Measure Theory, Macmillan publishing Company, 3rd edition.

*Reference Books* :

- P.R. Halmos, Measure Theory, Graduate texts in Maths, Springer Verlag - 1979.  
W. Rudin : Real and Complex Analysis, Tata - McGraw Hill 1987, 3rd edition.

#### M205 - COMPLEX ANALYSIS SX-5205

UNIT I : The field of Complex Numbers, Complex Plane, polar representation and roots of Complex numbers, Lines and half-lines in the Complex plane,

SXS-321

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ANDHRA UNIVERSITY  
DEPT. OF MATHEMATICS  
A.Sc. Mathematics, III Semester

M 302: COMPLEX ANALYSIS - II

UNIT - I

The maximum modulus theorem: The maximum principle - Schwarz's lemma - Convex functions and Hadamard's three circles theorem - Phragmen - Lindelof theorem.

(§ 1, §2, §3, § 4 of chapter - VI of the prescribed text book)

UNIT - II

Compactness and convergence in the Spaces of Analytic Functions: The space of continuous functions  $C(G, \Omega)$  - Spaces of analytic functions - Spaces of meromorphic functions - The Riemann Mapping Theorem - Weierstrass Factorization theorem - Factorization of sign functions.

(§ 1, §2, §3, § 4, § 5, §6 of chapter -VII of the prescribed text book)

UNIT - III

Runge's Theorem: Runge's Theorem - Simple connectedness - Mittag-Leffler's Theorem, Analytic Continuation and Riemann Surfaces, Schwarz Reflection Principle - Analytic Continuation Along A Path - Mondromy Theorem.

(§1, §2, §3 of chapter -VIII, §1, §2, §3 of chapter -IX of the prescribed text book)

UNIT - IV

Harmonic Functions: Basic Properties of Harmonic functions - Harmonic functions on a disk. Jensen's formula, The genus and the order of an entire function Hadamard's factorization theorem.

(§ 1, §2 of chapter - X and §1, §2, §3 of chapter -XI of the prescribed text book)

Prescribed textbook:

Functions of one complex variables by J.B. Conway: Second edition, Springer International Student Edition, Narosa Publishing House, NEW DELHI

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M 309 --- NUMBER THEORY-I

18/19  
2005-06 AB

UNIT—I: ARITHMETICAL FUNCTIONS AND DIRICHLET MULTIPLICATION

Introduction , The Mobius function  $\mu(n)$ , The Euler totient function  $\phi(n)$ , A relation connecting  $\phi$  and  $\mu$  , A product formula for  $\phi(n)$ , The Dirichlet product of arithmetical functions ,Dirichlet inverses and Mobius Inversions formula, The Mangoldt function  $\Lambda(n)$  , Multiplicative functions, Multiplicative functions and Dirichlet multiplication, The inverse of a completely multiplicative function, Liouville's function  $\lambda(n)$  , The divisor functions  $\sigma$   $\alpha(n)$ , Generalised convolutions.

UNIT—II AVERAGES OF ARITHMETICAL FUNCTIONS

Introduction, The big oh notation Asymptotic equality of functions, Euler's summation formula, some elementary asymptotic formulas, the average order of  $d(n)$ , the average order of divisor functions  $\sigma_{\alpha}(n)$  , the average order of  $\phi(n)$ , An application to the distribution of lattice points visible from the origin, The average order of  $\mu(n)$  and  $\Lambda(n)$  , The partial sums of a Dirichlet product, Applications to  $\mu(n)$  and  $\Lambda(n)$  , Another identity for the partial sums of a Dirichlet product.

UNIT—III SOME ELEMENTARY THEOREMS ON THE DISTRIBUTION OF PRIME NUMBERS

Introduction ,Chebyshev's functions  $\psi(x)$  and  $\theta(x)$ , Relations connecting  $\psi(x)$  and  $\theta(x)$ , some equivalent forms of the prime number theorem, Inequalities of  $\pi(n)$  and  $P_n$  , Shapiro's Tauberian theorem , Application of Shapiro's theorem, An asymptotic formulae for the partial sums  $\sum_{p \leq x} (1/p)$  ,

UNIT—IV CONGRUENCES

Definition and basic properties of congruences , Residue classes and complete residue systems ,Linear congruences, Reduced residue systems and Euler- Fermat theorem, Polynomial congruences modulo  $p$ . Lagrange's theorem, Simultaneous linear congruences, the Chinese remainder theorem , Applications of the Chinese remainder theorem, Polynomial congruences with prime power moduli.

CONTENT AND EXTENT AS IN THE TEXT BOOK.

INTRODUCTION TO ANALYTIC NUMBER THEORY - BY TOM M. APOSTOL,  
NAROSA PUBLISHING HOUSE, NEW DELHI

(Sections 2.2 to 2.14 , 3.1 to 3.12 , 4.1 to 4.9 , 5.1 to 5.9.)

SXS-325

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2005-2006 AB

Department of Mathematics  
Andhra University  
M.Sc Mathematics: III Semester

M-306. LATTICE THEORY - I

UNIT - I

Partly ordered sets - Diagrams - Special subsets of a poset - length - lower and upper bounds - the minimum and maximum condition - the Jordan chain conditions - Dimension functions.

( sections 1 to 9 of chapter I the prescribed text book )

UNIT - II

Algebras - lattices - the lattice theoretic duality principle - semi lattices - lattices as posets - diagrams of lattices - semi lattices, ideals - bound elements of Lattices - atoms and dual atoms - complements, relative complements, semi complements - irreducible and prime elements of a lattice - the homomorphism of a lattice - axioms systems of lattices.

( sections 10 to 21 of chapter II of the prescribed text book )

UNIT - III

Complete lattices - complete sublattices of a complete lattice - conditionally complete lattices,  $\sigma$ -lattices - compact elements, compactly generated lattices - subalgebra lattice of an algebra - closure operations - Galois connections, Dedekind cuts - partly ordered sets as topological spaces.

( sections 22 to 29 of chapter III of the prescribed text book )

UNIT - IV

Distributive lattices - infinitely distributive and completely distributive lattices - modular lattices - characterization of modular and distributive lattices by their sublattices - distributive sublattices of modular lattices - the isomorphism theorem of modular lattices, covering conditions - meet representations in modular and distributive lattices - some special subclasses of the class of modular lattices - preliminary theorems - modular lattices of locally finite length - the valuation of a lattice, metric and quasi metric lattices - complemented modular lattices .

( sections 30 to 40 of chapters IV and V of the prescribed text book )

**Prescribed Text Book:**

Introduction to Lattice Theory, by Gabor Szasz, Academic Press, New York.

**Books for reference:**

General Lattice Theory by G. Gratzer, Academic Press, New York.

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Audhra University  
 Department of Mathematics  
 M.Sc Mathematics  
 III Semester - Special Paper  
 Syllabus  
 M304 COMMUTATIVE ALGEBRA I

2005-06 AB

UNIT I

Rings and ring homomorphism, ideals, quotient rings, zero divisors, Nilpotent elements, units, prime ideals and Maximal ideals, nil radical and Jacobson radical, operations on ideals, Extensions and contractions.

UNIT II

Modules and module homomorphisms, Sub modules and quotient modules, operations on submodules, Direct sum and product; finitely generated modules, exact sequences, Tensor product of modules, Restriction and extension of scalars, Exactness properties of the tensor product, algebras, tensor product of algebras.

UNIT III

Local properties, Extended and contracted ideals in rings of fractions.

UNIT IV

Primary decompositions

Content and extent of chapters 1 to 4 of the prescribed textbook.

**Prescribed text book:** Introduction to commutative algebra, By M.F. ATIYAH AND I.G. MACDONALD, Addison- Wesley publishing company, London



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**SYLLABUS**

ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
M.A/M.SC MATHEMATICS  
IV SEMESTER

PLEASE SEE THE  
QUESTION PAPER  
\* KINDLY ADHERE TO  
SYLLABUS STRICTLY

2008-09 AB

**M. 401 Measure and Integration**

UNIT I: Lebesgue measure: Introduction, Outer measure, measurable sets and Lebesgue measure, A non measurable set, measurable functions, Little woods three principles. Chapter 3 of the text book

UNIT II: The Lebesgue Integral: The Riemann integral, The Lebesgue integral of a bounded function over a set of finite measure, the integral of a nonnegative function, the general Lebesgue integral, convergences in measure. Chapter 4 of the textbook

UNIT III: Differentiation and integration: Differentiation of monotone functions, Functions of bounded variation and differentiation of an integral, Absolute continuity, and convex functions. Chapter 5 of the textbook

UNIT IV: The classical Banach spaces: The  $L^p$ -spaces, The Holder's and Minkowski's inequality, convergences and completeness, approximations in  $L^p$  spaces, Linear functionals on  $L^p$  spaces. Chapter 6 of the textbook

Textbook: Real analysis by H. L. Royden, Macmillan publishing co. inc. 3<sup>rd</sup> edition, New York, 1988.

SX'S-421

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2003-2004 AB

ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
M.Sc MATHEMATICS  
IV SEMESTER  
M 402 PARTIAL DIFFERENTIAL EQUATIONS

Syllabus

UNIT I: First order partial differential equations in two independent variables and the Cauchy problem - semilinear equations - Quasilinear equations - The Characteristic Cauchy Problem - General solution - Monge strip and Charpit equations - solution of a Cauchy problem - Solution of a Characteristic Cauchy Problem - Determination of a complete integral - New solutions from a complete integral - solution of a Cauchy problem.

Sections 1.1, 2.1-2.4, 3.1-3.3, 4.1-4.3 in Chapter 1 of the Text Book.

UNIT II: Linear equation in two independent variables - Linear equation in more than two independent variables - The Cauchy Problem - Propagation of discontinuities - Boundary value problems and Cauchy Problem - singularity functions and the fundamental solutions: Green's function - Poisson's theorem - the mean value and the maximum and minimum properties.

Sections 1.1-1.4, 2.1-2.4 in Chapter 2 of the Text Book.

UNIT III: Existence and uniqueness theorems for the initial value problem in an infinite domain - Initial - boundary value problems for a semi infinite domain - Initial boundary value problems for heat conduction in a finite bar - the one dimensional wave equation.

Sections 3.1-3.3, 4.1 in Chapter 2 of the Text Book.

UNIT IV: The three dimensional Wave equation - Method of Spherical Means - the two dimensional wave equation: Hadamard's method of Descent - propagation of confined initial disturbances - Continuable initial conditions - Duhamel's principle, solution of the inhomogeneous wave equation, Retarded potential - Boundary value problem for the one dimensional wave equation.

Sections 4.2-4.8 in Chapter 2 of the Text Book.

Text book: Phoolan Prasad and Renuka Ravindran, Partial Differential Equations, New age International Publishers, New Delhi, 1985.

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STREAM - A

ANDHRA UNIVERSITY  
DEPARTMENT OF MATHEMATICS  
M.A/M.SC MATHEMATICS  
IV-SEMESTER

2005-2006 AB

M 403(1) NUMBER THEORY- II

UNIT-I :- FINITE ABELIAN GROUPS AND THEIR CHARACTERS:-

Characters of finite abelian groups- The character group- The orthogonality relations- for characters- Dirichlet characters- Sums involving Dirichlet characters-The nonvanishing of  $L(1, \chi)$  for real nonprincipal  $\chi$ .

Introduction- Dirichlet's theorem for primes of the form  $4n-1$  and  $4n+1$ - The plan of the proof of Dirichlet's theorem- Proof of Lemma 7.4- Proof of Lemma 7.5- Proof of Lemma 7.6- Proof of Lemma 7.7- Proof of Lemma 7.8- Distribution of primes in arithmetic progressions.

Chapters 6 & 7:- Articles 6.5 to 6.10 and 7.1 to 7.9

UNIT-II:- PERIODIC ARITHMETICAL FUNCTIONS AND GAUSS SUMS:-

Functions periodic modulo  $k$ - Existence of finite Fourier series for periodic arithmetical functions- Ramanujan's sum and generalizations- Multiplicative properties of the sums  $s_k(n)$ - Gauss sums associated with Dirichlet characters-Dirichlet characters with nonvanishing Gauss sums- Induced moduli and primitive characters- Further properties of induced moduli- The conductor of a character- Primitive characters and separable Gauss sums- The finite Fourier series of the Dirichlet characters- Polya's inequality for the partial sums of primitive characters.

Chapter 8:- Articles 8.1 to 8.12.

UNIT-III:- QUADRATIC RESIDUES AND THE QUADRATIC RECIPROCITY LAW:-

Quadratic residues- Legendre's symbol and its properties- Evaluation of  $(-1/p)$  and  $(2/p)$ - Gauss Lemma-The quadratic reciprocity law-Applications of the reciprocity law- The Jacobi symbol- Applications to Diophantine equations- Gauss sums and the quadratic reciprocity law.

Chapter 9:- Articles 9.1 to 9.9

UNIT-IV:- PRIMITIVE ROOTS:-

The exponent of a number mod  $m$ . Primitive roots- Primitive roots and reduced residue systems- The nonexistence of primitive roots mod  $2^\alpha$  for  $\alpha \geq 3$ - The existence of primitive roots and  $p$  for odd primes  $p$ . Primitive roots and quadratic residues- The existence of primitive roots mod  $p^\alpha$ - The existence of primitive roots mod  $2p^\alpha$ - The non existence of primitive roots in the remaining cases- The number of primitive roots mod  $m$ . The index calculus- Primitive roots and Dirichlet characters-Real-valued Dirichlet characters mod  $p^\alpha$ -Primitive Dirichlet characters mod  $p^\alpha$ .

Chapter- 10:- Articles 10.1 to 10.13.

2003 - 2004 AB

M 406 - Lattice Theory

(Prerequisite M 306 - Lattice-Theory-II)

UNIT I : Boolean algebras, De Morgan formulae - Complete Boolean algebras - Boolean algebras and Boolean rings - The algebra of relations - The lattice of propositions - Valuations of Boolean algebras.

(Sections 42 to 47 of Chapters VI of the prescribed textbook)

UNIT II : Birkhoff lattices - Semimodular lattices - Equivalence lattices - Linear dependence - Complemented semimodular lattices.

(Sections 48 to 52 of Chapters VII of the prescribed textbook)

UNIT III : Ideals and dual ideals, Ideal chains - Ideal lattices - Distributive lattices and rings of sets.

(Sections 53 to 55 of Chapters VIII of the prescribed textbook)

UNIT IV : Congruence relations of an algebra - Permutable equivalence relations - The Schreier refinement theorem in arbitrary algebras - Congruence relations of lattices - Minimal congruence relations of some subsets of a distributive lattice - The connection between ideals and congruence relations of lattice.

(Sections 56 to 61 of Chapters IX of the prescribed textbook)

*Prescribed Textbook :*

Introduction to Lattice Theory, by Gabor Szasz, Academic Press, New York.

*Books for Reference :*

General Lattice Theory by G. Grätzer, Academic Press, New York.

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Andhra University  
Department of Mathematics  
M.Sc Mathematics

2003-2004 AB

IV Semester - Special Paper

Syllabus

M 404 COMMUTATIVE ALGEBRA II

(prerequisite: M 304 Commutative Algebra - I)

UNIT I

Integral dependence, the going-up theorem - Integrally closed integral domains, the going - down theorem, valuation rings.

UNIT II

Chain conditions

UNIT III

Noetherian rings - Primary decomposition of Noetherian rings, Artin rings

UNIT IV

Discrete valuation rings, Dedekind domains, Fractional ideals

Content and extent of chapters 5 to 9 of the prescribed textbook.

Prescribed text book: Introduction to commutative algebra by  
M.F. Atiyah and I.G. Macdonald, Addison- Wesley publishing company,  
London



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**M101 ALGEBRA – I**

**Unit I**

Automorphisms- Conjugacy and G-sets- Normal series solvable groups- Nilpotent groups.  
(Sections 3& 4 of Chapter 5, Sections 1,2,3 of Chapter 6 )

**Unit II**

Structure theorems of groups: Direct product- Finitely generated abelian groups- Invariants of a finite abelian group- Sylow's theorems- Groups of orders  $p^2$ ,  $pq$ . (Sections 1 to 5 of Chapter 8)

**Unit III**

Ideals and homomorphisms- Sum and direct sum of ideals, Maximal and prime ideals- Nilpotent and nil ideals- Zorn's lemma (Sections 1 to 6 of Chapter 10)

**Unit-IV**

Unique factorization domains - Principal ideal domains- Euclidean domains-

Polynomial rings over UFD- Rings of fractions. (Sections 1 to 4 of Chapter 11, Sections 1 of Chapter 12)

TEXT BOOK: Basic Abstract Algebra , Second Edition by P.B. Bhattacharya, S.K. Jain and S.R. Nagpanl.

Reference: [1] Topics in Algebra by I.N. Herstein.



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**M102 REAL ANALYSIS-I**

**UNIT-I**

Basic Topology: Finite, Countable, and Uncountable Sets, Metric spaces, Compact sets, Connected sets.

(Chapter 2 of the text book)

**UNIT-II**

Numerical Sequences and Series: Convergent sequences, Subsequences, Cauchy sequences, Upper and Lower limits, Some special sequences, Series, Series of non-negative terms , number, The Root and Ratio tests, Power series , Summation by parts , Absolute Convergence , Addition and Multiplication of series, Rearrangements.

(Chapter 3 of the text book)

**UNIT-III**

Continuity: Limits of Functions, Continuous Functions, Continuity and Compactness, Continuity and Connectedness, Discontinuities, Monotone Functions, Infinite Limits and Limits at Infinity.

(Chapter 4 of the text book)

**UNIT-IV**

Differentiation: The Derivative of a Real Function, Mean Value Theorems, The Continuity of Derivatives, L' Hospital's Rule, Derivatives of Higher order, Taylor's theorem, Differentiation of Vector- valued Functions.

(Chapter 5 of the text book)

**TEXT BOOK:** Principles of Mathematical Analysis by Walter Rudin, International Student Edition, 3 rd Edition, 1985.

**REFERENCE:** Mathematical Analysis by Tom M. Apostol, Narosa Publishing House, 2 nd Edition, 1985.



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**M103 - DEFFERENTIAL EQUATIONS**

**UNIT-I**

Second order linear differential equations: Introduction-general solution of the homogeneous equation - Use of a known solution to find another - Homogeneous equation with constant coefficients - method of undetermined coefficients - method of variation of parameters.

Chapter 3 (Sec 14-19)

**UNIT-II**

Oscillation theory and boundary value problems: Qualitative properties of solutions - The Sturm comparison theorem - Eigen values, Eigen functions and the vibrating string.

Chapter 4 (Sec 22-24, Appendix A)

**UNIT-III**

Power series solutions: A review of power series-series solutions of first order equations-second order linear equations - ordinary points-regular singular points.

Chapter 5 (Sec 25-29)

**UNIT-IV**

Systems of first order equations: Linear systems - Homogeneous linear systems with constant coefficients - Existence and Uniqueness of solutions - successive approximations - Picard's theorem - Some examples.

Chapter 7 (Sec 36-38) and Chapter 11(Sec 55-56)

TEXT BOOK: George F. Simmons, Differential Equations, Tata McGraw-Hill Publishing  
Company Limited, New Delhi





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**M 104 - TOPOLOGY**

**UNIT-I**

Sets and Functions: Sets and Set inclusion – The algebra of sets – Functions – Products of sets – Partitions and equivalence relations – Countable sets – Uncountable sets – Partially ordered sets and lattices. (Chapter I: Sections 1 to 8.)

**UNIT-II**

Metric spaces: The definition and some examples – Open sets – Closed sets – Convergence, Completeness and Baire's theorem – Continuous mappings. (Chapter 2: Sections 9 to 13.)

**UNIT-III**

Metric spaces (Continued): Spaces of continuous functions – Euclidean and unitary spaces.

Topological spaces: The definition and some examples – Elementary concepts – Open bases and open sub bases – Weak topologies – The function algebras  $C(X, \mathbb{R})$  and  $C(X, \mathbb{C})$ .

(Chapter 2: Sections 14,15 and Chapter 3: 16 to 20.)

**UNIT-IV**

Compactness: Compact spaces – Product of Spaces – Tychonoff's theorem and locally Compact spaces – Compactness for metric spaces – Ascoli theorem.

(Chapter 4: Sections 21 to 25.)

TEXT BOOK: Introduction to Topology by G.F.Simmons, Mc.Graw-Hill book company.

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**M 105 - DISCRETE MATHEMATICS**

**UNIT-I:**

Graphs, digraphs, network, multi graph, elementary results , structure based on connectivity, characterization, theorems on trees, tree distances, binary trees.

Chapters 1, 2 and 3 of Text Book I

**UNIT-II:**

Eulerian graphs, Hamiltonian graphs, Spanning trees, Fundamental cycles, Minimal spanning trees. (Chapter 4 of text book I)

Kruskal algorithm, Prims algorithm. (8.5 of Text Book II)

**UNIT-III**

Definitions of lattices, Modular lattices and distributive lattices.

(Chapter I of text book of III)

**UNIT-IV**

Basic properties, Boolean polynomials, ideals, minimal forms of Boolean polynomials,

(Chapter 2 of text book III)

TEXT BOOK I: Graph Theory applications By L.R.Foulds, Narosa publishing House, New Delhi

TEXT BOOK II: Discrete mathematical structures by Kolman and Busby and Sharon Ross Prentice Hall of India-2000, (Third Edition)

TEXT BOOK III: Applied Abstract Algebra by Rudolf Lidl and Gunter Pilz, Published by Springer verlag.



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**M201 ALGEBRA – II**

**UNIT - I**

Algebraic extensions of fields: Irreducible polynomials and Eisenstein criterion- Adjunction of roots- Algebraic extensions-Algebraically closed fields. (Sections 1 to 4 of Chapter 15 )

**UNIT - II**

Normal and separable extensions: Splitting fields- Normal extensions- Multiple roots- Finite fields- Separable extensions (Sections 1 to 5 of Chapter 16 )

**UNIT - III**

Galois theory: Automorphism groups and fixed fields- Fundamental theorem of Galois theory- Fundamental theorem of Algebra (Sections 1 to 3 of Chapter 17 )

**UNIT - IV**

Applications of Galois theory to classical problems: Roots of unity and cyclotomic polynomials- Cyclic extensions- Polynomials solvable by radicals - Ruler and Compass constructions. (Sections 1 to 3 and 5 of Chapter 18 )

TEXT BOOK: Basic Abstract Algebra , Secound Editionby P.B. Bhattacharya, S.K. Jain and S.R. Nagpanl

REFERENCE: Topics in Algrbra By I. N. Herstein.



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**M202 REAL ANALYSIS-II**

**UNIT-I**

Riemann-Stieltjes Integral: Definition and existence of the Riemann Stieltjes Integral, Properties of the Integral, Integration and Differentiation, the fundamental theorem of calculus – Integral of Vector- valued Functions, Rectifiable curves.

(Chapter 6)

**UNIT-II**

Sequences and Series of the Functions: Discussion on the Main Problem, Uniform Convergence, Uniform Convergence and Continuity, Uniform Convergence and Integration, Uniform Convergence and Differentiation, Equicontinuous families of Functions, the Stone-Weierstrass Theorem.

(Chapter 7)

**UNIT-III**

Power Series: (A section in Chapter 8 of the text book)

Functions of Several Variables: Linear Transformations, Differentiation, The Contraction Principle, The Inverse Function theorem.

(First Four sections of chapter 9 of the text book)

**UNIT-IV**

Functions of several variables Continued: The Implicit Function theorem, The Rank theorem, Determinates, Derivatives of Higher Order, Differentiation of Integrals.

(5 th to 9 th sections of Chapter 9 of the text book)

TEXT BOOK: Principles of Mathematical Analysis by Walter Rudin, International Student Edition, 3 rd Edition, 1985.

REFERENCE: Mathematical Analysis by Tom M. Apostol, Narosa Publishing House, 2 nd Edition, 1985.



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**M204 LINEAR ALGEBRA**

**UNIT-I**

Elementary Canonical Forms : Introduction – Characteristic Values – Annihilating Polynomials –invariant subspaces – Simultaneous Triangulation – Simultaneous Diagonalization.

(Sections 6.1,6.2,6.3,6.4,6.5 of chapter-6)

**UNIT-II**

Direct – sum Decompositions – invariant direct sums – the primary decomposition theorem – cyclic subspaces and Annihilators – cyclic decompositions and the rational form.

(Sections 6.6,6.7,6.8 of chapter-6 and Sections 7.1,7.2 of chapter - 7)

**UNIT-III**

The Jordan Form – Computation of Invariant Factors – Semi Simple Operators.

(Sections 7.3,7.4,7.5 of chapter - 7)

**UNIT-IV**

Bilinear Forms : Bilinear Forms – Symmetric Bilinear Forms – Skew Symmetric Bilinear Forms – Group Preserving Bilinear Forms.

(Sections 10.1,10.2,10.3,10.4 of chapter - 10)

TEXT BOOK: Linear Algebra second edition By Kenneth Hoffman and Ray Kunze, Prentice Hall of india Private Limited, New Delhi.



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**M203 COMPLEX ANALYSIS -I**

**UNIT-I**

Elementary properties and examples of analytic functions: Power series- Analytic functions- Analytic functions as mappings, Mobius transformations.

(1,2,3 of chapter-III)

**UNIT-II**

Complex Integration: Riemann- Stieltjes integrals- Power series representation of analytic functions- zeros of an analytic functions- The index of a closed curve.

(1,2,3,4 of chapter-IV)

**UNIT-III**

Cauchy's theorem and integral formula- the homotopic version of Cauchy's theorem and simple connectivity- Counting zeros; the open mapping theorem.

(5,6,7 of chapter-IV )

**UNIT-IV**

Singularities: Classifications of singularities- Residues- The argument principle.

(1,2,3 of chapter-V )

TEXT BOOK: Functions of one complex variables by J.B.Conway : Second edition,

Springer International student Edition, Narosa Publishing House, New Delhi.



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**M205 - PROBABILITY THEORY & STATISTICS**

**UNIT I**

Sample spaces and events, The Axioms of probability, some elementary Theorems, Boole's Inequality, Conditional Probability, Baye's Theorem. [Text Book: 1]

**UNIT II**

Discrete & Continuous Random variables, mathematical Expectation, variance, covariance, moment generating functions, characteristic functions, Binomial, Poisson, Normal and Uniform Distributions [Text Book: 1]

**UNIT III**

Populations and samples, sampling distribution of the Mean (  $\sigma$  is known/unknown), sampling distribution of the variance and F distributions. Point estimation, Interval estimation, Tests of Hypotheses, Hypotheses concerning one and two means.

**UNIT IV**

Estimation of proportions, Hypotheses concerning one proportion, Hypotheses concerning several proportions, The analysis of  $r \times c$  tables, Goodness of Fit.

Correlation & Regression, The method of least squares, inferences bases on the least – square estimators.

**TEXT BOOKS:**

1. Fundamentals of Mathematical Statistics, SC Gupta, VK Kapoor [Only for First Two Units]
2. Probability & Statistics for Engineers & Scientists, Walpole, Myers, Myers, Ye, Pearson Education

**REFERENCE:**

1. statistics and Random Processes by T. Veerarajan, Tata McGraw Hill
2. Probability & Statistics, T. K. V. Iyengar, B. Krishna Gandhi and Others, S. Chand & Co.



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**M301 – FUNCTIONAL ANALYSIS**

**UNIT-I**

**Banach spaces:** the definition and some examples, continuous linear transformation, the Hahn-Banach theorem, the natural imbedding of  $N$  in  $N^{**}$ , The open mapping theorem.

(Sections 46 – 50 of chapter 9)

**UNIT-II**

The conjugate of an operator, **Hilbert spaces:** The definition and some simple properties, orthogonal complements, orthonormal sets.

(Sections 51 of chapter 9 and Sections 52- 54 of chapter 10)

**UNIT-III**

The Conjugate space  $H^*$ , the adjoint of an operator, Self- adjoint operators, Normal and Unitary operators, Projections.

(Sections 55 - 59 of chapter 10)

**UNIT-IV**

**Finite- dimensional spectral theory:** Matrices, determinants and the spectrum of an operator, the spectral theorem, A survey of the situation.

(Sections 60 - 63 of chapter - 11)

**TEXT BOOK:** Introduction to Topology and Modern Analysis by G.F.Simmons, McGraw Hill Book Company, Inc-International student ed.







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**M303 – ANALYTICAL NUMBER THEORY**

**UNIT-I**

**ARITHMETICAL FUNCTIONS AND DIRICHLET MULTIPLICATION :-** Introduction – The Mobius function  $\mu(n)$ . -The Euler quotient function  $\phi(n)$ -A relation connecting  $\phi$  and  $\mu$ - A product formula for  $\phi(n)$ -The Dirichlet product of arithmetical functions- Dirichlet inverses and the Mobius inversion formula- The mangoldt function  $\Lambda(n)$ - multiplicative functions- multiplicative function and Dirichlet multiplication – The inverse of a completely multiplicative function- Liouville's function  $\lambda(n)$ - The divisor functions  $\sigma(n)$ . Generalized convolutions.

(Sections 2.1 – 2.14 of chapter 2)

**UNIT-II**

**AVERAGES OF ARITHMETICAL FUNCTIONS:-** Introduction- The big oh notation. Asymptotic equality of functions – Euler's summation formula – Some elementary asymptotic formulas – The average order of  $d(n)$ -The average order of the divisor functions  $\sigma(n)$ - The average order of  $\phi(n)$ -An application to the distribution of lattice points visible from the origin – the average order of  $\mu(n)$  and  $\Lambda(n)$  – The partial sums of a Dirichlet product Applications to  $\mu(n)$  and  $\Lambda(n)$  – Another identity for the partial sums of a Dirichlet product.

(Sections 3.1 – 3.12 of chapter 3)

**UNIT-III**

**SOME ELEMENTARY THEOREMS ON THE DISTRIBUTION OF PRIME NUMBERS:-** introduction – chebushev's function  $\psi(x)$  and  $\theta(x)$ - Relations connecting  $\psi(x)$  and  $\theta(x)$  – Some equivalent forms of the prime number theorem 0- inequalities for  $\psi(x)$  and  $p_n$  – Shapiro's Tauberian theorem – Applications of Shapiro's theorem – An asymptotic formula for the partial sums  $\sum_{p \leq x} (1/p)$ - The partial sums of the Mobius function.

(Sections 4.1 – 4.9 of chapter 4)

**UNIT-IV**

**CONGRUENCES :-** Definition and basic properties of congruences – Residue classes and complete residue systems – linear congruences – Reduced residue systems and the Euler-Fermat theorem – Polynomial congruences modulo  $p$ . Lagrange's theorem –Applications of Lagrange's theorem – Simultaneous linear congruences. The Chinese remainder Theorem- Applications of the Chinese remainder Theorem – Polynomial congruences with prime power moduli.

(Sections 5.1 – 5.9 of chapter 5)

**TEXT BOOK :** Introduction to Analytic Number Theory – By T.M.APOSTOL – Springer

Verlag New York, Heidelberg – Berlin – 1976.

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**M304 - PARTIAL DIFFERENTIAL EQUATIONS**

**UNIT I**

Introduction, Methods of Solution of  $dx/P = dy/Q = dz/R$ , Orthogonal trajectories of a system of curves on a surface, Pfaffian Differential forms and equations, Solutions of Pfaffian differential equations in three variables, Cauchy's problem for first order partial differential equations. ( Sections 3 to 6 of Chapter 1, Sections 1 to 3 of Chapter 2)

**UNIT II**

Linear Equations of the first order, Integral surfaces, orgonal surfaces, non linear partial differential equations of the first order, Cauchy's method of characteristics, Compatible systems of first order equations, Charpit's Method, Special types of first order equations, Jacobi's method.( Sections 4 to 13 of Chapter 2)

**UNIT III**

Partial Differential Equations of the second order, Their origin, Linear partial Differential equations with constant and variable coefficients, Solutions of linear hyperbolic equations, Method of separation of variables, Monger's method.  
(Sections 1 to 5 and Sections 8,9,11 of Chapter 3)

**UNIT IV**

Laplace Equation, elementary solutions, families of equipotential surfaces, Boundary value problems, Method of separation of variables of solving Laplace equation, problems with axial symmetry, Kelvin's inversion theorem, The wave equat, Elementary solution in one dimensional form, Riemann-Volterra solution of one dimensional wave equation.  
(Sections 1 to 7 pf Chapter 4 and Sections 1 to 3 of Chapter 5)

**TEXT BOOK:**

[1] Elements of Partial Differential Equations by I.N.Sneddon, Mc Graw Hill, International Edition, Mathematics series.

**REFERENCE BOOK:**

1 Fritz John, Partial Differential Equations, Narosa Publishing House, New Delhi, 1979

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**M305.1 – LATTICE THEORY**

**UNIT-I:**

Partially Ordered sets – Diagrams – Special subsets of a poset – length – lower and upper bounds – the minimum and maximum condition – the Jordan Dedekind chain conditions – dimension functions.

(Sections 1 – 9 of Chapter 1)

**UNIT-II:**

Algebras – lattices – the lattice theoretic duality principle – semi lattices – lattices as posets – diagrams of lattices – semi lattices, ideals – bound elements of Lattices – atoms and dual atoms – complements, relative complements, semi complements – irreducible and prime elements of a lattice – the homomorphism of a lattice – axioms systems of lattices.

(Sections 10 - 21 of Chapter 2).

**UNIT-III:**

Completer lattices – complete sub lattices of a completer lattice – conditionally complete lattices – lattices – compact elements, compactly generated lattices – sub algebra lattice of an algebra – closure operations – Galois connecitons, Dedekind cuts – partilally ordered sets as topological spaces..

(Sections 22 - 29 of Chapter 3)

**UNIT-IV**

Distributive lattices – infinitely distributive and completely distributive lattices – modular lattices – characterization of modular and distributive lattices by their sub lattices – distributive sublattices of modular lattices – the isomorphism theorem of modular lattices, coveing conditions- meet representations in modular and distributive lattices – some special subclasses of the class of modular lattices – preliminary theorems – modular lattices of locally finite length – the valuation of a lattice, metric and quasi metric lattices – complemented modular lattices.

(Sections 30 – 40 of Chapter 4)

**TEXT BOOK:** Introduction to Lattice Theory by Gabor Szasz, Academic Press, New York

**REFERENCE :**

General Lattice theory by G.Gratzer, Academic Press, New York.



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**M401 – MEASURE THEORY**

**UNIT-I**

Measure spaces, Measurable functions, Integration, general convergence theorems.

(Section 3 of Chapter 6, Sections 1 to 4 of Chapter 11)

**UNIT-II**

Signed Measures, The Raydon – Nikodym Theorem, the  $L^p$  Spaces

(Sections 5 to 7 of Chapter 11)

**UNIT-III**

Outer measure and measurability, The Extension theorem, Product measures.

(Sections 1 to 4 of Chapter 12)

**UNIT-IV**

Inner measure, Extension by sets of measure zero, Carathéodory outer measure, Hausdorff measure. (Sections 5 to 9 of Chapter 12)

**TEXT BOOK:** H.L.Royden, Real Analysis, Macmillan Publishing Company, New York,

Third Edition, 1988



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**M 402 – NUMERICAL ANALYSIS**

**UNIT I**

Transcendental and polynomial equations: Introduction, Bisection method, Iteration methods based on first degree equation; Secant method, Regula-falsi method, Newton-Raphson method, Iteration method based on second degree equation; Mullers method, Chebyshev method, Multipoint iterative method, Rate of convergence of secant method, Newton Raphson method,

**Unit II**

System of linear algebraic equation: Direct methods, Gauss elimination method, Triangularization method, Cholesky method, Partition method, Iteration method: Gauss seidel Iterative method, OR method.

**UNIT III**

Interpolation and Approximation: Introduction, Lagrange and Newton's divided difference interpolation, Finite difference operators, sterling and Bessel interpolation, Hermite interpolation, piecewise and Spline Interpolation, least square approximation.

**UNIT IV**

Numerical Differentiation: methods based on Interpolation, methods based on Finite difference operators Numerical Integration: methods based on Interpolation, Newton's cotes methods, methods based on Undetermined coefficients, Gauss Legendre Integration method, Numerical methods ODE: Single step methods: Euler's method, Taylor series method, Runge kutte second and forth order methods, Multistep methods: Adam Bash forth method, Adam Moulton methods, Milne-Simpson method.

Text Book: [1] Numerical Methods for Scientific and Engineering computation by M.K.

Jain, S.R.K. Iyengar, R.K. Jain, New Age Int. Ltd., New Delhi.

Reference: [1] Introduction to Numerical Analysis, by S.S. Sastry, Prentice Hall India.



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**M405.1 - GRAPH THEORY**

**UNIT I**

Basic concepts, Isomorphism, Euclidian and Hamilton Graphs, Trees, Properties of Trees, Spanning Trees, Connectivity and Separability, Network flows.

(Chapters 1,2,3 and Sections 4.1 to 4.6 of Chapter 4 of the text book 1)

**UNIT II**

Planar graphs, Kuratowski's two graphs, Different representations of planar graphs, Detection of Planarity, Geometric and Combinational Duals of a graph, Vector spaces of a Graph.

(Sections 5.1 to 5.7 Chapter 5 and Sections 6.5 to 6.9 of Chapter 6 of the text book 1)

**UNIT III**

Matrix representation of graphs, Incidence and circuit matrices of a graph, Fundamental Circuit matrix, Application to a Switching network, Cut set and Path Matrices, Adjacency matrices, Directed Graphs, Trees with directed Edges, Incidence and adjacency matrix of a digraph.

(Chapter 7 and Sections 9.1 to 9.6, 9.8 and 9.9 of Chapter 9 of text book 1)

**UNIT IV**

Coloring, Covering and Partitioning, Chromatic number, Chromatic Partitioning, Chromatic polynomial, Matchings, Coverings, The four color problem, Applications of graph theory in Operations Research.

(Chapters 8 and Sections 14.1 to 14.3 of chapter 14 of text book 1)

**TEXT BOOK :** Graph Theory with applications to Engineering and Computer Science by  
Narasingh Deo; Prentice – Hall of India.

**REFERENCES:**

1. Graph Theory with applications by Bond JA and Murthy USR, North Holland, New York.
  2. Introduction to Graph Theory by Douglas B. West. Prentice Hall of India.
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**M404 - LINEAR PROGRAMMING**

**UNIT I**

Formulation of Linear Programming problems, Graphical solution of Linear Programming problem, General formulation of Linear Programming problems, Standard and Matrix forms of Linear Programming problems, Simplex Method.

**UNIT II**

Two-phase method, Big-M method, Method to resolve degeneracy in Linear Programming problem, Alternative optimal solutions. Solution of simultaneous equations by simplex Method, Inverse of a Matrix by simplex Method, Concept of Duality in Linear Programming, Comparison of solutions of the Dual and its primal.

**UNIT III**

Mathematical formulation of Assignment problem, Reduction theorem, Hungarian Assignment Method, Travelling salesman problem, Formulation of Travelling Salesman problem as an Assignment problem, Solution procedure.

**UNIT IV**

Mathematical formulation of Transportation problem, Tabular representation, Methods to find initial basic feasible solution, North West corner rule, Lowest cost entry method, Vogel's approximation methods, Optimality test, Method of finding optimal solution, Degeneracy in transportation problem, Method to resolve degeneracy, Unbalanced transportation problem.

**TEXT BOOKS:**

[1] S. D. Sharma, Operations Research.

**REFERENCE BOOKS:**

[1] Kanti Swarup, P. K. Gupta and Manmohan, Operations Research.

[2] H. A. Taha, Operations Research – An Introduction.





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**M405.3 - ADVANCED DIFFERENTIAL EQUATIONS**

**UNIT I**

Boundary value problems: Preliminaries – Sturm – Liouville Problem – Green's function – Application of Boundary Value Problem – Picard's theorem.

[Chapter 7 of prescribed text book.]

**UNIT II**

Oscillations of second order equations: Fundamental results – Sturm's Comparisons theorem – Elementary linear oscillations – Comparisons theorem of Hille – Wintner – oscillations of  $x'' + a(t)x = 0$ .

[Chapter 8 of prescribed text book.]

**UNIT III**

Stability of linear and nonlinear systems: preliminaries – Elementary critical points – system of equations with constant coefficients – Linear equation with constant coefficients – Lyapunov stability – stability of quasi linear systems – second order linear differential equations.

[Chapter 9 of prescribed text book.]

**UNIT IV**

Equations with deviating arguments: Preliminaries – equations with constant delay – Equations with piecewise constant delay – a few other types of delay equations.

[Chapter 11 of prescribed text book.]

**TEXT BOOK:**

S.G. Deo, V. Lakshmikantham and V. Raghavendra: Text book of ordinary Differential equations, Second edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1997.

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**DEPARTMENT OF PHYSICS**  
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Common for M.Sc. Physics and M.Sc. Space Physics  
I Semester (w.e.f 2009-10 batch)

		<b>MARKS</b>
<b>P 101.</b>	<b>CLASSICAL MECHANICS</b>	<b>85+15=100</b>
<b>P 102.</b>	<b>INTRODUCTORY QUANTUM MECHANICS.</b>	<b>85+15=100</b>
<b>P 103.</b>	<b>MATHEMATICAL METHODS OF PHYSICS</b>	<b>85+15=100</b>
<b>P 104.</b>	<b>ELECTRONIC DEVICES AND CIRCUITS</b>	<b>85+15=100</b>
<b>P105</b>	<b>Modern Physics Lab -I</b>	<b>100</b>
<b>P106</b>	<b>Electronics Lab -I</b>	<b>100</b>

**TOTAL MARKS**

**600**

*For Each Theory Paper 85 marks for semester end exam and 15 marks for internal assessment*

**SCHEME OF EXAMINATION**

<b>Theory pass minimum</b>	<b>40%</b>
<b>Practical pass minimum</b>	<b>50%</b>
<b>Aggregate</b>	<b>50%</b>

**SCHEME OF INSTRUCTION :**

<b>Teaching Hours</b>	<b>4 Periods per week</b>
<b>Tutorial</b>	<b>1 Period per week</b>
<b>Practical</b>	<b>6 Periods per week</b>

**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**

**Common for M.Sc. Physics and M.Sc. Space Physics**  
**I Semester**  
**(w.e.f 2009-10 batch)**

**P101,SP101: CLASSICAL MECHANICS.**

**UNIT-I:** Mechanics of a particle. Mechanics of a system of particles, constraints, D'Alembert's principle and Lagrange's equations, Velocity Dependent potentials and the Dissipation function Simple applications of the Lagrangian Formulation

**5 Hrs.**

Chapter : 1. Section : 1, 2, 3, 4,5 & 6 .

Hamilton's principle, some techniques of the calculus of variations. Derivation of Lagrange's equations from Hamilton's principle. Conservation theorems and symmetry properties, Energy function and the conservation of Energy

**6 Hrs.**

Chapter : 2. Section : 1, 2, 3, 5, 6

**UNIT-II:** Reduction to the equivalent one body problem. The equation of motion and first Integrals, The equivalent One – Dimensional problem and classification of orbits, The differential equation for the orbit, and Integrable power –law potentials, Conditions for closed orbits (Bertrand's theorem), The Kepler problem inverse square law of force , The motion in time in the Kepler problem, Scattering in a central force field..

Chapter : 3. Section. 1, 2, 3, 5, 6, 7, 8

**7 Hrs**

Legendre transformations and Hamilton's equations of motion. Cyclic Coordinates and conservation theorems, Derivation of Hamilton's equation of motion from variational principle, Principle of Least Action.

**6 Hrs**

Chapter : 7 Section: 1, 2,3,4 5 .

**UNIT-III:** Equations of canonical transformation, Examples of Canonical transformations, The harmonic Oscillator, Poisson brackets and other Canonical invariants, Equations of motion, Infinitesimal canonical transformations, and conservation theorems in the poisson bracket formulation, the angular momentum poisson bracket relations.

**5Hrs**

Chapter : 8. Section : 1 , 2 ,4, 5, 6 & 7.

Hamilton – Jacobi equation of Hamilton's principal function, The Harmonic oscillator problem as an example of the Hamilton – Jacobi Method, Hamilton –Jacobi equation for Hamilton's characteristic function. Action – angle variables in systems of one degree of freedom.

**8 Hrs.**

Chapter : 9. Section : 1, 2, 3, & 5.

**UNIT-IV:** Independent coordinates of rigid body. , The Euler angles, Euler's theorem on the Motion of a rigid body, Infinitesimal rotations, Rate of change of a vector, The Coriolis Effect.

Chapter : 4. Section : 1, 4, 6, 8, 9 .

The Inertia tensor and the moment of inertia, The Eigenvalues of the inertia tensor and the principal axis transformation, Solving rigid body problems and Euler equations of motion, Torque – free motion of a rigid body

**6 Hrs**

Chapter 5 Section: 3, 4, 5 & 6.

The Eigenvalue equation and the principal axis transformation, Frequencies of free vibration, and normal coordinates, Free vibrations of a linear triatomic molecule

Chapter 10 Section: 2, 3 & 4 .

**6**

**Hrs**

**TEXT BOOKS :** Classical Mechanics H.Goldstein (Addison-Wiley, 1<sup>st</sup> & 2<sup>nd</sup> ed)

**REFERENCE BOOK:** Classical Dynamics of Particles and Systems J.B.Marion.

**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**

**Common for M.Sc. Physics and M.Sc. Space Physics**  
**I Semester**  
**(w.e.f 2009-10 batch)**

**P102,SP102 : INTRODUCTORY QUANTUM MECHANICS**

**UNIT-I:** The Conceptual aspect :Wave particle duality,Bohr's complementarity principle.Wave function and its interpretation -Principle of superposition-Wave packets – phase velocity and group velocity-Uncertainty relation Postulates of Quantum Mechanics - Schrodinger wave equation - Conservation of probability

**UNIT-II:** Operators and their properties - Equation of Motion for operators, Hermitian operators and their Eigen values and eigen functions Stationary states, Bohr's correspondence principle - Coordinate and Momentum representation- Ehrenfest's theorem Commutator Algebra.- Dirac Delta function, definition and properties. Dirac Delta Normalization

**UNIT-III:** One dimensional problems - Free Particle, Particle in a box- Potential step, potential Well, Rectangular Potential Barrier - Linear Harmonic Oscillator Angular Momentum, Angular Momentum in spherical polar coordinates, Eigenvalues and eigenfunctions of  $L^2$ ,  $L_z$ ,  $L_+$  and  $L_-$  operators. Eigen values and eigen functions of Rigid rotator and Hydrogen atom. Commutation relations, electron spin.

**UNIT-IV:** Time- independent perturbation theory for(i) non degenerate systems and application to Hydrogen atom: Kinetic energy correction, spin-orbit interaction, fine structure. Ground state of Helium atom.

ii) degenerate systems, application to linear stark effect in Hydrogen.  
Variation method and its application to Helium atom.  
Exchange energy and low lying excited states of Helium atom.  
Interaction of electromagnetic radiation with matter. Selection rules.

**Text Book :**

Quantum Mechanics R.D. RATNA RAJU

**Reference Books :**

1. Quantum Mechanics Aruldas
2. Quantum Mechanics G. S. Chaddha
3. Quantum Mechanics B.H.Bransden and C.J.Joachain
4. Quantum Mechanics E. Merzbacher
5. Quantum Mechanics Richard Liboff

**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**

**Common for M.Sc. Physics and M.Sc. Space Physics**  
**I Semester**  
**(w.e.f 2009-10 batch)**

**P103,SP103: Mathematical Methods of Physics**

**Unit I : Complex Variables**

**15 Hrs**

Function of complex number- definition-properties, analytic function-Cauchy –Riemann conditions-polar form-problems, Complex differentiation, complex integration –Cauchy’s integral theorem-Cauchy’s integral formulae-multiply connected region- problems, Infinite series-Taylor’s theorem-Laurent’s theorem-Problems, Cauchy’s Residue theorem- evaluation of definite integrals-problems.

**Text Book:** 1. Mathematical Methods of Physics-G.Arffen, Academic Press

2. Mathematical Physics-Satya Prakash, Sultan Chand & co, New Delhi

3. Complex Variables ( Schaum’s out line series) Murray R. Spiegel

**Ref Book:** Mathematical Methods B.D.Gupta

**Unit II : Beta , Gamma functions & Special functions**

**10 Hrs**

Beta & Gamma functions -definition, relation between them- properties-evaluation of some integrals

Special Functions- Legendre Polynomial, Hermite Polynomial, Laguerre Polynomial-Generating function-recurrence relations-Rodrigue’s formula-orthonormal property-associated Legendre polynomial- simple recurrence relation-orthonormal property-spherical harmonics

**Text Book:** 1. Mathematical Methods of Physics-G.Arffen, Academic Press

2. Mathematical Physics-Satya Prakash, Sultan Chand & co, New Delhi

3. Mathematical Physics B S Rajput

**Ref book :** Special Functions .M.D.Raisinghania

**Unit III : Laplace Transforms & Fourier series, Fourier Transforms**

**15 Hrs**

Laplace Transforms – definition- properties – Laplace transform of elementary functions-Inverse Laplace transforms-properties- evaluation of Inverse Laplace Transforms-elementary function method-Partial fraction method-Heavyside expansion method-Convolution method-complex inversion formula method-application to differential equations Fourier series-evaluation of Fourier coefficients- Fourier integral theorem-problems-square wave-rectangular wave-triangular wave

Fourier Transforms- infinite Fourier Transforms-Finite Fourier Transforms-Properties-problems-application to Boundary value problem

**Text Book:** 1. Mathematical Methods of Physics-G.Arffen, Academic Press

2. Mathematical Physics-Satya Prakash, Sultan Chand & co, New Delhi

3. Laplace n Fourier Transforms Goyal & Gupta,

**Ref books:** Integral Transforms M.D.Raisinghanna

Integral Transforms Goyal & Gupta

Mathematical Physics B S Rajput

**Unit IV: Numerical Analysis**

**10 Hrs**

Solutions of algebraic and Transcendental equations-Bisection method-method of successive approximations-method of false position Iteration method-Newton Rapson method

Simultaneous linear algebraic equations-Gauss elimination method-Gauss Jordan method-Matrix inversion method-jacobi method – Gauss-Siedel method

Interpolation with equal intervals-Finite differences-Newton Forward & Backward

Interpolation formulæ Interpolation with unequal intervals-Newtons divided difference

formula-Lagrange interpolation formula Numerical Integration-General Quadrature formula-Trapezoidal rule -Simpson’ 1/3 rule & 3/8 rule

**Text Books:** **Introductory methods of Numerical analysis S.S.Sastry**

**Numerical Methods V.N.Vedamurthy & N.Ch.S.N.Iyengar**

**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**  
Common for M.Sc. Physics and M.Sc. Space Physics  
I Semester  
(w.e.f 2009-2010 admitted batch of students)  
**P104,SP104: ELECTRONIC DEVICES AND CIRCUITS**

**UNIT-I**

**SEMICONDUCTOR DEVICES: 10 Hrs.**  
Tunnel diode, photo diode, solar cell, LED, Silicon controlled Rectifier,  
Uni Junction Transistor, Field Effect Transistor, (JFET & MOSFET), CMOS

**UNIT-II**

**MICROWAVE DEVICES: 15 Hrs.**  
Varactor diode, Parametric Amplifier, Thyristors, Klystron, Reflex Klystron,  
Gunn Diode, Magnetron, CFA, TWT, BWO, IMPATT, TRAPATT, APD, PIN Diode,  
Schottky Barrier Diode.

**UNIT-III**

**OPERATIONAL AMPLIFIERS : 10 Hrs.**  
The ideal Op Amp – Practical inverting and Non inverting Op Amp stages. Op Amp  
Architecture – differential stage, gain stage, DC level shifting, output stage, offset  
voltages and currents  
Operational Amplifier parameters- input offset voltage, input bias current ,  
Common Mode Rejection Ratio, Slew Rate

**UNIT-IV**

**OP- AMP APPLICATIONS: 15 Hrs.**  
Summing amplifier, Integrator, Differentiator,  
Voltage to Current converter, Current to Voltage converter  
Oscillators – Phase shift oscillator, Wien-Bridge Oscillator, Voltage Controlled Oscillator,  
Schmitt Trigger  
Special applications – Monostable and Astable multivibrators using 555, Phase locked  
Loop, Voltage regulators.

**TEXT BOOKS:**

1. Integrated Electronics - Jacob Millman & C.C. Halkies (TMH)
2. Op.Amps and Linear Integrated Circuits – Ramakant A.Gayakwad (PHI)
3. Electronic Communication Systems – George Kennedy (PHI)

**REFERENCE BOOKS:**

1. Microelectronics - Jacob Millman & Arvin Grabel (McGraw Hill)
2. Electronic Devices and Circuits – G.K. Mithal (Khanna)
3. Op-amps and Linear Integrated Circuits – D. Mahesh Kumar (MacMillan).

**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**

Common for M.Sc. Physics and M.Sc. Space Physics  
I Semester  
(w.e.f 2009-10 batch)

**P105 / SP105 : MODERN PHYSICS LAB - I**

1. Atomic Spectrum of Zinc.
  - a) Verification of Lande's interval rule
  - b) Study of relative intensities
  
2. Grating spectrometer
  - a) Wavelengths of Hg spectrum,
  - b) wavelength of Balmer series, Rydberg constant
  
3. Reciprocal dispersion curve
4. Application of Point Groups.
  - a) Identification of symmetry operations in  $H_2O$ ,  $BH_3$ ,  $NH_3$  and  $H_2CO$
  - b) Reducible representations and Vibrational modes of  $H_2O$ .
5. Determination of Planck's constant, work function and threshold frequency
6. Band gap of a semiconductor. (Two Probe Method)
7. Thermo emf
8. The Franck-Hertz experiment
9. Band spectrum of CN in the violet
  - a) conversion of given wavelengths to wavenumbers and assignment of  $(\nu, \nu')$
  - b) Deslandres' table and Vibrational constants.

**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**Common for M.Sc. Physics and M.Sc. Space Physics**  
**I Semester**  
**(w.e.f 2009-10 batch)**  
**P106/SP106: ELECTRONICS LAB -I**

**LIST OF EXPERIMENTS**

- |                                     |              |
|-------------------------------------|--------------|
| 1. FET amplifier                    | (BFW 10/11 ) |
| 2. Negative feedback amplifier      | (BC 147 )    |
| 3. Colpitts Oscillator              | (BF 194)     |
| 4. Phase shift Oscillator           | (BC 147)     |
| 5. Astable Multivibrator            | (BF 194)     |
| 6. Op.Amp.Characteristics           | (IC 741 )    |
| 7. Power Supply                     |              |
| 8. UJT Characteristics              | (2 N 2646 )  |
| 9. R.F.Amplifier                    | (BF 194)     |
| 10. Boot-strap time based generator | (2N 2222)    |



**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**

**Common for M.Sc. Physics and M.Sc. Space Physics**  
**I Semester (w.e.f 2009-10 batch)**

**P101,SP101: CLASSICAL MECHANICS.**

**UNIT-I:** Mechanics of a particle. Mechanics of a system of particles, constraints, D'Alembert's principle and Lagrange's equations, Velocity Dependent potentials and the Dissipation function Simple applications of the Lagrangian Formulation

**5 Hrs.**

Chapter : 1. Section : 1, 2, 3, 4,5 & 6 .

Hamilton's principle, some techniques of the calculus of variations. Derivation of Lagrange's equations from Hamilton's principle. Conservation theorems and symmetry properties. Energy function and the conservation of Energy

**6 Hrs.**

Chapter : 2. Section : 1, 2, 3, 5, 6

**UNIT-II:** Reduction to the equivalent one body problem. The equation of motion and first Integrals, The equivalent One – Dimensional problem and classification of orbits, The differential equation for the orbit, and Integrable power –law potentials, Conditions for closed orbits (Bertrand's theorem), The Kepler problem inverse square law of force , The motion in time in the Kepler problem, Scattering in a central force field..

Chapter : 3. Section. 1, 2, 3, 5, 6, 7, 8

**7 Hrs**

Legendre transformations and Hamilton's equations of motion. Cyclic Coordinates and conservation theorems, Derivation of Hamilton's equation of motion from variational principle, Principle of Least Action.

**6 Hrs**

Chapter : 7 Section: 1, 2,3,4 5 .

**UNIT-III:** Equations of canonical transformation, Examples of Canonical transformations, The harmonic Oscillator, Poisson brackets and other Canonical invariants, Equations of motion, Infinitesimal canonical transformations, and conservation theorems in the poisson bracket formulation, the angular momentum poisson bracket relations.

**5Hrs**

Chapter : 8. Section : 1, 2, 4, 5, 6 & 7.

Hamilton – Jacobi equation of Hamilton's principal function, The Harmonic oscillator problem as an example of the Hamilton – Jacobi Method, Hamilton –Jacobi equation for Hamilton's characteristic function. Action – angle variables in systems of one degree of freedom.

**8 Hrs.**

Chapter : 9. Section : 1, 2, 3, & 5.

**UNIT-IV:** Independent coordinates of rigid body. , The Euler angles, Euler's theorem on the Motion of a rigid body, Infinitesimal rotations, Rate of change of a vector, The Coriolis Effect.

Chapter : 4. Section : 1, 4, 6, 8, 9 .

The Inertia tensor and the moment of inertia, The Eigenvalues of the inertia tensor and the principal axis transformation, Solving rigid body problems and Euler equations of motion, Torque – free motion of a rigid body

**6 Hrs**

Chapter 5 Section: 3, 4, 5 & 6.

The Eigenvalue equation and the principal axis transformation, Frequencies of free vibration, and normal coordinates, Free vibrations of a linear triatomic molecule

Chapter 10 Section: 2, 3 & 4 .

**6 Hrs**

**TEXT BOOKS :** Classical Mechanics H.Goldstein (Addison-Wiley, 1<sup>st</sup> & 2<sup>nd</sup> ed)

**REFERENCE BOOK :** Classical Dynamics of Particles and Systems J.B.Marion.

**P102,SP102 : INTRODUCTORY QUANTUM MECHANICS**

**UNIT-I:** The Conceptual aspect :Wave particle duality,Bohr's complementarity principle.Wave function and its interpretation - Principle of superposition-Wave packets – phase velocity and group velocity-Uncertainty relation Postulates of Quantum Mechanics - Schrodinger wave equation - Conservation of probability

**UNIT-II:** Operators and their properties - Equation of Motion for operators, Hermitian operators and their Eigen values and eigen functions Stationary states, Bohr's correspondence principle - Coordinate and Momentum representation- Ehrenfest's theorem Commutator Algebra.- Dirac Delta function, definition and properties. Dirac Delta Normalization

**UNIT-III:** One dimensional problems - Free Particle, Particle in a box- Potential step, potential Well, Rectangular Potential Barrier - Linear Harmonic Oscillator Angular Momentum, Angular Momentum in spherical polar coordinates, Eigenvalues and eigenfunctions of  $L^2$ ,  $L_z$ ,  $L_+$  and  $L_-$  operators. Eigen values and eigen functions of Rigid rotator and Hydrogen atom. Commutation relations, electron spin.

**UNIT-IV:** Time- independent perturbation theory for(i) non degenerate systems and application to Hydrogen atom: Kinetic energy correction, spin-orbit interaction, fine structure. Ground state of Helium atom.

ii) degenerate systems, application to linear stark effect in Hydrogen.

Variation method and its application to Helium atom.

Exchange energy and low lying excited states of Helium atom.

Interaction of electromagnetic radiation with matter. Selection rules.

**Text Book :**

Quantum Mechanics R.D. RATNA RAJU

**Reference Books :**

6. Quantum Mechanics Aruldas
7. Quantum Mechanics G. S. Chaddha
8. Quantum Mechanics B.H.Brandsen and C.J.Joachain
9. Quantum Mechanics E. Merzbacher
10. Quantum Mechanics Richard Liboff

P103,SP103: Mathematical Methods of Physics

**Unit I : Complex Variables**

**15 Hrs**

Function of complex number- definition-properties, analytic function-Cauchy –Riemann conditions-polar form-problems, Complex differentiation, complex integration –Cauchy’s integral theorem- Cauchy’s integral formulae-multiply connected region- problems, Infinite series-Taylor’s theorem- Laurent’s theorem-Problems, Cauchy’s Residue theorem- evaluation of definite integrals-problems.

**Text Book:** 1. Mathematical Methods of Physics-G.Arken, Academic Press  
2. Mathematical Physics-Satya Prakash, Sultan Chand & co, New Delhi  
3. Complex Variables ( Schaum’s out line series) Murray R. Spiegel

**Ref Book:** Mathematical Methods B.D.Gupta

**Unit II : Beta , Gamma functions & Special functions**

**10 Hrs**

Beta & Gamma functions -definition, relation between them- properties-evaluation of some integrals

**Special Functions-** Legendre Polynomial, Hermite Polynomial, Laguerre Polynomial-Generating function-recurrence relations- Rodrigue’s formula-orthonormal property-associated Legendre polynomial- simple recurrence relation-orthonormal property-spherical harmonics

**Text Book:** 1. Mathematical Methods of Physics-G.Arken, Academic Press  
2. Mathematical Physics-Satya Prakash, Sultan Chand & co, New Delhi  
3. Mathematical Physics B S Rajput

**Ref book :** Special Functions .M.D.Raisinghania

**Unit III : Laplace Transforms & Fourier series, Fourier Transforms**

**15 Hrs**

Laplace Transforms – definition- properties – Laplace transform of elementary functions-Inverse Laplace transforms-properties-evaluation of Inverse Laplace Transforms-elementary function method-Partial fraction method-Heavyside expansion method-Convolution method-complex inversion formula method-application to differential equations Fourier series-evaluation of Fourier coefficients- Fourier integral theorem-problems-square wave-rectangular wave-triangular wave  
Fourier Transforms- infinite Fourier Transforms-Finite Fourier Transforms-Properties-problems-application to Boundary value problem

**Text Book:** 1. Mathematical Methods of Physics-G.Arken, Academic Press  
2. Mathematical Physics-Satya Prakash, Sultan Chand & co, New Delhi  
3. Laplace n Fourier Transforms Goyal & Gupta,

**Ref books:** Integral Transforms M.D.Raisinghanna  
Integral Transforms Goyal & Gupta  
Mathematical Physics B S Rajput

**Unit IV: Numerical Analysis**

**10 Hrs**

Solutions of algebraic and Transcendental equations-Bisection method-method of successive approximations-method of false position Iteration method-Newton Rapson method Simultaneous linear algebraic equations-Gauss elimination method-Gauss Jordan method-Matrix inversion method-jacobi method – Gauss-Siedel method  
Interpolation with equal intervals-Finite differences-Newton Forward & Backward Interpolation formulæ Interpolation with unequal intervals-Newton’s divided difference formula-Lagrange interpolation formula Numerical Integration-General Quadrature formula-Trapezoidal rule -Simpson’s 1/3 rule & 3/8 rule

**Text Books:** **Introductory methods of Numerical analysis S.S.Sastry**  
**Numerical Methods V.N.Vedamurthy & N.Ch.S.N.Iyengar**

P104,SP104: ELECTRONIC DEVICES AND CIRCUITS

**UNIT-I: SEMICONDUCTOR DEVICES:**

**10 Hrs.**

Tunnel diode, photo diode, solar cell, LED, Silicon controlled Rectifier, Uni Junction Transistor, Field Effect Transistor, (JFET & MOSFET), CMOS

**UNIT-II: MICROWAVE DEVICES:**

**15 Hrs.**

Varactor diode, Parametric Amplifier, Thyristors, Klystron, Reflex Klystron, Gunn Diode, Magnetron, CFA, TWT, BWO, IMPATT, TRAPATT, APD, PIN Diode, Schottky Barrier Diode.

**UNIT-III: OPERATIONAL AMPLIFIERS :**

**10 Hrs.**

The ideal Op Amp – Practical inverting and Non inverting Op Amp stages. Op Amp Architecture – differential stage, gain stage, DC level shifting, output stage, offset voltages and currents

Operational Amplifier parameters- input offset voltage, input bias current , Common Mode Rejection Ratio, Slew Rate

**UNIT-IV**

**15 Hrs.**

**OP- AMP APPLICATIONS:**

Summing amplifier, Integrator, Differentiator, Voltage to Current converter, Current to Voltage converter  
Oscillators – Phase shift oscillator, Wien-Bridge Oscillator, Voltage Controlled Oscillator, Schmitt Trigger  
Special applications – Monostable and Astable multivibrators using 555, Phase locked Loop, Voltage regulators.

**TEXT BOOKS:**

1. Integrated Electronics - Jacob Millman & C.C. Halkies (TMH)
2. Op.Amps and Linear Integrated Circuits – Ramakant A.Gayakwad (PHI)
3. Electronic Communication Systems – George Kennedy (PHI)

**REFERENCE BOOKS:**

1. Microelectronics - Jacob Millman & Arvin Grabel (McGraw Hill)
2. Electronic Devices and Circuits – G.K. Mithal (Khanna)
3. Op-amps and Linear Integrated Circuits – D. Mahesh Kumar (MacMillan).

DEPARTMENT OF PHYSICS  
ANDHRA UNIVERSITY  
Common for M.Sc. Physics and M.Sc. Space Physics  
I Semester(w.e.f 2009-10 batch)

**P105 / SP105 : MODERN PHYSICS LAB - I**

1. Atomic Spectrum of Zinc.
  - a) Verification of Lande's interval rule
  - b) Study of relative intensities
2. Grating spectrometer
  - a) Wavelengths of Hg spectrum,
  - b) wavelength of Balmer series, Rydberg constant
3. Reciprocal dispersion curve
4. Application of Point Groups.
  - a) Identification of symmetry operations in  $H_2O$ ,  $BH_3$ ,  $NH_3$  and  $H_2CO$
  - b) Reducible representations and Vibrational modes of  $H_2O$ .
5. Determination of Planck's constant, work function and threshold frequency
6. Band gap of a semiconductor. (Two Probe Method)
7. Thermo emf
8. The Franck-Hertz experiment
9. Band spectrum of CN in the violet
  - a) conversion of given wavelengths to wavenumbers and assignment of ( $\nu'$ ,  $\nu''$ )
  - b) Deslandres' table and Vibrational constants.

ANDHRA UNIVERSITY  
DEPARTMENT OF PHYSICS  
Common for M.Sc. Physics and M.Sc. Space Physics  
I Semester (w.e.f 2009-10 batch)

**P106/SP106: ELECTRONICS LAB -I**

**LIST OF EXPERIMENTS**

- |                                     |              |
|-------------------------------------|--------------|
| 1. FET amplifier                    | (BFW 10/11 ) |
| 2. Negative feedback amplifier      | (BC 147 )    |
| 3. Colpitts Oscillator              | (BF 194)     |
| 4. Phase shift Oscillator           | (BC 147)     |
| 5. Astable Multivibrator            | (BF 194)     |
| 6. Op.Amp.Characteristics           | (IC 741 )    |
| 7. Power Supply                     |              |
| 8. UJT Characteristics              | (2 N 2646 )  |
| 9. R.F.Amplifier                    | (BF 194)     |
| 10. Boot-strap time based generator | (2N 2222)    |



**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**

**Common for M.Sc. Physics and M.Sc. Space Physics**  
**II Semester (w.e.f 2009-10 batch)**

		<b>MARKS</b>
<b>P 201.</b>	<b>ELECTRODYNAMICS</b>	<b>85+15=100</b>
<b>P 202.</b>	<b>STATISTICAL MECHANICS</b>	<b>85+15=100</b>
<b>P203</b>	<b>ATOMIC AND MOLECULAR PHYSICS</b>	<b>85+15=100</b>
<b>P 204.</b>	<b>NUCLEAR AND PARTICLE PHYSICS</b>	<b>85+15=100</b>
<b>P205</b>	<b>Modern Physics lab - II Practical -75 + record-25</b>	<b>100</b>
<b>P206</b>	<b>ELECTRONICS LAB –II Practical -75 + record-25</b>	<b>100</b>
<b>TOTAL MARKS</b>		<b>600</b>
<b>Choice Based Paper for other Departments in University Campus only</b>		
	<b>INTRODUCTORY ATMOSPHERIC AND SPACE PHYSICS</b>	

*For Each Theory Paper 85 marks for semester end exam and 15 marks for internal assessment*

**SCHEME OF EXAMINATION**

<b>Theory pass minimum</b>	<b>40%</b>
<b>Practical pass minimum</b>	<b>50%</b>
<b>Aggregate</b>	<b>50%</b>

**SCHEME OF INSTRUCTION :**

<b>Teaching Hours</b>	<b>4 Periods per week</b>
<b>Tutorial</b>	<b>1 Period per week</b>
<b>Practical</b>	<b>6 Periods per week</b>

**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**  
**Common for M.Sc. Physics and M.Sc. (Space Physics)**  
**II Semester**  
**(w.e.f 2009-10 batch)**  
**P201,SP201: ELECTRO DYNAMICS.**

**UNIT-I:** Gauss Theorem, Poission's equation, Laplaces equation, solution to Lapalaces equation in cartesian coordiantes, spherical coordinates, cylidrical coordinates, use of Laplaces equation in the solutions of electrostatic problems.  
**6Hrs**

Ampere's circuital law, magnetic vector potential, displacement current, Faraday's law of electromagnetic induction,  
**4Hrs**

**UNIT-II;** Maxwell's equations, differential and integral forms, physical significance of Maxwell's equations.  
**4 Hrs**

Wave equation, plane electromagnetic waves in free space , in nonconducting isotropic medium, in conducting medium, electromagnetic vector and scalar potentials, uniqueness of electromagnetic potentials and concept of gauge, Lorentz gauge, Coulomb gauge,  
**6Hrs**

charged particles in electric and magnetic fields: charged particles in uniform electric field, charged particles in homogorous magnetic fields, charged particles in simultaneous electric and magnetic fields, charged particles in nonhomogeneous magnetic fields.  
**6Hrs**

**UNIT-III:** Lienard-Wiechert potentials, electromagnetic fields from Lienard-wiechert potentials of a moving charge, electromagnetic fields of a uniformly moving charge, radiation due to non-relativistic charges, radiation damping, Abraham-Lorentz formula, cherenkov radiation, radiation due to an oscillatory electric dipole, radiation due to a small current element. Condition for plasma existence, occurrence of plasma, magneto hydrodynamics, plasma waves  
**10 Hrs**

**UNIT-IV:** Transformation of electromagentic potentials, Lorentz condition in covariant form, invariance or covariance of Maxwell field eqations in terms of 4 vectors, electromagnetic field tensor, Lorentz transformation of electric and magnetic fields.  
**12 Hrs**

**Text books:**

- |  |                  |
|--|------------------|
| 1. Classical Electrodynamics :                 | - J.D. Jackson   |
| 2. Introduction to Electrodynamics :           | - D.R. Griffiths |
| 3. .Electromagnetic Theory and Electrodynamics | - Satyaprakash   |
| 4. Electrodynamics                             | - KL Kakani      |

**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**  
**Common for M.Sc. Physics and M.Sc. Space Physics**  
**II Semester**  
**(w.e.f 2009-10 batch)**  
**P202,SP202: STATISTICAL MECHANICS**

**UNIT-I : Basic Methods and Results of Statistical Mechanics: 13 Hrs**

Specification of the state of a system, phase space and quantum states, Liouville's theorem, Basic postulates, Probability calculations, concept of ensembles, thermal interaction, Mechanical interaction, quasi static process, distribution of energy between systems in equilibrium, statistical calculations of thermo dynamic quantities, Isolated systems(Microcanonical ensemble). Entropy of a perfect gas in microcanonical ensemble. Canonical ensemble - system in contact with heat reservoir, system with specified mean energy, connection with thermodynamics, Energy fluctuations in the canonical ensemble . Grand canonical ensemble, Thermodynamic function for the grand canonical ensemble. Density and energy fluctuations in the grand canonical ensemble. Thermodynamic equivalence of ensembles. Reif Ch:2, 3.3,3.12 Ch:6

**UNIT-II : Simple Applications of Statistical Mechanics: 12 Hrs**

Partition functions and their properties. Calculation of thermo dynamic quantities to an ideal mono atomic gas. Gibbs paradox, validity of the classical approximation. Proof of the equipartition theorem. Simple applications – mean K.E. of a molecule in a gas. Brownian motion. Harmonic Oscillator, Specific heats of solids (Einstein and Debye model of solids), Paramagnetism, Partition function for polyatomic molecules, Electronic energy, vibrational energy and rotational energy of a diatomic molecule. Effect of Nuclear spin-ortho and para Hydrogen. Reif Ch:7, Ch:9.12

**UNIT-III: Quantum Statistics: 15 Hrs**

Formulation of the statistical problem. Maxwell–Boltzmann statistics. Photon statistics, Bose-Einstein statistics, Fermi–Dirac statistics, Quantum statistics in the classical limit, calculation of dispersion for MB, BE & FD statistics Equation of state of an Ideal Bose Gas, Black body radiation, Bose-Einstein condensation, Equation of state for a weakly degenerate and strongly degenerate ideal Fermi gas. Thermionic emission. The theory of white dwarf stars. Reif Ch:9

**UNIT-IV: Non Ideal Classical Gas: 10 Hrs**

Calculation of the partition function for low densities. Equation of state and virial coefficients (Van Der Waals equation) Reif Ch:10.3,10.4

**Phase Transitions and Critical Phenomena:**

Phase transitions , conditions for Phase equilibrium, First order Phase transition – the Clausius–Clayperon equation, Second order phase transition, The critical indices, Van der Waals theory of liquid gas transition. Order parameter, Landau theory. Sinha Ch:10

**Text Books**

1. Fundamentals of Statistical and Thermal Physics F. Reif
2. Statistical Mechanics, Theory and Applications S.K. Sinha
3. Statistical Mechanics R.K. Pathria

**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**  
**Common for M.Sc. Physics and M.Sc. Space Physics**  
**II Semester (w.e.f 2009-10 batch)**  
**P203,SP203: ATOMIC AND MOLECULAR PHYSICS.**

**UNIT-I**

**12 Hrs**

**ONE ELECTRON ATOMS :** Quantum numbers, Term values . Relation between Magnetic dipole moment and angular momentum of an orbiting electron. Stern–Gerlach experiment and electron spin . Spin- orbit interaction, relativistic kinetic energy correction and dependence of energy on J value only. Selection rules. Fine structure of Balmer series of Hydrogen and Fowler series of ionized Helium. Hyperfine structure of H $\alpha$  line of hydrogen ( $I = 1/2$ ).

**ONE VALENCE ELECTRON ATOMS:** Modified term values (quantum defect) due to lifting of orbital degeneracy by core penetration (penetrating orbits) and core polarization (non-penetrating orbits) by nl electrons. Term values and fine structure of chief spectral series of sodium. Intensity rules and application to doublets of sodium. Hyperfine structure of  $^2P-^2S$  of sodium ( $I= 3/2$ ).

**UNIT-II**

**10 Hrs**

**MANY ELECTRON ATOMS :** Indistinguishable particles, bosons, fermions. Pauli's principle. Ground states. LS coupling and Hund's rules based on Residual coulombic interaction and spin-orbit interaction. Lande's interval rule. Equivalent and non-equivalent electrons. Spectral terms in LS and JJ coupling (ss, $s^2$ , pp, $p^2$  configurations). Exchange force and Spectral series of Helium.

**Lasers-** spontaneous emission, stimulated emission, population inversion, Einstein coefficients, metastable levels, resonance transfer and population inversion in He-Ne laser.

**UNIT- III**

**8 Hrs**

**ATOMS IN EXTERNAL MAGNETIC FIELD:** Quantum theory of Zeeman and Paschen-Back effects and application to  $^2P-^2S$ ,  $^3P-^3S$ , transitions.

**ATOMS IN EXTERNAL ELECTRIC FIELD:** Linear stark pattern of H $\alpha$  line of hydrogen and Quadratic stark pattern of D<sub>1</sub> and D<sub>2</sub> lines of Sodium.

**UNIT-IV**

**20 Hrs**

**DIATOMIC MOLECULES:** Molecular quantum numbers. Bonding and anti-bonding orbitals from LCAO's. Explanation of bond order for N<sub>2</sub> and O<sub>2</sub> and their ions. Rotational spectra and the effect of isotopic substitution. Effect of nuclear spin functions on Raman rotation spectra of H<sub>2</sub> (Fermion) and D<sub>2</sub> (Boson). Vibrating rotator. Spectrum. Combination relations and evaluation of rotational constants (infrared and Raman). Intensity of vibrational bands of an electronic band system in absorption.(The Franck-Condon principle). Sequences and progressions. Deslandre's table and vibrational constants.

**MOLECULAR VIBRATIONS :** Symmetry operations and identification of point Groups of HCN, CO<sub>2</sub> , BH<sub>3</sub> , NH<sub>3</sub> , H<sub>2</sub>O molecules. Properties of irreducible representations and C<sub>2v</sub> character table. Reducible representation and symmetry of fundamental vibrations of H<sub>2</sub>O

**BOOKS :**

- |   |                |
|---|----------------|
| 1. Atomic and Molecular Spectra           | - Rajkumar     |
| 2. Fundamentals of Molecular Spectroscopy | - C.N.Banwell. |
| 3. Group Theory                           | - K.V.Raman.   |
| 4. Introduction to Atomic Spectra         | - H.E.White.   |



**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**  
**Common for M.Sc. Physics and M.Sc. Space Physics**  
**II Semester**  
**(w.e.f 2009-10 batch)**  
**P204,SP204: NUCLEAR AND PARTICLE PHYSICS**

**UNIT - I**

**INTRODUCTION :**

Objective of Studying Nuclear Physics, Nomenclature, nuclear radius, mass & Binding energy, angular momentum, magnetic dipole moment, Electric quadrupole moment, parity and symmetry, domains of instability, Energy levels, mirror nuclei.

**NUCLEAR FORCES** : Simple theory of the deuteron, scattering cross-sections, qualitative discussion of neutron- proton and proton- proton scattering, charge independence and charge symmetry of nuclear forces, exchange forces, Yukawa's Potential, Characteristics of Nuclear Forces.

**UNIT - II**

**NUCLEAR MODELS** . Liquid drop model:, Weissacker's semi-empirical mass formula, Mass – parabolas. Nuclear shell model : Spin orbit interaction, magic numbers, prediction of angular momenta and parities for ground states, Collective model., More-realistic models

**NUCLEAR DECAY** : Alpha decay process, Energy release in Beta-decay, Fermi's Theory of  $\beta$  - decay, selection rules, parity violation in  $\beta$ -decay, Detection and properties of neutrino, . Energetics of gamma decay, selection rules, angular correlation, Mossbauer effect.

**NUCLEAR REACTIONS** : Types of reactions and conservation laws, the Q – equation, Optical model, heavy ion Reactions

**UNIT - III**

**NUCLEAR ENERGY** Stability limit against spontaneous fission, Characteristics of fission, delayed neutrons, Four factor formula for controlled fission, Nuclear fusion, prospects of continued fusion energy.

**ELEMENTARY PARTICLE PHYSICS:** Particle interactions and families, symmetries and conservation laws ( energy and momentum, angular momentum, parity, Baryon number, Lepton number, isospin, strangeness quantum number( Gellmann and Nishijima formula) and charm), Elementary ideas of CP and CPT invariance, SU(2), SU(3) multiplets, Quark model.

**UNIT - IV**

**DETECTING NUCLEAR RADIATION:** Interaction of radiation with matter. Gas filled counters, scintillation detectors, semiconductor detectors, energy measurements, coincidence measurements and time resolution, magnetic spectrometers.

**ACCELERATORS:** Electrostatic accelerators, cyclotron accelerators, synchrotrons, linear accelerators, colliding beam accelerators.

**APPLICATIONS OF NUCLEAR PHYSICS:** Trace Element Analysis, Rutherford Back-scattering, Mass spectrometry with accelerators, Diagnostic Nuclear Medicine, Therapeutic Nuclear Medicine.

**TEXT BOOKS** : “Introductory Nuclear Physics” Kenneth S. Krane

**Reference Books:**

1. “Introduction to Nuclear Physics “ Harald A. Enge
2. “Concepts of Nuclear Physics “ Bernard L. Cohen.
3. “ Introduction to High Energy physics” D.H. Perkins
4. “ Introduction to Elementary Particles” D. Griffiths

## **Department of Physics, Andhra University**

### **Introductory Atmospheric and Space Physics**

(Choice based course to be offered in the Department of Physics during II Semester with a minimum intake of 15 and maximum 25)  
With effect from 2009-2010 admitted batch)

Target aspirants: PG students from departments of Meteorology and Oceanography, Geophysics, Environmental sciences, Geography, Geo-engineering and Electronics and Communication engineering)

**Unit I :** The Neutral atmosphere, atmospheric nomenclature, the Hydrostatic equation, geopotential height, expansion and contraction, fundamental forces in the atmosphere, apparent forces, atmospheric composition, solar radiation interaction with the neutral atmosphere, climate change.

**Unit II:** Electromagnetic radiation and propagation of waves: EM Radiation, fundamentals of EM waves, effects of environment, Antennas- basic considerations, types of antennas. Propagation of waves: ground wave, sky wave, and space wave propagation, troposcatter communication and extra terrestrial communication.

**Unit III:** The Ionosphere, morphology of ionosphere, the D, E and F-regions, chemistry of the ionosphere, ionospheric parameters, E and F region anomalies and irregularities in the ionosphere.

**Unit IV:** Global Positioning systems (GPS)- basic concepts, overview of GPS system, augmentation services, GPS system segment, GPS signal characteristics, GPS errors, multi path effects, GPS performance, satellite navigation system and applications.

#### **Reference Books:**

1. An Introduction to Dynamic Meteorology by James R Holton, Academic Press Inc.
2. Climatology, An atmospheric Science by John E. Oliver and John J. Hindore, Pearson Education
3. Electronic Communication systems by George Kennedy and Bernard Davis, Tata McGraw Hill publishing Co., Ltd.
4. Introduction to Ionospheric Physics by Henry Rishbeth and Owen K. Garriot, Academic press
5. Understanding GPS principles and applications by Elliot D. Kaplan and Christopher J. Hegarty, Artech House, Boston.

**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**LIST OF EXPERIMENTS FOR**  
**COMMON FOR M.SC.PHYSICS AND M.SC. (SPACE PHYSICS)**

**II Semester**

**(w.e.f 2009-10 batch)**

**P205,SP205: MODERN PHYSICS LAB -II**

- 1. Atomic Spectrum of Sodium.**
  - a) identification of sharp and diffuse doublets**
  - b) doublet separation**
  - c) assignment of principal quantum numbers**
- 2. Raman Spectrum of Carbon Tetrachloride**
  - a) Raman shifts**
  - b) Fermi resonance**
- 3. Vibrational analysis of AlO Green system.**
  - a) identification of sequences, assignment of vibrational quantum numbers,**
  - b) Deslandre's table and Vibrational constants.**
- 4. Determination of Specific Charge of an electron by Thomson's Method.**
- 5. Experiments with He- Ne laser .**
  - a) Polarization of laser light**
  - b) Divergence of laser beam and monochromaticity.**
- 6. Band gap of a semiconductor (Four probe method).**
- 7. Dielectric constant as a function of temperature and determination of Curie Temperature**
- 8. Susceptibility of a substance Gouy's method**
- 9. Dissociation energy of Iodine molecule from the given data.**

**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**LIST OF EXPERIMENTS FOR**  
**COMMON FOR M.SC.PHYSICS AND M.Sc. SPACE PHYSICS**  
**II Semester**  
**(w.e.f 2009-10 batch)**  
**P206,SP206: ELECTRONICS LAB -II**

**List of Experiments (Any SIX of the following)**

- 1. Active Low pass and High Pass filters (IC 741 )**
- 2. Twin -T filter (IC 741 )**
- 3. Logarithmic Amplifier (IC 741 )**
- 4. Wein Bridge Oscillator (IC 741 )**
- 5. Monostable multivibrator (IC 555 )**
- 6. Voltage Regulator (IC 723 )**
- 7. Phase Shift Oscillator (IC 741 )**
- 8. Astable multivibrator (IC 555 )**
- 9. Active band pass filter (IC 741 )**
- 10. Voltage controlled oscillator ((IC 741, IC 555 )**

**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**M.Sc. PHYSICS,**  
**III SEMESTER.**

		<b>MARKS</b>
<b>P301.</b>	<b>SOLID STATE PHYSICS (85+15)</b>	<b>100</b>

<b>P302.</b>	<b>LASERS AND FIBER OPTICS (85+15)</b>	<b>100</b>
<b>P303.</b>	<b>DIGITAL ELECTRONICS &amp; MICROPROCESSORS (85+15)</b>	<b>100</b>

**Special paper**

<b>P304</b>	<b>RADAR SYSTEMS AND SATELLITE COMMUNICATION (85+15)</b>	<b>100</b>
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<b>P305</b>	<b>DIGITAL ELECTRONICS LAB practical-75 +record-25</b>	<b>100</b>
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<b>P306</b>	<b>SOLID STATE PHYSICS LAB practical-75+record-25</b>	<b>100</b>
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**Total Marks                      600**

Choice Based Paper for other Departments in University Campus Only

	<b>ANALYTICAL TECHNIQUES</b>	
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**SCHEME OF EXAMINATION**

<b>Theory pass minimum</b>	<b>40%</b>
<b>Practical pass minimum</b>	<b>50%</b>
<b>Aggregate</b>	<b>50%</b>

**SCHEME OF INSTRUCTION :**

<b>Teaching Hours</b>	<b>4 Periods per week</b>
<b>Tutorial</b>	<b>1 Period per week</b>
<b>Practical</b>	<b>6 Periods per week</b>

**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**  
**M.Sc. Physics**  
**III Semester**  
**(w.e.f 2009-10 batch)**  
**P301: SOLID STATE PHYSICS.**

**UNIT-I: CRYSTAL STRUCTURE: 14 Hrs**

Periodic array of atoms—Lattice translation vectors and lattices, symmetry operations, The Basis and the Crystal Structure, Primitive Lattice cell, Fundamental types of lattices—Two Dimensional lattice types, three Dimensional lattice types, Index system for crystal planes, simple crystal structures-- sodium chloride, cesium chloride and diamond structures.

**UNIT-II: CRYSTAL DIFFRACTION AND RECIPROCAL LATTICE: 14 Hrs**

Bragg's law, Experimental diffraction methods-- Laue method and powder method, Derivation of scattered wave amplitude, indexing pattern of cubic crystals and non-cubic crystals (analytical methods). Geometrical Structure Factor, Determination of number of atoms in a cell and position of atoms. Reciprocal lattice, Brillouin Zone, Reciprocal lattice to bcc and fcc Lattices.

**UNIT-III: PHONONS AND LATTICE VIBRATIONS: 6 Hrs**

Vibrations of monoatomic lattices, First Brillouin Zone, Group velocity, Long wave length, Lattice with two atoms per primitive cell, Quantization of Lattice Vibrations-Phonon momentum.

**FREE ELECTRON FERMI GAS: 6 Hrs**

Energy levels and density of orbitals in one dimension, Free electron gas in 3 dimensions, Heat capacity of the electron gas, Experimental heat capacity of metals, Motion in Magnetic Fields-Hall effect, Ratio of thermal to electrical conductivity.

**UNIT-IV: THE BAND THEORY OF SOLIDS: 10 Hrs**

. Nearly free electron model, Origin of the energy gap, The Bloch Theorem, Kronig-Penny Model, wave equation of electron in a periodic potential, Crystal momentum of an electron-Approximate solution near a zone boundary, Number of orbitals in a band--metals and insulators. The distinction between metals, insulators and semiconductors

**TEXT BOOKS:**

- 1.Introduction to Solid State Physics, C.Kittel, 5<sup>th</sup> edition,
- 2.Solid State Physics, A.J.DEKKER.

**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**M.Sc. PHYSICS**  
**III Semester**  
**(w.e.f 2009-10 batch)**

**P302: Lasers and Fiber optics**

**UNIT-I**

**LASER SYSTEMS** :Light Amplification and relation between Einstein A and B Coefficients. Rate equations for three level and four level systems. Laser systems: Ruby laser, Nd-YAG laser, CO<sub>2</sub> Laser, Dye laser, Excimer laser, Semiconductor laser.

**UNIT – II:**

**LASER CAVITY MODES:** Line shape function and Full Width at half maximum (FWHM) for Natural broadening, Collision broadening, Doppler broadening, Saturation behavior of broadened transitions, Longitudinal and Transverse modes. ABCD matrices and cavity Stability criteria for confocal resonators. Quality factor, Q-Switching, Mode Locking in lasers. Expression for Intensity for modes oscillating at random and modes locked in phase. Methods of Q-Switching and Mode locking.

**UNIT-III**

**OPTICAL FIBER WAVEGUIDES** : Basic optical laws and Self focusing. Optical fiber modes and configurations Fiber types, Rays and Modes, Step-index fiber structure. Ray optics representation, wave representation. Mode theory of circular step-index wave guides. Wave equation for step-index fibers, modes in step-index fibers and power flow in step-index fibers. Graded – index fiber structure, Graded-index numerical aperture, modes in Graded-index fibers.

**UNIT-IV**

**FIBER CHARACTERISTICS** : Signal Degradation In Fibers - Attenuation, Absorption, Scattering and Bending losses in fibers, radiative losses, Core and Cladding losses. Signal distortion in optical wave guides: Group delay, material dispersion, waveguide dispersion and intermodal dispersion. Pulse broadening in optical fibers. Power launching in Optical fibers, Source-output pattern, Lensing schemes. Fiber-to-fiber joints: Mechanical misalignment, fiber related losses, Fiber and face preparation. fiber splicing techniques, fiber connectors.

**TEXT BOOKS:**

1. **Lasers -Theory and Applications – K.Thyagarajan and A.K. Ghatak. (MacMillan)**
2. **Optical fiber Communications – Gerd Keiser (Mc Graw-Hill)**

**REFERENCE BOOKS:**

1. **Laser fundamentals – William T. Silfvast (Cambridge)**
2. **Introduction to fiber optics – Ajoy Ghatak and K. Thyagarajan (Cambridge)**
3. **Optical Electronics – Ajoy Ghatak and K.Thyagarajan (Cambridge)**
4. **Opto- electronics – J. Wilson and J.F.B. Hawkes (Printice Hall)**

ANDHRA UNIVERSITY  
DEPARTMENT OF PHYSICS  
M.Sc. PHYSICS, SPACE PHYSICS

**III Semester**

**(w.e.f 2009-10 batch)**

P303, SP303: Digital Electronics & Microprocessors  
(Common for M.Sc.Space Physics and M.Sc.Physics)

## **UNIT - I**

**Digital Circuits (i) Number Systems and Codes:** Binary, Octal, Hexadecimal number systems, Gray code, BCD code, ASCII code. (ii) Logic Gates and Boolean Algebra: OR, AND, NOT, NOR, NAND gates, Boolean theorems, DeMorgan laws.

**II) Combinational Logic Circuits:** (i) Simplification of Boolean Expressions: Algebraic method, Karnaugh Map method, EX-OR, EX-NOR gates, ENCODER, DECODER, Multiplexer, Demultiplexers.

(ii) Digital Arithmetic Operations and Circuits: Binary addition, Design of Adders and Subtractors, Parallel binary adder, IC parallel adder. (iii) Applications of Boolean Algebra: Magnitude Comparator, Parity generator, Checker, Code converter, Seven-segment decoder/ Driver display.

### **UNIT - II**

**Sequential Logic Circuits:** (i) Flip-Flops and Related Devices: NAND latch, NOR latch, Clocked flip-flops, Clocked S-C flip-flop, J-K flip-flop, D flip-flop, D latch, Asynchronous inputs, Timing problem in flip-flops. (ii) Counters: Asynchronous counters (Ripple), Counters with MOD number  $< 2^N$ , Asynchronous down counter, Synchronous counters, Up-down counter, Presettable counter. (iii) Registers: Shift Register, Integrated Circuit registers, Parallel In Parallel Out (PIPO), SISO, SIPO, PISO (iv) Applications of Counters: Frequency Counter and Digital clock.

**A/D and D/A Converter Circuits:** D/A Converter, Linear weighted and ladder type, An integrated circuit DAC; Analog-to-Digital Conversion, Digital Ramp ADC, Successive Approximation Method, Sample and Hold Circuit, Digital Voltmeter.

### **UNIT - III**

**Intel 8085 Microprocessor:**

Architecture, Functional diagram, Pin description, Timing Diagram of Read Cycle, Timing diagram of write Cycle.

**Programming the 8085 Microprocessor:**

(i) Addressing Methods, Instruction set, Assembly language programming.

(ii) Examples of Assembly Language Programming: Simple Arithmetic - Addition/Subtraction of two 8-bit/16-bit numbers, Addition of two decimal numbers, Masking of digits, word disassembly.

(iii) Programming using Loops: Sum of series of 8-bit numbers, Largest element in the array, Multiple byte addition, Delay sub-routine.

### **UNIT - IV**

**Data Transfer Technique:**

Serial transfer, Parallel transfer, Synchronous, Asynchronous, DMA transfer, Interrupt driven Data transfer.

**8085 Interfacing:**

I/O Interfacing: Programmable Peripheral Interfacing, 8255, Programmable Peripheral Interval Timer 8253, Programmable Communication Interface 8251, DAC 0800 and ADC 0800 interfacing.

### **TEXT & REFERENCE BOOKS:**

1. "Digital Systems – Principles and applications" – Ronald.J.Tocci,
2. "Fundamentals of Microprocessors & Microcomputers" - B. RAM.
3. " Introduction to Microprocessors for Engineers and Scientists" - P.K.Ghosh and P.R.Sridhar
4. "Microprocessor Architecture, Programming and Applications with the 8085 /8080A" – Ramesh. S. Gaonkar.



**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**M.Sc. PHYSICS AND M.Sc. SPACE PHYSICS**

**III Semester**

**(w.e.f 2009-10 batch)**

**(Common for M.Sc. Space Physics and M.Sc. Physics)**

**P304 , SP 304 - RADAR SYSTEMS & SATELLITE COMMUNICATION**

**UNIT - I**

**Radar Systems:**

Fundamental – A simple RADAR – overview of frequencies – Antenna gain Radar Equation – Accuracy and Resolution – Integration time and the Doppler shift (Ch 1 of Text Book 1)

Designing a surveillance radar – Radar and surveillance – Antenna beam – width consideration – pulse repetition frequency – unambiguous range and velocity – pulse length and sampling – radar cross section – clutter noise (Ch 2 of Text Book 1)

Tracking Radar – Sequential lobbing – conical scanning – Monopoles Radar – Tracking accuracy and Process – Frequency Agility – Radar guidance (Ch3 of Text Book 1)

**UNIT - II**

Signal and Data Processing – Properties of clutter – Moving Target Indicator Processing Shareholding – Plot extraction – Tract Association, Initiation and Tracking (Ch 5 of Text Book 1)

Radar Antenna – Antenna parameters – Antenna Radiation Pattern and aperture distribution – Parabolic reflector – cosecant squared antenna pattern – effect of errors on radiation pattern – Stabilization of antennas (Ch7 of Text Book 2).

**UNIT - III**

**Satellite Communication**

Satellite System – Historical development of satellites – communication satellite systems – communication satellites – orbiting satellites – satellite frequency bands – satellite multiple access formats (Ch1 of Text Book 3).

Satellite orbits and inclination – Look angles, orbital perturbations, space craft and its subsystems – attitude and orbit control system – Telemetry, Tracking and Command – Power system – Transponder – Reliability and space qualification – launch vehicles

(Ch2 & 3 of Text Book 4)

**UNIT - IV**

Multiple Access Techniques – Time division multiple access – Frequency division multiple access – Code division multiple access – Space domain multiple access

(Ch 7 of Text Book 4).

Earth Station technology – Subsystem of an earth station – Transmitter – Receiver Tracking and pointing – Small earth station – different types of earth stations – Frequency coordination – Basic principles of special communication satellites – INMARSAT VSAT, GPS, RADARSAT, INTELST

(Ch 10 & 11 of Text Book 4).

**Text Books:**

1. Understanding Radar Systems – Simon Kingsley and Shaun Quegan.
2. Introduction to Radar Systems – MI Skolnik
3. Satellite Communication – Robert M. Gagliardi
4. Satellite Communication – Manojit Mitra

**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**M.Sc. PHYSICS AND M.Sc. SPACE PHYSICS**  
**III Semester**  
**(w.e.f 2009-10 batch)**  
**P 305 : DIGITAL ELECTONICS Lab**

**I Digital electronics**

1. Verification of Gates: AND, OR, NOT, NAND, NOR, EX –OR, EX – NOR gates
2. Encoder and Decoder
3. Multiplexer and De multiplexer
4. Adders: Half adder, Full Adder, Paraller Adder
5. Flip Flops ( 7400,7402,7408,7446)
6. Decade Counter (IC 7490)
7. Seven segment Decoder/ Driver (7490,7447)
8. UP/DOWN Counter IC 74193
9. Digital Comparator ( 7485)
10. Microprocessor 8085
  - Addition/ subtraction of 8 bit numbers
  - Sum of series of 8 – bit numbers

**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**M.Sc. PHYSICS**

**III Semester**

**(w.e.f 2009-10 batch)**

**P 306: PRACTICALS : Solid State Physics Lab**

**LIST OF EXPERIMENTS**

(Any six of the following)

1. LATIC DYNAMICS – STUDY OF PHONON DISPERSION CHARACTERISTICS.
2. DETERMINATION OF DIELECTRIC CONSTANT-DETERMINATION OF GUIDE WAVELENGTH OF AN X-BAND TEST BENCH AND DETERMINATION OF DIELECTRIC CONSTANT OF BENZENE.
3. HALL EFFECT: DETERMINATION OF HALL COEFFICIENT AND ESTIMATION OF CARRIER CONCENTRATION
4. ESR STUDIES AND DPPH- DETERMINATION OF 'G' VALUE OF AN ELECTRON
5. COUPLED OSCILLATIONS AND STUDY OF THE STRENGTH OF THE COUPLING CONSTANT.
6. X-RAY DIFFRACTION STUDIES
7. DETERMINATION OF ELASTIC CONSTANT.
8. THERMOLUMINESCENCE-DETERMINATION OF ACTIVATION ENERGY OF ELECTRONS.
9. DETERMINATION OF MAGNETIC RESISTANCE
10. STUDY OF MAGNETIC HYSTERESIS LOOPS OF FERROMAGNETIC MATERIALS (BH CURVE)

**Department of Physics, A.U**  
**ANALYTICAL TECHNIQUES**

(Choice Based Paper to be offered in the Dept., of Physics during 3<sup>rd</sup> Semester for  
Other Dept., students in AU Campus only)  
(W.e.f. 2009 – 2010 admitted batch)

**Unit I**

Concepts of interaction of electromagnetic radiation with matter, wave and particle properties of electromagnetic radiation, electromagnetic spectrum, absorption laws, electronic transitions, optical and molecular spectra, molecular energies, Raman spectra, photoelectric effect, photoelectric cells, Compton effect, radiation sources, detectors, lasers

**References :**

- 1) Instrumental methods of analysis, Willard, Merritt, Dean, Settle (CBS Pub.)
- 2) Instrumental methods of chemical analysis, H. Kaur (Pragati Prakasan Pub.)

**Unit II : Ultrasonic techniques**

Acoustic Plane waves-Elastic behavior of fluids, plane wave equation, velocity of sound in fluids, energy density acoustic intensity, specific acoustic impedance. Transmission phenomenon-transmission from one fluid medium to another reflection at the surface of a solid, transmission through three media normal incidence and oblique incidence. Resonators & filters- Helmholtz resonator, acoustic impedance, acoustic analogue. Ultrasonic & sonar transducers-piezoelectric effect equivalent electrical circuit, generalized theory, quality factor, piezoelectric relations. Architectural acoustics-classical Ray theory decay of sound in live room & dead rooms. Applications of Ultrasonics

**References:**

- 1) Fundamentals of Acoustics-Kinsler & Fray Wiley Eastern.Limited
- 2) Ultrasonics , Jack Blitz
- 3) Physical Ultrasonics-Beyer & Letcher Academic Press

**Unit III : Magnetic Resonance Techniques**

1) Electron Spin Resonance: Basic Concepts, g-factor and nuclear hyperfine interaction,, essential features of an ESR spectrometer, Applications of ESR: in Physical Sciences and biological systems.

2) Nuclear Magnetic Resonance: Basic principles, continuous wave and pulsed NMR, Fourier Transform NMR, measurement of spin -lattice and spin- spin relaxation times, proton and C-13 NMR, basic pulsed Fourier Transform NMR spectrometer, 2D NMR, applications of NMR in physical and biological sciences, basic features of MRI.

3) Nuclear quadrupole resonance: Basic principle and applications

**References**

- 1) Electron Paramagnetic Resonance : Elementary Theory and practical Applications, J.A.Weil, J.R.Bolton and J.E.Wertz (Wiley) N.Y, 1994
- 2) Principles of Nuclear Magnetic Resonance in One and Two Dimensions, R.R.Ernst, G.Bodenhausen and A.Wokun,(Oxford)1987
- (3) Basics of NMR, Joseph. P. Hornack, Free Online Text
- (4) Nuclear Quadrupole Coupling Constants, E.A.C. Lucken (A.P ) 1969

**Unit IV : Structural characterization techniques**

X-ray diffraction, indexing pattern of cubic crystals and non-cubic crystals (analytical methods), crystal structure identification and determination of lattice parameters.

Fundamentals of Transmission Electron Microscopy (TEM) and Scanning Electron Microscopy (SEM), major components in SEM and TEM, study of crystal structure using TEM, study of microstructure using SEM.

**References :**

- 1) Elements of X-ray Diffraction, B.D. Cullity, Addison-Wesley Publishing Co. Inc., USA (1977).
- 2) Physical Methods of Materials Characterization (Second Edition), PEJ Flewitt and RK Wild, Institute of Physics Publishing, Bristol, UK.



**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**M.Sc. PHYSICS.**  
**IV SEMESTER**  
**(w.e.f 2009-2010 admitted batch)**

**P401: ADVANCED QUANTUM MECHANICS .**

**UNIT - I**

Linear Vector Spaces in Quantum Mechanics:

Vectors and operators, change of basis, Dirac's bra and ket notations. Eigen value problem for operators. The continuous spectrum. Application to wave mechanics in one dimension.

*(Merzbacher Sec. 14.1, 14.2, 14.3, 14.4, 14.5, 14.6, 14.7)*

**UNIT - II**

Quantum Dynamics :

The equation of motion, Quantization postulates, canonical quantization, Constants of motion and invariance properties. Heisenberg picture. Harmonic Oscillator.

*(Merzbacher . Sec. 15.1, 15.2, 15.3, 15.4, 15.6, 15.7)*

**UNIT - III**

Development of time-dependent perturbation theory. The golden rule for constant transition rates.

*(Merzbacher. Chapter. 18 relevant parts)*

Addition of two angular momenta. Tensor operators.

Wigner-Eckart theorem. Matrix elements of vector operators. Parity and time reversal symmetries.

*(Merzbacher . Section. 16.6, 16.8, 16.10, 16.11)*

**UNIT - IV**

Scattering:

Concept of differential cross-section. Scattering of a wave packet. Born approximation. Partial waves and phase shift analysis.

*(Merzbacher. Section. 11.1, 11.2, 11.4, 11.5)*

. Relativistic Quantum Mechanics

Klein – Gordon equation, Dirac equation for a free particle, Equation of continuity, Spin of a Dirac particle, Solutions of free particle Dirac equation, Negative energy states and hole theory

**TEXT BOOKS:**

1. “ Quantum Mechanics” by R.D. Ratna Raju
2. “Quantum Mechanics “ by E. Merzbacher

**Reference Books:**

- 1.” Quantum Mechanics” by Thankappan
2. “Quantum Mechanics” by Biswas

**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**M.Sc. PHYSICS**  
**IV SEMESTER**  
**(w.e.f 2009-2010 batch)**

**P.402 : PROPERTIES AND CHARACTERIZATION OF MATERIALS**

**UNIT - I**

**THERMAL PROPERTIES:**

Anharmonic crystal interactions-thermal expansion, thermal conductivity, lattice thermal resistivity, umklapp processes, and imperfections.

**OPTICAL PROPERTIES :**

Lattice Vacancies, Diffusion, Color Centers—F Centers, other centers in alkali halides, Alloys, Order-disorder transformations, Elementary theory of Order.

**UNIT - II**

**MICROSCOPIC EXAMINATION:**

Fundamentals of Transmission electron microscopy and scanning electron microscopy, study of crystal structure using TEM, study of microstructure using SEM.

**UNIT - III**

**RESONANCE METHODS:**

Spin and an applied field—the nature of spinning particles, interaction between spin and a magnetic field, population of energy levels, the Larmor precession, relaxation times—spin- spin relation, spin-lattice relaxation,

Electron Spin Resonance: Introduction, g-factor, experimental methods.

Nuclear Magnetic Resonance—equations of motion, line width, motional narrowing, hyperfine splitting,

Nuclear Gamma Ray Resonance: Principles of Mossbauer Spectroscopy, Line Width, Resonance absorption, Mossbauer Spectrometer, Isomer Shift, Quadrupole Splitting, magnetic field effects, Applications.

**UNIT - IV**

**ELECTRICAL AND MAGNETIC CHARACTERIZATION TECHNIQUES:**

DC & AC Conductivity, Curie temperature, Saturation Magnetization and Susceptibility

**OPTICAL SPECTROSCOPY:**

Fundamentals of Infra-red Spectroscopy and Applications.

**TEXT BOOKS:**

Solid State Physics, 5<sup>th</sup> edition, C.Kittel

Fundamentals of Molecular Spectroscopy CN Banwell

Mossbauer Effect and its Applications VG Bhide

**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**M.Sc PHYSICS, and SPACE PHYSICS**  
**IV SEMESTER**

(w.e.f 2009-2010 batch)

**P 403 , SP 403 COMMUNICATION ELECTRONICS**

*(Common for M.Sc. Space Physics and M.Sc Physics)*

**UNIT 1. CW Modulation:**

Amplitude Modulation (AM): 8 periods

**Introduction, Amplitude modulation, modulation index, Frequency spectrum, Average power**

for sinusoidal AM, Amplitude modulator and demodulator circuits, Double side band suppressed carrier (DSBSC) Modulation, Super heterodyne receiver.

Single Side Band Modulation (SSB): 4 periods

**SSB principles, Balanced Modulator, SSB generation**

Angle Modulation: 8 periods

**Frequency modulation (FM), sinusoidal FM, Frequency spectrum for sinusoidal FM**

frequency deviation, modulation index, Average power in sinusoidal FM, FM generation

Phase Modulation: Equivalence between PM and FM, FM detectors: Slope detector, Balanced slope detector, Foster – Seley discriminator, Ratio detector, Amplitude limiter, FM receiver.

**UNIT 2. Pulse Modulation:**

Digital Line Codes: Symbols, Functional notation for pulses, Line codes and wave forms: RZ, NRZ, Polar, Unipolar, AMI, HDBn and Manchester codes, M-ary encoding, Differential encoding 8 periods

Sampling theorem, Principles of pulse Amplitude Modulation (PAM) and Pulse Time Modulation (PTM), Pulse code modulation (PCM), quantization, Nonlinear quantization, companding, differential pulse code modulation (DPCM), Delta Modulation (DM).

Digital Carrier Systems: 8 periods

**ASK, PSK, FSK and DPSK**

**UNIT 3. Special Communication Circuits :** 6 periods

**Tuned amplifiers :Single tuned amplifier-Hybrid  $\pi$  – equivalent for the BJT, Short circuit**

**current gain for the BJT in CE and CB amplifiers, CE and CB tuned amplifiers, Cascode amplifier.**

Mixer Circuits : Diode mixer, IC balanced mixer.

Filters : Active filters, Ceramic, Mechanical and crystal filters.

Oscillators: Crystal oscillator, Voltage controlled oscillator, phase locked loop (PLL).

**UNIT 4. Noise in Communication Systems:** 8 periods

Thermal Noise, Shot Noise, Partition noise, Signal - to - Noise ratio, Noise factor, Amplifier input noise in terms of F, Noise factor of amplifiers in cascade (Friss formula), Noise temperature, Noise in AM, Noise in FM systems. Noise in pulse modulation systems: Intersymbol interference (ISI), eye diagrams.

**Text Books:**

1. Electronic Communications D. Roody and John Coolin
2. Electronic Communications Systems G. Kennedy
3. Modern Analog & Digital Communications B.P. Lathi.

**ANDHRA UNIVERSITY**



**DEPARTMENT OF PHYSICS**

M.Sc. PHYSICS and M.Sc. SPACE PHYSICS,

**IV SEMESTER (w.e.f 2009-2010 batch)**

*(Common for M.Sc. Space Physics and M.Sc Physics)*

**P404 , SP404 : ANTENNA THEORY AND RADIOWAVE PROPAGATION**

**UNIT - I**

**Radiation**

Potential functions of electro magnetic fields. Potential function for sinusoidal oscillations. Fields radiated by an alternating current element. Power radiated by a current element and radiation resistance. Radiation from a quarter wave monopole or a half wave dipole. EM field close to an antenna and far field approximation. (*Chapter 10 in Jordan and Balmain* 6 Hrs.

**Antenna Fundamentals**

Definition of an antenna. Antenna properties – radiation pattern, gain, directive gain and directivity. Effective area. Antenna beam width and band width. Directional properties of dipole antennas. (*Chapter 11 in Jordan and Balmain and Chapter 2 in Kraus*) 6 Hrs.

**UNIT - II**

**Antenna Arrays**

Two element array. Linear arrays. Multiplication of patterns and binomial array. Effect of Earth on vertical patterns. Mathematical theory of linear arrays. Antenna synthesis – Tchebycheff polynomial method. Wave polarization. (*Chapter 11 and 12 in Jordan and Balmain and Chapter 4 in Kraus*) 12 Hrs.

**Impedance**

Antenna terminal impedance. Mutual impedance between two antennas. Computation of mutual impedance. Radiation resistance by induced emf method. Reactance of an antenna. Biconical antenna and its impedance. (*Chapter 14 in Jordan and Balmain and Chapters 8.1 –8.5 in Kraus*) 6 Hrs.

**UNIT - III**

**Frequency Independent (FI) Antennas**

Frequency Independence concept. Equiangular spiral. Log Periodic (LP) antennas. Array theory of LP and FI structures. (*Chapter 15 in Jordan and Balmain and Chapter 15 in Kraus*) 4 Hrs.

**Methods of excitation and Practical Antennas**

Methods of excitation and stub matching and baluns. Folded dipole, loop antennas. Parasitic elements and Yagi-Uda arrays and Helical antenna. Complementary screens and slot antennas. Radiation from a rectangular horn antenna. (*Chapter 11.15 in Jordan and Balmain and Chapters 6.1 – 6.4 ,7.1 – 7.8 and 13 in Kraus*) 10 Hrs.

**UNIT - IV**

**Radio Wave Propagation**

Elements of Ground wave and Space wave propagation. Tropospheric propagation and Troposcatter. Fundamentals of Ionosphere. Sky wave propagation – critical frequency, MUF and skip distance. (*Chapter 16 and 17 in Jordan and Balmain*) 6 Hrs.

**BOOKS**

1. "Electromagnetic waves and Radiating Systems" by E.C.Jordan and K.G.Balmain
2. "Antennas" by J.D.Kraus. (Second Edition)

**M.Sc PHYSICS,**  
**IV SEMESTER**  
**(w.e.f 2009-2010 batch)**

**P 405 : MICROPROCESSOR LAB**

- 1. Decimal addition of 8 – bit numbers**
- 2 Addition of two 16 – bit numbers**
- 3 Multibyte addition**
- 4. Sum of series of 16 – bit numbers**
- 5. Word Disassembly**
- 6. Largest number in an array**
- 7. Ascending order of array of 8 - bit number**
- 8. Interfacing of 8255 PPI: generation of square wave and rectangular waves**
- 9. Interfacing of 8253 programmable timer: Mode 1, Mode2, Mode3, Mode 4, Mode5**
- 10 0800 DAC interfacing : generation of square, triangular and stair case wave forms**

ANDHRA UNIVERSITY  
DEPARTMENT OF PHYSICS  
M.Sc. PHYSICS  
**IV SEMESTER**  
(w.e.f 2009-2010 batch)

P 406 : COMMUNICATION LAB  
LIST OF EXPERIMENTS

1. **AMPLITUDE MODULATION**
2. **FREQUENCY MODULATION AND DETECTION**
3. **MIXER**
4. **BUTTERWORTH FIRST ORDER LOWPASS AND HIGHPASS FILTERS**
5. **CHEBYSHEV SECOND ORDER LOWPASS FILTER**
6. **PHASE LOCKED LOOP (PLL)**
7. **PULSE MODULATION-PAM-AND SAMPLING**
8. **STUDY OF PRE- EMPHASIS AND DE- EMPHASIS CIRCUITS**
9. **GENERATION OF PWAM, AND PPM USING PLL AND 555 TIMER**
10. **STUDY OF FSK TRANSMISSION AND RECEPTION**
11. **OPTICAL FIBRE –BENDING LOSSES AND NUMERICAL APERTURE**
12. **MEASUREMENT OF BIT ERROR RATE (BER)**
13. **MEASUREMENT OF SPEED OF LIGHT IN OPTICAL FIBRE**
14. **DETERMINATION OF FREQUENCY AND WAVELENGTH IN A RECTANGULAR WAVEGUIDE IN  $TE_{1,0}$**
15. **DETERMINATION OF STANDING WAVE RATIO AT REFLECTION COEFFICIENT**
16. **STUDY OF ISOLATOR /CIRCULATOR**
  17. **MEASUREMENT OF GAIN ,FRONT TO BACK RATIO,BEAM WIDTH OF RADIATION PATTERN IN HALF WAVE DIPOLE**
18. **FIVE ELEMENT YAGI UDA ANTENNA**
19. **HELICAL ANTENNA**
20. **CUT –PARABOIDAL REFLECTOR ANTENNA**

**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**

Common for M.Sc. Physics and M.Sc. Space Physics  
I Semester (w.e.f 2009-10 batch)

		<b>MARKS</b>
<b>P 101.</b>	<b>CLASSICAL MECHANICS</b>	<b>85+15=100</b>
<b>P 102.</b>	<b>INTRODUCTORY QUANTUM MECHANICS.</b>	<b>85+15=100</b>
<b>P 103.</b>	<b>MATHEMATICAL METHODS OF PHYSICS</b>	<b>85+15=100</b>
<b>P 104.</b>	<b>ELECTRONIC DEVICES AND CIRCUITS</b>	<b>85+15=100</b>
<b>P105</b>	<b>Modern Physics Lab -I</b>	<b>100</b>
<b>P106</b>	<b>Electronics Lab -I</b>	<b>100</b>

**TOTAL MARKS**

**600**

*For Each Theory Paper 85 marks for semester end exam and 15 marks for internal assessment*

**SCHEME OF EXAMINATION**

<b>Theory pass minimum</b>	<b>40%</b>
<b>Practical pass minimum</b>	<b>50%</b>
<b>Aggregate</b>	<b>50%</b>

**SCHEME OF INSTRUCTION :**

<b>Teaching Hours</b>	<b>4 Periods per week</b>
<b>Tutorial</b>	<b>1 Period per week</b>
<b>Practical</b>	<b>6 Periods per week</b>

**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**

**Common for M.Sc. Physics and M.Sc. Space Physics**  
**I Semester**  
**(w.e.f 2009-10 batch)**

**P101,SP101: CLASSICAL MECHANICS.**

**UNIT-I:** Mechanics of a particle. Mechanics of a system of particles, constraints, D'Alembert's principle and Lagrange's equations, Velocity Dependent potentials and the Dissipation function Simple applications of the Lagrangian Formulation

**5 Hrs.**

Chapter : 1. Section : 1, 2, 3, 4,5 & 6 .

Hamilton's principle, some techniques of the calculus of variations. Derivation of Lagrange's equations from Hamilton's principle. Conservation theorems and symmetry properties, Energy function and the conservation of Energy

**6 Hrs.**

Chapter : 2. Section : 1, 2, 3, 5, 6

**UNIT-II:** Reduction to the equivalent one body problem. The equation of motion and first Integrals, The equivalent One – Dimensional problem and classification of orbits, The differential equation for the orbit, and Integrable power –law potentials, Conditions for closed orbits (Bertrand's theorem), The Kepler problem inverse square law of force , The motion in time in the Kepler problem, Scattering in a central force field..

Chapter : 3. Section. 1, 2, 3, 5, 6, 7, 8

**7 Hrs**

Legendre transformations and Hamilton's equations of motion. Cyclic Coordinates and conservation theorems, Derivation of Hamilton's equation of motion from variational principle, Principle of Least Action.

**6 Hrs**

Chapter : 7 Section: 1, 2,3,4 5 .

**UNIT-III:** Equations of canonical transformation, Examples of Canonical transformations, The harmonic Oscillator, Poisson brackets and other Canonical invariants, Equations of motion, Infinitesimal canonical transformations, and conservation theorems in the poisson bracket formulation, the angular momentum poisson bracket relations.

**5Hrs**

Chapter : 8. Section : 1 , 2 ,4, 5, 6 & 7.

Hamilton – Jacobi equation of Hamilton's principal function, The Harmonic oscillator problem as an example of the Hamilton – Jacobi Method, Hamilton –Jacobi equation for Hamilton's characteristic function. Action – angle variables in systems of one degree of freedom.

**8 Hrs.**

Chapter : 9. Section : 1, 2, 3, & 5.

**UNIT-IV:** Independent coordinates of rigid body. , The Euler angles, Euler's theorem on the Motion of a rigid body, Infinitesimal rotations, Rate of change of a vector, The Coriolis Effect.

Chapter : 4. Section : 1, 4, 6, 8, 9 .

The Inertia tensor and the moment of inertia, The Eigenvalues of the inertia tensor and the principal axis transformation, Solving rigid body problems and Euler equations of motion, Torque – free motion of a rigid body

**6 Hrs**

Chapter 5 Section: 3, 4, 5 & 6.

The Eigenvalue equation and the principal axis transformation, Frequencies of free vibration, and normal coordinates, Free vibrations of a linear triatomic molecule

Chapter 10 Section: 2, 3 & 4 .

**6**

**Hrs**

**TEXT BOOKS :** Classical Mechanics H.Goldstein (Addison-Wiley, 1<sup>st</sup> & 2<sup>nd</sup> ed)

**REFERENCE BOOK:** Classical Dynamics of Particles and Systems J.B.Marion.

**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**

**Common for M.Sc. Physics and M.Sc. Space Physics**  
**I Semester**  
**(w.e.f 2009-10 batch)**

**P102,SP102 : INTRODUCTORY QUANTUM MECHANICS**

**UNIT-I:** The Conceptual aspect :Wave particle duality,Bohr's complementarity principle.Wave function and its interpretation -Principle of superposition-Wave packets – phase velocity and group velocity-Uncertainty relation Postulates of Quantum Mechanics - Schrodinger wave equation - Conservation of probability

**UNIT-II:** Operators and their properties - Equation of Motion for operators, Hermitian operators and their Eigen values and eigen functions Stationary states, Bohr's correspondence principle - Coordinate and Momentum representation- Ehrenfest's theorem Commutator Algebra.- Dirac Delta function, definition and properties. Dirac Delta Normalization

**UNIT-III:** One dimensional problems - Free Particle, Particle in a box- Potential step, potential Well, Rectangular Potential Barrier - Linear Harmonic Oscillator Angular Momentum, Angular Momentum in spherical polar coordinates, Eigenvalues and eigenfunctions of  $L^2$ ,  $L_z$ ,  $L_+$  and  $L_-$  operators. Eigen values and eigen functions of Rigid rotator and Hydrogen atom. Commutation relations, electron spin.

**UNIT-IV:** Time- independent perturbation theory for(i) non degenerate systems and application to Hydrogen atom: Kinetic energy correction, spin-orbit interaction, fine structure. Ground state of Helium atom.

ii) degenerate systems, application to linear stark effect in Hydrogen.  
Variation method and its application to Helium atom.  
Exchange energy and low lying excited states of Helium atom.  
Interaction of electromagnetic radiation with matter. Selection rules.

**Text Book :**

Quantum Mechanics R.D. RATNA RAJU

**Reference Books :**

1. Quantum Mechanics Aruldas
2. Quantum Mechanics G. S. Chaddha
3. Quantum Mechanics B.H.Bransden and C.J.Joachain
4. Quantum Mechanics E. Merzbacher
5. Quantum Mechanics Richard Liboff

**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**

**Common for M.Sc. Physics and M.Sc. Space Physics**  
**I Semester**  
**(w.e.f 2009-10 batch)**

**P103,SP103: Mathematical Methods of Physics**

**Unit I : Complex Variables**

**15 Hrs**

Function of complex number- definition-properties, analytic function-Cauchy –Riemann conditions-polar form-problems, Complex differentiation, complex integration –Cauchy’s integral theorem-Cauchy’s integral formulae-multiply connected region- problems, Infinite series-Taylor’s theorem-Laurent’s theorem-Problems, Cauchy’s Residue theorem- evaluation of definite integrals-problems.

**Text Book:** 1. Mathematical Methods of Physics-G.Arffen, Academic Press

2. Mathematical Physics-Satya Prakash, Sultan Chand & co, New Delhi

3. Complex Variables ( Schaum’s out line series) Murray R. Spiegel

**Ref Book:** Mathematical Methods B.D.Gupta

**Unit II : Beta , Gamma functions & Special functions**

**10 Hrs**

Beta & Gamma functions -definition, relation between them- properties-evaluation of some integrals

Special Functions- Legendre Polynomial, Hermite Polynomial, Laguerre Polynomial-Generating function-recurrence relations-Rodrigue’s formula-orthonormal property-associated Legendre polynomial- simple recurrence relation-orthonormal property-spherical harmonics

**Text Book:** 1. Mathematical Methods of Physics-G.Arffen, Academic Press

2. Mathematical Physics-Satya Prakash, Sultan Chand & co, New Delhi

3. Mathematical Physics B S Rajput

**Ref book :** Special Functions .M.D.Raisinghania

**Unit III : Laplace Transforms & Fourier series, Fourier Transforms**

**15 Hrs**

Laplace Transforms – definition- properties – Laplace transform of elementary functions-Inverse Laplace transforms-properties- evaluation of Inverse Laplace Transforms-elementary function method-Partial fraction method-Heavyside expansion method-Convolution method-complex inversion formula method-application to differential equations Fourier series-evaluation of Fourier coefficients- Fourier integral theorem-problems-square wave-rectangular wave-triangular wave

Fourier Transforms- infinite Fourier Transforms-Finite Fourier Transforms-Properties-problems-application to Boundary value problem

**Text Book:** 1. Mathematical Methods of Physics-G.Arffen, Academic Press

2. Mathematical Physics-Satya Prakash, Sultan Chand & co, New Delhi

3. Laplace n Fourier Transforms Goyal & Gupta,

**Ref books:** Integral Transforms M.D.Raisinghanna

Integral Transforms Goyal & Gupta

Mathematical Physics B S Rajput

**Unit IV: Numerical Analysis**

**10 Hrs**

Solutions of algebraic and Transcendental equations-Bisection method-method of successive approximations-method of false position Iteration method-Newton Rapson method

Simultaneous linear algebraic equations-Gauss elimination method-Gauss Jordan method-Matrix inversion method-jacobi method – Gauss-Siedel method

Interpolation with equal intervals-Finite differences-Newton Forward & Backward

Interpolation formulæ Interpolation with unequal intervals-Newtons divided difference

formula-Lagrange interpolation formula Numerical Integration-General Quadrature formula-Trapezoidal rule -Simpson’ 1/3 rule & 3/8 rule

**Text Books:** **Introductory methods of Numerical analysis S.S.Sastry**

**Numerical Methods V.N.Vedamurthy & N.Ch.S.N.Iyengar**

**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**  
Common for M.Sc. Physics and M.Sc. Space Physics  
I Semester  
(w.e.f 2009-2010 admitted batch of students)  
**P104,SP104: ELECTRONIC DEVICES AND CIRCUITS**

**UNIT-I**

**SEMICONDUCTOR DEVICES: 10 Hrs.**  
Tunnel diode, photo diode, solar cell, LED, Silicon controlled Rectifier,  
Uni Junction Transistor, Field Effect Transistor, (JFET & MOSFET), CMOS

**UNIT-II**

**MICROWAVE DEVICES: 15 Hrs.**  
Varactor diode, Parametric Amplifier, Thyristors, Klystron, Reflex Klystron,  
Gunn Diode, Magnetron, CFA, TWT, BWO, IMPATT, TRAPATT, APD, PIN Diode,  
Schottky Barrier Diode.

**UNIT-III**

**OPERATIONAL AMPLIFIERS : 10 Hrs.**  
The ideal Op Amp – Practical inverting and Non inverting Op Amp stages. Op Amp  
Architecture – differential stage, gain stage, DC level shifting, output stage, offset  
voltages and currents  
Operational Amplifier parameters- input offset voltage, input bias current ,  
Common Mode Rejection Ratio, Slew Rate

**UNIT-IV**

**OP- AMP APPLICATIONS: 15 Hrs.**  
Summing amplifier, Integrator, Differentiator,  
Voltage to Current converter, Current to Voltage converter  
Oscillators – Phase shift oscillator, Wien-Bridge Oscillator, Voltage Controlled Oscillator,  
Schmitt Trigger  
Special applications – Monostable and Astable multivibrators using 555, Phase locked  
Loop, Voltage regulators.

**TEXT BOOKS:**

1. Integrated Electronics - Jacob Millman & C.C. Halkies (TMH)
2. Op.Amps and Linear Integrated Circuits – Ramakant A.Gayakwad (PHI)
3. Electronic Communication Systems – George Kennedy (PHI)

**REFERENCE BOOKS:**

1. Microelectronics - Jacob Millman & Arvin Grabel (McGraw Hill)
2. Electronic Devices and Circuits – G.K. Mithal (Khanna)
3. Op-amps and Linear Integrated Circuits – D. Mahesh Kumar (MacMillan).



**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**

Common for M.Sc. Physics and M.Sc. Space Physics  
I Semester  
(w.e.f 2009-10 batch)

**P105 / SP105 : MODERN PHYSICS LAB - I**

1. Atomic Spectrum of Zinc.
  - a) Verification of Lande's interval rule
  - b) Study of relative intensities
  
2. Grating spectrometer
  - a) Wavelengths of Hg spectrum,
  - b) wavelength of Balmer series, Rydberg constant
  
3. Reciprocal dispersion curve
4. Application of Point Groups.
  - a) Identification of symmetry operations in  $H_2O$ ,  $BH_3$ ,  $NH_3$  and  $H_2CO$
  - b) Reducible representations and Vibrational modes of  $H_2O$ .
5. Determination of Planck's constant, work function and threshold frequency
6. Band gap of a semiconductor. (Two Probe Method)
7. Thermo emf
8. The Franck-Hertz experiment
9. Band spectrum of CN in the violet
  - a) conversion of given wavelengths to wavenumbers and assignment of  $(\nu, \nu')$
  - b) Deslandres' table and Vibrational constants.

**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**Common for M.Sc. Physics and M.Sc. Space Physics**  
**I Semester**  
**(w.e.f 2009-10 batch)**  
**P106/SP106: ELECTRONICS LAB -I**

**LIST OF EXPERIMENTS**

- |                                     |              |
|-------------------------------------|--------------|
| 1. FET amplifier                    | (BFW 10/11 ) |
| 2. Negative feedback amplifier      | (BC 147 )    |
| 3. Colpitts Oscillator              | (BF 194)     |
| 4. Phase shift Oscillator           | (BC 147)     |
| 5. Astable Multivibrator            | (BF 194)     |
| 6. Op.Amp.Characteristics           | (IC 741 )    |
| 7. Power Supply                     |              |
| 8. UJT Characteristics              | (2 N 2646 )  |
| 9. R.F.Amplifier                    | (BF 194)     |
| 10. Boot-strap time based generator | (2N 2222)    |

**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**

**Common for M.Sc. Physics and M.Sc. Space Physics**  
**I Semester (w.e.f 2009-10 batch)**

**P101,SP101: CLASSICAL MECHANICS.**

**UNIT-I:** Mechanics of a particle. Mechanics of a system of particles, constraints, D'Alembert's principle and Lagrange's equations, Velocity Dependent potentials and the Dissipation function Simple applications of the Lagrangian Formulation

**5 Hrs.**

Chapter : 1. Section : 1, 2, 3, 4,5 & 6 .

Hamilton's principle, some techniques of the calculus of variations. Derivation of Lagrange's equations from Hamilton's principle. Conservation theorems and symmetry properties. Energy function and the conservation of Energy

**6 Hrs.**

Chapter : 2. Section : 1, 2, 3, 5, 6

**UNIT-II:** Reduction to the equivalent one body problem. The equation of motion and first Integrals, The equivalent One – Dimensional problem and classification of orbits, The differential equation for the orbit, and Integrable power –law potentials, Conditions for closed orbits (Bertrand's theorem), The Kepler problem inverse square law of force , The motion in time in the Kepler problem, Scattering in a central force field..

Chapter : 3. Section. 1, 2, 3, 5, 6, 7, 8

**7 Hrs**

Legendre transformations and Hamilton's equations of motion. Cyclic Coordinates and conservation theorems, Derivation of Hamilton's equation of motion from variational principle, Principle of Least Action.

**6 Hrs**

Chapter : 7 Section: 1, 2,3,4 5 .

**UNIT-III:** Equations of canonical transformation, Examples of Canonical transformations, The harmonic Oscillator, Poisson brackets and other Canonical invariants, Equations of motion, Infinitesimal canonical transformations, and conservation theorems in the poisson bracket formulation, the angular momentum poisson bracket relations.

**5Hrs**

Chapter : 8. Section : 1, 2, 4, 5, 6 & 7.

Hamilton – Jacobi equation of Hamilton's principal function, The Harmonic oscillator problem as an example of the Hamilton – Jacobi Method, Hamilton –Jacobi equation for Hamilton's characteristic function. Action – angle variables in systems of one degree of freedom.

**8 Hrs.**

Chapter : 9. Section : 1, 2, 3, & 5.

**UNIT-IV:** Independent coordinates of rigid body. , The Euler angles, Euler's theorem on the Motion of a rigid body, Infinitesimal rotations, Rate of change of a vector, The Coriolis Effect.

Chapter : 4. Section : 1, 4, 6, 8, 9 .

The Inertia tensor and the moment of inertia, The Eigenvalues of the inertia tensor and the principal axis transformation, Solving rigid body problems and Euler equations of motion, Torque – free motion of a rigid body

**6 Hrs**

Chapter 5 Section: 3, 4, 5 & 6.

The Eigenvalue equation and the principal axis transformation, Frequencies of free vibration, and normal coordinates, Free vibrations of a linear triatomic molecule

Chapter 10 Section: 2, 3 & 4 .

**6 Hrs**

**TEXT BOOKS :** Classical Mechanics H.Goldstein (Addison-Wiley, 1<sup>st</sup> & 2<sup>nd</sup> ed)

**REFERENCE BOOK :** Classical Dynamics of Particles and Systems J.B.Marion.

**P102,SP102 : INTRODUCTORY QUANTUM MECHANICS**

**UNIT-I:** The Conceptual aspect :Wave particle duality,Bohr's complementarity principle.Wave function and its interpretation - Principle of superposition-Wave packets – phase velocity and group velocity-Uncertainty relation Postulates of Quantum Mechanics - Schrodinger wave equation - Conservation of probability

**UNIT-II:** Operators and their properties - Equation of Motion for operators, Hermitian operators and their Eigen values and eigen functions Stationary states, Bohr's correspondence principle - Coordinate and Momentum representation- Ehrenfest's theorem Commutator Algebra.- Dirac Delta function, definition and properties. Dirac Delta Normalization

**UNIT-III:** One dimensional problems - Free Particle, Particle in a box- Potential step, potential Well, Rectangular Potential Barrier - Linear Harmonic Oscillator Angular Momentum, Angular Momentum in spherical polar coordinates, Eigenvalues and eigenfunctions of  $L^2$ ,  $L_z$ ,  $L_+$  and  $L_-$  operators. Eigen values and eigen functions of Rigid rotator and Hydrogen atom. Commutation relations, electron spin.

**UNIT-IV:** Time- independent perturbation theory for(i) non degenerate systems and application to Hydrogen atom: Kinetic energy correction, spin-orbit interaction, fine structure. Ground state of Helium atom.

ii) degenerate systems, application to linear stark effect in Hydrogen.

Variation method and its application to Helium atom.

Exchange energy and low lying excited states of Helium atom.

Interaction of electromagnetic radiation with matter. Selection rules.

**Text Book :**

Quantum Mechanics R.D. RATNA RAJU

**Reference Books :**

6. Quantum Mechanics Aruldhas
7. Quantum Mechanics G. S. Chaddha
8. Quantum Mechanics B.H.Bransden and C.J.Joachain
9. Quantum Mechanics E. Merzbacher
10. Quantum Mechanics Richard Liboff

P103,SP103: Mathematical Methods of Physics

**Unit I : Complex Variables**

**15 Hrs**

Function of complex number- definition-properties, analytic function-Cauchy –Riemann conditions-polar form-problems, Complex differentiation, complex integration –Cauchy’s integral theorem- Cauchy’s integral formulae-multiply connected region- problems, Infinite series-Taylor’s theorem- Laurent’s theorem-Problems, Cauchy’s Residue theorem- evaluation of definite integrals-problems.

**Text Book:** 1. Mathematical Methods of Physics-G.Arken, Academic Press  
2. Mathematical Physics-Satya Prakash, Sultan Chand & co, New Delhi  
3. Complex Variables ( Schaum’s out line series) Murray R. Spiegel

**Ref Book:** Mathematical Methods B.D.Gupta

**Unit II : Beta , Gamma functions & Special functions**

**10 Hrs**

Beta & Gamma functions -definition, relation between them- properties-evaluation of some integrals

**Special Functions-** Legendre Polynomial, Hermite Polynomial, Laguerre Polynomial-Generating function-recurrence relations- Rodrigue’s formula-orthonormal property-associated Legendre polynomial- simple recurrence relation-orthonormal property-spherical harmonics

**Text Book:** 1. Mathematical Methods of Physics-G.Arken, Academic Press  
2. Mathematical Physics-Satya Prakash, Sultan Chand & co, New Delhi  
3. Mathematical Physics B S Rajput

**Ref book :** Special Functions .M.D.Raisinghania

**Unit III : Laplace Transforms & Fourier series, Fourier Transforms**

**15 Hrs**

Laplace Transforms – definition- properties – Laplace transform of elementary functions-Inverse Laplace transforms-properties-evaluation of Inverse Laplace Transforms-elementary function method-Partial fraction method-Heavyside expansion method-Convolution method-complex inversion formula method-application to differential equations Fourier series-evaluation of Fourier coefficients- Fourier integral theorem-problems-square wave-rectangular wave-triangular wave  
Fourier Transforms- infinite Fourier Transforms-Finite Fourier Transforms-Properties-problems-application to Boundary value problem

**Text Book:** 1. Mathematical Methods of Physics-G.Arken, Academic Press  
2. Mathematical Physics-Satya Prakash, Sultan Chand & co, New Delhi  
3. Laplace n Fourier Transforms Goyal & Gupta,

**Ref books:** Integral Transforms M.D.Raisinghanna  
Integral Transforms Goyal & Gupta  
Mathematical Physics B S Rajput

**Unit IV: Numerical Analysis**

**10 Hrs**

Solutions of algebraic and Transcendental equations-Bisection method-method of successive approximations-method of false position Iteration method-Newton Rapson method Simultaneous linear algebraic equations-Gauss elimination method-Gauss Jordan method-Matrix inversion method-jacobi method – Gauss-Siedel method  
Interpolation with equal intervals-Finite differences-Newton Forward & Backward Interpolation formulæ Interpolation with unequal intervals-Newton’s divided difference formula-Lagrange interpolation formula Numerical Integration-General Quadrature formula-Trapezoidal rule -Simpson’s 1/3 rule & 3/8 rule

**Text Books:** **Introductory methods of Numerical analysis S.S.Sastry**  
**Numerical Methods V.N.Vedamurthy & N.Ch.S.N.Iyengar**

P104,SP104: ELECTRONIC DEVICES AND CIRCUITS

**UNIT-I: SEMICONDUCTOR DEVICES:**

**10 Hrs.**

Tunnel diode, photo diode, solar cell, LED, Silicon controlled Rectifier, Uni Junction Transistor, Field Effect Transistor, (JFET & MOSFET), CMOS

**UNIT-II: MICROWAVE DEVICES:**

**15 Hrs.**

Varactor diode, Parametric Amplifier, Thyristors, Klystron, Reflex Klystron, Gunn Diode, Magnetron, CFA, TWT, BWO, IMPATT, TRAPATT, APD, PIN Diode, Schottky Barrier Diode.

**UNIT-III: OPERATIONAL AMPLIFIERS :**

**10 Hrs.**

The ideal Op Amp – Practical inverting and Non inverting Op Amp stages. Op Amp Architecture – differential stage, gain stage, DC level shifting, output stage, offset voltages and currents

Operational Amplifier parameters- input offset voltage, input bias current , Common Mode Rejection Ratio, Slew Rate

**UNIT-IV**

**15 Hrs.**

**OP- AMP APPLICATIONS:**

Summing amplifier, Integrator, Differentiator, Voltage to Current converter, Current to Voltage converter  
Oscillators – Phase shift oscillator, Wien-Bridge Oscillator, Voltage Controlled Oscillator, Schmitt Trigger  
Special applications – Monostable and Astable multivibrators using 555, Phase locked Loop, Voltage regulators.

**TEXT BOOKS:**

1. Integrated Electronics - Jacob Millman & C.C. Halkies (TMH)
2. Op.Amps and Linear Integrated Circuits – Ramakant A.Gayakwad (PHI)
3. Electronic Communication Systems – George Kennedy (PHI)

**REFERENCE BOOKS:**

1. Microelectronics - Jacob Millman & Arvin Grabel (McGraw Hill)
2. Electronic Devices and Circuits – G.K. Mithal (Khanna)
3. Op-amps and Linear Integrated Circuits – D. Mahesh Kumar (MacMillan).

DEPARTMENT OF PHYSICS  
ANDHRA UNIVERSITY  
Common for M.Sc. Physics and M.Sc. Space Physics  
I Semester(w.e.f 2009-10 batch)

**P105 / SP105 : MODERN PHYSICS LAB - I**

1. Atomic Spectrum of Zinc.
  - a) Verification of Lande's interval rule
  - b) Study of relative intensities
2. Grating spectrometer
  - a) Wavelengths of Hg spectrum,
  - b) wavelength of Balmer series, Rydberg constant
3. Reciprocal dispersion curve
4. Application of Point Groups.
  - a) Identification of symmetry operations in  $H_2O$ ,  $BH_3$ ,  $NH_3$  and  $H_2CO$
  - b) Reducible representations and Vibrational modes of  $H_2O$ .
5. Determination of Planck's constant, work function and threshold frequency
6. Band gap of a semiconductor. (Two Probe Method)
7. Thermo emf
8. The Franck-Hertz experiment
9. Band spectrum of CN in the violet
  - a) conversion of given wavelengths to wavenumbers and assignment of ( $\nu'$ ,  $\nu''$ )
  - b) Deslandres' table and Vibrational constants.

ANDHRA UNIVERSITY  
DEPARTMENT OF PHYSICS  
Common for M.Sc. Physics and M.Sc. Space Physics  
I Semester (w.e.f 2009-10 batch)

**P106/SP106: ELECTRONICS LAB -I**

**LIST OF EXPERIMENTS**

- |                                     |              |
|-------------------------------------|--------------|
| 1. FET amplifier                    | (BFW 10/11 ) |
| 2. Negative feedback amplifier      | (BC 147 )    |
| 3. Colpitts Oscillator              | (BF 194)     |
| 4. Phase shift Oscillator           | (BC 147)     |
| 5. Astable Multivibrator            | (BF 194)     |
| 6. Op.Amp.Characteristics           | (IC 741 )    |
| 7. Power Supply                     |              |
| 8. UJT Characteristics              | (2 N 2646 )  |
| 9. R.F.Amplifier                    | (BF 194)     |
| 10. Boot-strap time based generator | (2N 2222)    |



**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**

**Common for M.Sc. Physics and M.Sc. Space Physics**  
**II Semester (w.e.f 2009-10 batch)**

		<b>MARKS</b>
<b>P 201.</b>	<b>ELECTRODYNAMICS</b>	<b>85+15=100</b>
<b>P 202.</b>	<b>STATISTICAL MECHANICS</b>	<b>85+15=100</b>
<b>P203</b>	<b>ATOMIC AND MOLECULAR PHYSICS</b>	<b>85+15=100</b>
<b>P 204.</b>	<b>NUCLEAR AND PARTICLE PHYSICS</b>	<b>85+15=100</b>
<b>P205</b>	<b>Modern Physics lab - II Practical -75 + record-25</b>	<b>100</b>
<b>P206</b>	<b>ELECTRONICS LAB –II Practical -75 + record-25</b>	<b>100</b>
<b>TOTAL MARKS</b>		<b>600</b>
<b>Choice Based Paper for other Departments in University Campus only</b>		
	<b>INTRODUCTORY ATMOSPHERIC AND SPACE PHYSICS</b>	

*For Each Theory Paper 85 marks for semester end exam and 15 marks for internal assessment*

**SCHEME OF EXAMINATION**

<b>Theory pass minimum</b>	<b>40%</b>
<b>Practical pass minimum</b>	<b>50%</b>
<b>Aggregate</b>	<b>50%</b>

**SCHEME OF INSTRUCTION :**

<b>Teaching Hours</b>	<b>4 Periods per week</b>
<b>Tutorial</b>	<b>1 Period per week</b>
<b>Practical</b>	<b>6 Periods per week</b>

**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**  
**Common for M.Sc. Physics and M.Sc. (Space Physics)**  
**II Semester**  
**(w.e.f 2009-10 batch)**  
**P201,SP201: ELECTRO DYNAMICS.**

**UNIT-I:** Gauss Theorem, Poission's equation, Laplaces equation, solution to Lapalaces equation in cartesian coordiantes, spherical coordinates, cylidrical coordinates, use of Laplaces equation in the solutions of electrostatic problems.  
**6Hrs**

Ampere's circuital law, magnetic vector potential, displacement current, Faraday's law of electromagnetic induction,  
**4Hrs**

**UNIT-II;** Maxwell's equations, differential and integral forms, physical significance of Maxwell's equations.  
**4 Hrs**

Wave equation, plane electromagnetic waves in free space , in nonconducting isotropic medium, in conducting medium, electromagnetic vector and scalar potentials, uniqueness of electromagnetic potentials and concept of gauge, Lorentz gauge, Coulomb gauge,  
**6Hrs**

charged particles in electric and magnetic fields: charged particles in uniform electric field, charged particles in homogorous magnetic fields, charged particles in simultaneous electric and magnetic fields, charged particles in nonhomogeneous magnetic fields.  
**6Hrs**

**UNIT-III:** Lienard-Wiechert potentials, electromagnetic fields from Lienard-wiechert potentials of a moving charge, electromagnetic fields of a uniformly moving charge, radiation due to non-relativistic charges, radiation damping, Abraham-Lorentz formula, cherenkov radiation, radiation due to an oscillatory electric dipole, radiation due to a small current element. Condition for plasma existence, occurrence of plasma, magneto hydrodynamics, plasma waves  
**10 Hrs**

**UNIT-IV:** Transformation of electromagentic potentials, Lorentz condition in covariant form, invariance or covariance of Maxwell field eqations in terms of 4 vectors, electromagnetic field tensor, Lorentz transformation of electric and magnetic fields.  
**12 Hrs**

**Text books:**

- |  |                  |
|--|------------------|
| 1. Classical Electrodynamics :                 | - J.D. Jackson   |
| 2. Introduction to Electrodynamics :           | - D.R. Griffiths |
| 3. .Electromagnetic Theory and Electrodynamics | - Satyaprakash   |
| 4. Electrodynamics                             | - KL Kakani      |



**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**  
**Common for M.Sc. Physics and M.Sc. Space Physics**  
**II Semester**  
**(w.e.f 2009-10 batch)**  
**P202,SP202: STATISTICAL MECHANICS**

**UNIT-I : Basic Methods and Results of Statistical Mechanics: 13 Hrs**

Specification of the state of a system, phase space and quantum states, Liouville's theorem, Basic postulates, Probability calculations, concept of ensembles, thermal interaction, Mechanical interaction, quasi static process, distribution of energy between systems in equilibrium, statistical calculations of thermo dynamic quantities, Isolated systems(Microcanonical ensemble). Entropy of a perfect gas in microcanonical ensemble. Canonical ensemble - system in contact with heat reservoir, system with specified mean energy, connection with thermodynamics, Energy fluctuations in the canonical ensemble. Grand canonical ensemble, Thermodynamic function for the grand canonical ensemble. Density and energy fluctuations in the grand canonical ensemble. Thermodynamic equivalence of ensembles. Reif Ch:2, 3.3,3.12 Ch:6

**UNIT-II : Simple Applications of Statistical Mechanics: 12 Hrs**

Partition functions and their properties. Calculation of thermo dynamic quantities to an ideal mono atomic gas. Gibbs paradox, validity of the classical approximation. Proof of the equipartition theorem. Simple applications – mean K.E. of a molecule in a gas. Brownian motion. Harmonic Oscillator, Specific heats of solids (Einstein and Debye model of solids), Paramagnetism, Partition function for polyatomic molecules, Electronic energy, vibrational energy and rotational energy of a diatomic molecule. Effect of Nuclear spin-ortho and para Hydrogen. Reif Ch:7, Ch:9.12

**UNIT-III: Quantum Statistics: 15 Hrs**

Formulation of the statistical problem. Maxwell–Boltzmann statistics. Photon statistics, Bose-Einstein statistics, Fermi–Dirac statistics, Quantum statistics in the classical limit, calculation of dispersion for MB, BE & FD statistics Equation of state of an Ideal Bose Gas, Black body radiation, Bose-Einstein condensation, Equation of state for a weakly degenerate and strongly degenerate ideal Fermi gas. Thermionic emission. The theory of white dwarf stars. Reif Ch:9

**UNIT-IV: Non Ideal Classical Gas: 10 Hrs**

Calculation of the partition function for low densities. Equation of state and virial coefficients (Van Der Waals equation) Reif Ch:10.3,10.4

**Phase Transitions and Critical Phenomena:**

Phase transitions, conditions for Phase equilibrium, First order Phase transition – the Clausius–Clayperon equation, Second order phase transition, The critical indices, Van der Waals theory of liquid gas transition. Order parameter, Landau theory. Sinha Ch:10

**Text Books**

1. Fundamentals of Statistical and Thermal Physics F. Reif
2. Statistical Mechanics, Theory and Applications S.K. Sinha
3. Statistical Mechanics R.K. Pathria

**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**  
**Common for M.Sc. Physics and M.Sc. Space Physics**  
**II Semester (w.e.f 2009-10 batch)**  
**P203,SP203: ATOMIC AND MOLECULAR PHYSICS.**

**UNIT-I**

**12 Hrs**

**ONE ELECTRON ATOMS :** Quantum numbers, Term values . Relation between Magnetic dipole moment and angular momentum of an orbiting electron. Stern–Gerlach experiment and electron spin . Spin- orbit interaction, relativistic kinetic energy correction and dependence of energy on J value only. Selection rules. Fine structure of Balmer series of Hydrogen and Fowler series of ionized Helium. Hyperfine structure of H $\alpha$  line of hydrogen ( $I = 1/2$ ).

**ONE VALENCE ELECTRON ATOMS:** Modified term values (quantum defect) due to lifting of orbital degeneracy by core penetration (penetrating orbits) and core polarization (non-penetrating orbits) by nl electrons. Term values and fine structure of chief spectral series of sodium. Intensity rules and application to doublets of sodium. Hyperfine structure of  $^2P-^2S$  of sodium ( $I= 3/2$ ).

**UNIT-II**

**10 Hrs**

**MANY ELECTRON ATOMS :** Indistinguishable particles, bosons, fermions. Pauli's principle. Ground states. LS coupling and Hund's rules based on Residual coulombic interaction and spin-orbit interaction. Lande's interval rule. Equivalent and non-equivalent electrons. Spectral terms in LS and JJ coupling (ss,s<sup>2</sup>, pp,p<sup>2</sup> configurations). Exchange force and Spectral series of Helium.

**Lasers-** spontaneous emission, stimulated emission, population inversion, Einstein coefficients, metastable levels, resonance transfer and population inversion in He-Ne laser.

**UNIT- III**

**8 Hrs**

**ATOMS IN EXTERNAL MAGNETIC FIELD:** Quantum theory of Zeeman and Paschen-Back effects and application to  $^2P-^2S$ ,  $^3P-^3S$ , transitions.

**ATOMS IN EXTERNAL ELECTRIC FIELD:** Linear stark pattern of H $\alpha$  line of hydrogen and Quadratic stark pattern of D<sub>1</sub> and D<sub>2</sub> lines of Sodium.

**UNIT-IV**

**20 Hrs**

**DIATOMIC MOLECULES:** Molecular quantum numbers. Bonding and anti-bonding orbitals from LCAO's. Explanation of bond order for N<sub>2</sub> and O<sub>2</sub> and their ions. Rotational spectra and the effect of isotopic substitution. Effect of nuclear spin functions on Raman rotation spectra of H<sub>2</sub> (Fermion) and D<sub>2</sub> (Boson). Vibrating rotator. Spectrum. Combination relations and evaluation of rotational constants (infrared and Raman). Intensity of vibrational bands of an electronic band system in absorption.(The Franck-Condon principle). Sequences and progressions. Deslandre's table and vibrational constants.

**MOLECULAR VIBRATIONS :** Symmetry operations and identification of point Groups of HCN, CO<sub>2</sub> , BH<sub>3</sub> , NH<sub>3</sub> , H<sub>2</sub>O molecules. Properties of irreducible representations and C<sub>2v</sub> character table. Reducible representation and symmetry of fundamental vibrations of H<sub>2</sub>O

**BOOKS :**

- |   |                |
|---|----------------|
| 1. Atomic and Molecular Spectra           | - Rajkumar     |
| 2. Fundamentals of Molecular Spectroscopy | - C.N.Banwell. |
| 3. Group Theory                           | - K.V.Raman.   |
| 4. Introduction to Atomic Spectra         | - H.E.White.   |

**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**  
**Common for M.Sc. Physics and M.Sc. Space Physics**  
**II Semester**  
**(w.e.f 2009-10 batch)**  
**P204,SP204: NUCLEAR AND PARTICLE PHYSICS**

**UNIT - I**

**INTRODUCTION :**

Objective of Studying Nuclear Physics, Nomenclature, nuclear radius, mass & Binding energy, angular momentum, magnetic dipole moment, Electric quadrupole moment, parity and symmetry, domains of instability, Energy levels, mirror nuclei.

**NUCLEAR FORCES** : Simple theory of the deuteron, scattering cross-sections, qualitative discussion of neutron- proton and proton- proton scattering, charge independence and charge symmetry of nuclear forces, exchange forces, Yukawa's Potential, Characteristics of Nuclear Forces.

**UNIT - II**

**NUCLEAR MODELS** . Liquid drop model:, Weissacker's semi-empirical mass formula, Mass – parabolas. Nuclear shell model : Spin orbit interaction, magic numbers, prediction of angular momenta and parities for ground states, Collective model., More-realistic models

**NUCLEAR DECAY** : Alpha decay process, Energy release in Beta-decay, Fermi's Theory of  $\beta$  - decay, selection rules, parity violation in  $\beta$ -decay, Detection and properties of neutrino, . Energetics of gamma decay, selection rules, angular correlation, Mossbauer effect.

**NUCLEAR REACTIONS** : Types of reactions and conservation laws, the Q – equation, Optical model, heavy ion Reactions

**UNIT - III**

**NUCLEAR ENERGY** Stability limit against spontaneous fission, Characteristics of fission, delayed neutrons, Four factor formula for controlled fission, Nuclear fusion, prospects of continued fusion energy.

**ELEMENTARY PARTICLE PHYSICS:** Particle interactions and families, symmetries and conservation laws ( energy and momentum, angular momentum, parity, Baryon number, Lepton number, isospin, strangeness quantum number( Gellmann and Nishijima formula) and charm), Elementary ideas of CP and CPT invariance, SU(2), SU(3) multiplets, Quark model.

**UNIT - IV**

**DETECTING NUCLEAR RADIATION:** Interaction of radiation with matter. Gas filled counters, scintillation detectors, semiconductor detectors, energy measurements, coincidence measurements and time resolution, magnetic spectrometers.

**ACCELERATORS:** Electrostatic accelerators, cyclotron accelerators, synchrotrons, linear accelerators, colliding beam accelerators.

**APPLICATIONS OF NUCLEAR PHYSICS:** Trace Element Analysis, Rutherford Back-scattering, Mass spectrometry with accelerators, Diagnostic Nuclear Medicine, Therapeutic Nuclear Medicine.

**TEXT BOOKS** : “Introductory Nuclear Physics” Kenneth S. Krane

**Reference Books:**

1. “Introduction to Nuclear Physics “ Harald A. Enge
2. “Concepts of Nuclear Physics “ Bernard L. Cohen.
3. “ Introduction to High Energy physics” D.H. Perkins
4. “ Introduction to Elementary Particles” D. Griffiths

## **Department of Physics, Andhra University**

### **Introductory Atmospheric and Space Physics**

(Choice based course to be offered in the Department of Physics during II Semester with a minimum intake of 15 and maximum 25)  
With effect from 2009-2010 admitted batch)

Target aspirants: PG students from departments of Meteorology and Oceanography, Geophysics, Environmental sciences, Geography, Geo-engineering and Electronics and Communication engineering)

**Unit I :** The Neutral atmosphere, atmospheric nomenclature, the Hydrostatic equation, geopotential height, expansion and contraction, fundamental forces in the atmosphere, apparent forces, atmospheric composition, solar radiation interaction with the neutral atmosphere, climate change.

**Unit II:** Electromagnetic radiation and propagation of waves: EM Radiation, fundamentals of EM waves, effects of environment, Antennas- basic considerations, types of antennas. Propagation of waves: ground wave, sky wave, and space wave propagation, troposcatter communication and extra terrestrial communication.

**Unit III:** The Ionosphere, morphology of ionosphere, the D, E and F-regions, chemistry of the ionosphere, ionospheric parameters, E and F region anomalies and irregularities in the ionosphere.

**Unit IV:** Global Positioning systems (GPS)- basic concepts, overview of GPS system, augmentation services, GPS system segment, GPS signal characteristics, GPS errors, multi path effects, GPS performance, satellite navigation system and applications.

#### **Reference Books:**

1. An Introduction to Dynamic Meteorology by James R Holton, Academic Press Inc.
2. Climatology, An atmospheric Science by John E. Oliver and John J. Hindore, Pearson Education
3. Electronic Communication systems by George Kennedy and Bernard Davis, Tata McGraw Hill publishing Co., Ltd.
4. Introduction to Ionospheric Physics by Henry Rishbeth and Owen K. Garriot, Academic press
5. Understanding GPS principles and applications by Elliot D. Kaplan and Christopher J. Hegarty, Artech House, Boston.

**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**LIST OF EXPERIMENTS FOR**  
**COMMON FOR M.SC.PHYSICS AND M.SC. (SPACE PHYSICS)**

**II Semester**

**(w.e.f 2009-10 batch)**

**P205,SP205: MODERN PHYSICS LAB -II**

- 1. Atomic Spectrum of Sodium.**
  - a) identification of sharp and diffuse doublets**
  - b) doublet separation**
  - c) assignment of principal quantum numbers**
- 2. Raman Spectrum of Carbon Tetrachloride**
  - a) Raman shifts**
  - b) Fermi resonance**
- 3. Vibrational analysis of AlO Green system.**
  - a) identification of sequences, assignment of vibrational quantum numbers,**
  - b) Deslandre's table and Vibrational constants.**
- 4. Determination of Specific Charge of an electron by Thomson's Method.**
- 5. Experiments with He- Ne laser .**
  - a) Polarization of laser light**
  - b) Divergence of laser beam and monochromaticity.**
- 6. Band gap of a semiconductor (Four probe method).**
- 7. Dielectric constant as a function of temperature and determination of Curie Temperature**
- 8. Susceptibility of a substance Gouy's method**
- 9. Dissociation energy of Iodine molecule from the given data.**

**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**LIST OF EXPERIMENTS FOR**  
**COMMON FOR M.SC.PHYSICS AND M.Sc. SPACE PHYSICS**  
**II Semester**  
**(w.e.f 2009-10 batch)**  
**P206,SP206: ELECTRONICS LAB -II**

**List of Experiments (Any SIX of the following)**

- 1. Active Low pass and High Pass filters (IC 741 )**
- 2. Twin -T filter (IC 741 )**
- 3. Logarithmic Amplifier (IC 741 )**
- 4. Wein Bridge Oscillator (IC 741 )**
- 5. Monostable multivibrator (IC 555 )**
- 6. Voltage Regulator (IC 723 )**
- 7. Phase Shift Oscillator (IC 741 )**
- 8. Astable multivibrator (IC 555 )**
- 9. Active band pass filter (IC 741 )**
- 10. Voltage controlled oscillator ((IC 741, IC 555 )**

**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**M.Sc. PHYSICS,**  
**III SEMESTER.**

		<b>MARKS</b>
<b>P301.</b>	<b>SOLID STATE PHYSICS (85+15)</b>	<b>100</b>

<b>P302.</b>	<b>LASERS AND FIBER OPTICS (85+15)</b>	<b>100</b>
<b>P303.</b>	<b>DIGITAL ELECTRONICS &amp; MICROPROCESSORS (85+15)</b>	<b>100</b>

**Special paper**

<b>P304</b>	<b>RADAR SYSTEMS AND SATELLITE COMMUNICATION (85+15)</b>	<b>100</b>
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<b>P305</b>	<b>DIGITAL ELECTRONICS LAB practical-75 +record-25</b>	<b>100</b>
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<b>P306</b>	<b>SOLID STATE PHYSICS LAB practical-75+record-25</b>	<b>100</b>
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**Total Marks                      600**

Choice Based Paper for other Departments in University Campus Only

	<b>ANALYTICAL TECHNIQUES</b>	
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**SCHEME OF EXAMINATION**

<b>Theory pass minimum</b>	<b>40%</b>
<b>Practical pass minimum</b>	<b>50%</b>
<b>Aggregate</b>	<b>50%</b>

**SCHEME OF INSTRUCTION :**

<b>Teaching Hours</b>	<b>4 Periods per week</b>
<b>Tutorial</b>	<b>1 Period per week</b>
<b>Practical</b>	<b>6 Periods per week</b>

**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**  
**M.Sc. Physics**  
**III Semester**  
**(w.e.f 2009-10 batch)**  
**P301: SOLID STATE PHYSICS.**

**UNIT-I: CRYSTAL STRUCTURE: 14 Hrs**

Periodic array of atoms—Lattice translation vectors and lattices, symmetry operations, The Basis and the Crystal Structure, Primitive Lattice cell, Fundamental types of lattices—Two Dimensional lattice types, three Dimensional lattice types, Index system for crystal planes, simple crystal structures-- sodium chloride, cesium chloride and diamond structures.

**UNIT-II: CRYSTAL DIFFRACTION AND RECIPROCAL LATTICE: 14 Hrs**

Bragg's law, Experimental diffraction methods-- Laue method and powder method, Derivation of scattered wave amplitude, indexing pattern of cubic crystals and non-cubic crystals (analytical methods). Geometrical Structure Factor, Determination of number of atoms in a cell and position of atoms. Reciprocal lattice, Brillouin Zone, Reciprocal lattice to bcc and fcc Lattices.

**UNIT-III: PHONONS AND LATTICE VIBRATIONS: 6 Hrs**

Vibrations of monoatomic lattices, First Brillouin Zone, Group velocity, Long wave length, Lattice with two atoms per primitive cell, Quantization of Lattice Vibrations-Phonon momentum.

**FREE ELECTRON FERMI GAS: 6 Hrs**

Energy levels and density of orbitals in one dimension, Free electron gas in 3 dimensions, Heat capacity of the electron gas, Experimental heat capacity of metals, Motion in Magnetic Fields- Hall effect, Ratio of thermal to electrical conductivity.

**UNIT-IV: THE BAND THEORY OF SOLIDS: 10 Hrs**

. Nearly free electron model, Origin of the energy gap, The Bloch Theorem, Kronig-Penny Model, wave equation of electron in a periodic potential, Crystal momentum of an electron- Approximate solution near a zone boundary, Number of orbitals in a band--metals and isolators. The distinction between metals, insulators and semiconductors

**TEXT BOOKS:**

- 1.Introduction to Solid State Physics, C.Kittel, 5<sup>th</sup> edition,
- 2.Solid State Physics, A.J.DEKKER.



**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**M.Sc. PHYSICS**  
**III Semester**  
**(w.e.f 2009-10 batch)**

**P302: Lasers and Fiber optics**

**UNIT-I**

**LASER SYSTEMS** :Light Amplification and relation between Einstein A and B Coefficients. Rate equations for three level and four level systems. Laser systems: Ruby laser, Nd-YAG laser, CO<sub>2</sub> Laser, Dye laser, Excimer laser, Semiconductor laser.

**UNIT – II:**

**LASER CAVITY MODES:** Line shape function and Full Width at half maximum (FWHM) for Natural broadening, Collision broadening, Doppler broadening, Saturation behavior of broadened transitions, Longitudinal and Transverse modes. ABCD matrices and cavity Stability criteria for confocal resonators. Quality factor, Q-Switching, Mode Locking in lasers. Expression for Intensity for modes oscillating at random and modes locked in phase. Methods of Q-Switching and Mode locking.

**UNIT-III**

**OPTICAL FIBER WAVEGUIDES** : Basic optical laws and Self focusing. Optical fiber modes and configurations Fiber types, Rays and Modes, Step-index fiber structure. Ray optics representation, wave representation. Mode theory of circular step-index wave guides. Wave equation for step-index fibers, modes in step-index fibers and power flow in step-index fibers. Graded – index fiber structure, Graded-index numerical aperture, modes in Graded-index fibers.

**UNIT-IV**

**FIBER CHARACTERISTICS** : Signal Degradation In Fibers - Attenuation, Absorption, Scattering and Bending losses in fibers, radiative losses, Core and Cladding losses. Signal distortion in optical wave guides: Group delay, material dispersion, waveguide dispersion and intermodal dispersion. Pulse broadening in optical fibers. Power launching in Optical fibers, Source-output pattern, Lensing schemes. Fiber-to-fiber joints: Mechanical misalignment, fiber related losses, Fiber and face preparation. fiber splicing techniques, fiber connectors.

**TEXT BOOKS:**

1. **Lasers -Theory and Applications – K.Thyagarajan and A.K. Ghatak. (MacMillan)**
2. **Optical fiber Communications – Gerd Keiser (Mc Graw-Hill)**

**REFERENCE BOOKS:**

1. **Laser fundamentals – William T. Silfvast (Cambridge)**
2. **Introduction to fiber optics – Ajoy Ghatak and K. Thyagarajan (Cambridge)**
3. **Optical Electronics – Ajoy Ghatak and K.Thyagarajan (Cambridge)**
4. **Opto- electronics – J. Wilson and J.F.B. Hawkes (Printice Hall)**

ANDHRA UNIVERSITY  
DEPARTMENT OF PHYSICS  
M.Sc. PHYSICS, SPACE PHYSICS

**III Semester**

**(w.e.f 2009-10 batch)**

P303, SP303: Digital Electronics & Microprocessors  
(Common for M.Sc.Space Physics and M.Sc.Physics)

## **UNIT - I**

**Digital Circuits (i) Number Systems and Codes:** Binary, Octal, Hexadecimal number systems, Gray code, BCD code, ASCII code. (ii) Logic Gates and Boolean Algebra: OR, AND, NOT, NOR, NAND gates, Boolean theorems, DeMorgan laws.

**II) Combinational Logic Circuits:** (i) Simplification of Boolean Expressions: Algebraic method, Karnaugh Map method, EX-OR, EX-NOR gates, ENCODER, DECODER, Multiplexer, Demultiplexers.

(ii) Digital Arithmetic Operations and Circuits: Binary addition, Design of Adders and Subtractors, Parallel binary adder, IC parallel adder. (iii) Applications of Boolean Algebra: Magnitude Comparator, Parity generator, Checker, Code converter, Seven-segment decoder/ Driver display.

### **UNIT - II**

**Sequential Logic Circuits:** (i) Flip-Flops and Related Devices: NAND latch, NOR latch, Clocked flip-flops, Clocked S-C flip-flop, J-K flip-flop, D flip-flop, D latch, Asynchronous inputs, Timing problem in flip-flops. (ii) Counters: Asynchronous counters (Ripple), Counters with MOD number  $< 2^N$ , Asynchronous down counter, Synchronous counters, Up-down counter, Presettable counter. (iii) Registers: Shift Register, Integrated Circuit registers, Parallel In Parallel Out (PIPO), SISO, SIPO, PISO (iv) Applications of Counters: Frequency Counter and Digital clock.

**A/D and D/A Converter Circuits:** D/A Converter, Linear weighted and ladder type, An integrated circuit DAC; Analog-to-Digital Conversion, Digital Ramp ADC, Successive Approximation Method, Sample and Hold Circuit, Digital Voltmeter.

### **UNIT - III**

**Intel 8085 Microprocessor:**

Architecture, Functional diagram, Pin description, Timing Diagram of Read Cycle, Timing diagram of write Cycle.

**Programming the 8085 Microprocessor:**

(i) Addressing Methods, Instruction set, Assembly language programming.

(ii) Examples of Assembly Language Programming: Simple Arithmetic - Addition/Subtraction of two 8-bit/16-bit numbers, Addition of two decimal numbers, Masking of digits, word disassembly.

(iii) Programming using Loops: Sum of series of 8-bit numbers, Largest element in the array, Multiple byte addition, Delay sub-routine.

### **UNIT - IV**

**Data Transfer Technique:**

Serial transfer, Parallel transfer, Synchronous, Asynchronous, DMA transfer, Interrupt driven Data transfer.

**8085 Interfacing:**

I/O Interfacing: Programmable Peripheral Interfacing, 8255, Programmable Peripheral Interval Timer 8253, Programmable Communication Interface 8251, DAC 0800 and ADC 0800 interfacing.

### **TEXT & REFERENCE BOOKS:**

1. "Digital Systems – Principles and applications" – Ronald.J.Tocci,
2. "Fundamentals of Microprocessors & Microcomputers" - B. RAM.
3. " Introduction to Microprocessors for Engineers and Scientists" - P.K.Ghosh and P.R.Sridhar
4. "Microprocessor Architecture, Programming and Applications with the 8085 /8080A" – Ramesh. S. Gaonkar.

**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**M.Sc. PHYSICS AND M.Sc. SPACE PHYSICS**

**III Semester**

**(w.e.f 2009-10 batch)**

**(Common for M.Sc. Space Physics and M.Sc. Physics)**

**P304 , SP 304 - RADAR SYSTEMS & SATELLITE COMMUNICATION**

**UNIT - I**

**Radar Systems:**

Fundamental – A simple RADAR – overview of frequencies – Antenna gain Radar Equation – Accuracy and Resolution – Integration time and the Doppler shift (Ch 1 of Text Book 1)

Designing a surveillance radar – Radar and surveillance – Antenna beam – width consideration – pulse repetition frequency – unambiguous range and velocity – pulse length and sampling – radar cross section – clutter noise (Ch 2 of Text Book 1)

Tracking Radar – Sequential lobbing – conical scanning – Monopoles Radar – Tracking accuracy and Process – Frequency Agility – Radar guidance (Ch3 of Text Book 1)

**UNIT - II**

Signal and Data Processing – Properties of clutter – Moving Target Indicator Processing Shareholding – Plot extraction – Tract Association, Initiation and Tracking (Ch 5 of Text Book 1)

Radar Antenna – Antenna parameters – Antenna Radiation Pattern and aperture distribution – Parabolic reflector – cosecant squared antenna pattern – effect of errors on radiation pattern – Stabilization of antennas (Ch7 of Text Book 2).

**UNIT - III**

**Satellite Communication**

Satellite System – Historical development of satellites – communication satellite systems – communication satellites – orbiting satellites – satellite frequency bands – satellite multiple access formats (Ch1 of Text Book 3).

Satellite orbits and inclination – Look angles, orbital perturbations, space craft and its subsystems – attitude and orbit control system – Telemetry, Tracking and Command – Power system – Transponder – Reliability and space qualification – launch vehicles  
(Ch2 & 3 of Text Book 4)

**UNIT - IV**

Multiple Access Techniques – Time division multiple access – Frequency division multiple access – Code division multiple access – Space domain multiple access  
(Ch 7 of Text Book 4).

Earth Station technology – Subsystem of an earth station – Transmitter – Receiver Tracking and pointing – Small earth station – different types of earth stations – Frequency coordination – Basic principles of special communication satellites – INMARSAT VSAT, GPS, RADARSAT, INTELST

(Ch 10 & 11 of Text Book 4).

**Text Books:**

1. Understanding Radar Systems – Simon Kingsley and Shaun Quegan.
2. Introduction to Radar Systems – MI Skolnik
3. Satellite Communication – Robert M. Gagliardi
4. Satellite Communication – Manojit Mitra

**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**M.Sc. PHYSICS AND M.Sc. SPACE PHYSICS**  
**III Semester**  
**(w.e.f 2009-10 batch)**  
**P 305 : DIGITAL ELECTONICS Lab**

**I Digital electronics**

1. Verification of Gates: AND, OR, NOT, NAND, NOR, EX –OR, EX – NOR gates
2. Encoder and Decoder
3. Multiplexer and De multiplexer
4. Adders: Half adder, Full Adder, Paraller Adder
5. Flip Flops ( 7400,7402,7408,7446)
6. Decade Counter (IC 7490)
7. Seven segment Decoder/ Driver (7490,7447)
8. UP/DOWN Counter IC 74193
9. Digital Comparator ( 7485)
10. Microprocessor 8085
  - Addition/ subtraction of 8 bit numbers
  - Sum of series of 8 – bit numbers

**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**M.Sc. PHYSICS**

**III Semester**

**(w.e.f 2009-10 batch)**

**P 306: PRACTICALS : Solid State Physics Lab**

**LIST OF EXPERIMENTS**

(Any six of the following)

1. LATIC DYNAMICS – STUDY OF PHONON DISPERSION CHARACTERISTICS.
2. DETERMINATION OF DIELECTRIC CONSTANT-DETERMINATION OF GUIDE WAVELENGTH OF AN X-BAND TEST BENCH AND DETERMINATION OF DIELECTRIC CONSTANT OF BENZENE.
3. HALL EFFECT: DETERMINATION OF HALL COEFFICIENT AND ESTIMATION OF CARRIER CONCENTRATION
4. ESR STUDIES AND DPPH- DETERMINATION OF 'G' VALUE OF AN ELECTRON
5. COUPLED OSCILLATIONS AND STUDY OF THE STRENGTH OF THE COUPLING CONSTANT.
6. X-RAY DIFFRACTION STUDIES
7. DETERMINATION OF ELASTIC CONSTANT.
8. THERMOLUMINESCENCE-DETERMINATION OF ACTIVATION ENERGY OF ELECTRONS.
9. DETERMINATION OF MAGNETIC RESISTANCE
10. STUDY OF MAGNETIC HYSTERESIS LOOPS OF FERROMAGNETIC MATERIALS (BH CURVE)

**Department of Physics, A.U**  
**ANALYTICAL TECHNIQUES**

(Choice Based Paper to be offered in the Dept., of Physics during 3<sup>rd</sup> Semester for  
Other Dept., students in AU Campus only)  
(W.e.f. 2009 – 2010 admitted batch)

**Unit I**

Concepts of interaction of electromagnetic radiation with matter, wave and particle properties of electromagnetic radiation, electromagnetic spectrum, absorption laws, electronic transitions, optical and molecular spectra, molecular energies, Raman spectra, photoelectric effect, photoelectric cells, Compton effect, radiation sources, detectors, lasers

**References :**

- 1) Instrumental methods of analysis, Willard, Merritt, Dean, Settle (CBS Pub.)
- 2) Instrumental methods of chemical analysis, H. Kaur (Pragati Prakasan Pub.)

**Unit II : Ultrasonic techniques**

Acoustic Plane waves-Elastic behavior of fluids, plane wave equation, velocity of sound in fluids, energy density acoustic intensity, specific acoustic impedance. Transmission phenomenon-transmission from one fluid medium to another reflection at the surface of a solid, transmission through three media normal incidence and oblique incidence. Resonators & filters- Helmholtz resonator, acoustic impedance, acoustic analogue. Ultrasonic & sonar transducers-piezoelectric effect equivalent electrical circuit, generalized theory, quality factor, piezoelectric relations. Architectural acoustics-classical Ray theory decay of sound in live room & dead rooms. Applications of Ultrasonics

**References:**

- 1) Fundamentals of Acoustics-Kinsler & Fray Wiley Eastern.Limited
- 2) Ultrasonics , Jack Blitz
- 3) Physical Ultrasonics-Beyer & Letcher Academic Press

**Unit III : Magnetic Resonance Techniques**

1) Electron Spin Resonance: Basic Concepts, g-factor and nuclear hyperfine interaction,, essential features of an ESR spectrometer, Applications of ESR: in Physical Sciences and biological systems.

2) Nuclear Magnetic Resonance: Basic principles, continuous wave and pulsed NMR, Fourier Transform NMR, measurement of spin -lattice and spin- spin relaxation times, proton and C-13 NMR, basic pulsed Fourier Transform NMR spectrometer, 2D NMR, applications of NMR in physical and biological sciences, basic features of MRI.

3) Nuclear quadrupole resonance: Basic principle and applications

**References**

- 1) Electron Paramagnetic Resonance : Elementary Theory and practical Applications, J.A.Weil, J.R.Bolton and J.E.Wertz (Wiley) N.Y, 1994
- 2) Principles of Nuclear Magnetic Resonance in One and Two Dimensions, R.R.Ernst, G.Bodenhausen and A.Wokun,(Oxford)1987
- (3) Basics of NMR, Joseph. P. Hornack, Free Online Text
- (4) Nuclear Quadrupole Coupling Constants, E.A.C. Lucken (A.P ) 1969

**Unit IV : Structural characterization techniques**

X-ray diffraction, indexing pattern of cubic crystals and non-cubic crystals (analytical methods), crystal structure identification and determination of lattice parameters.

Fundamentals of Transmission Electron Microscopy (TEM) and Scanning Electron Microscopy (SEM), major components in SEM and TEM, study of crystal structure using TEM, study of microstructure using SEM.

**References :**

- 1) Elements of X-ray Diffraction, B.D. Cullity, Addison-Wesley Publishing Co. Inc., USA (1977).
- 2) Physical Methods of Materials Characterization (Second Edition), PEJ Flewitt and RK Wild, Institute of Physics Publishing, Bristol, UK.



**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**M.Sc. PHYSICS.**  
**IV SEMESTER**  
(w.e.f 2009-2010 admitted batch)

**P401: ADVANCED QUANTUM MECHANICS .**

**UNIT - I**

Linear Vector Spaces in Quantum Mechanics:

Vectors and operators, change of basis, Dirac's bra and ket notations. Eigen value problem for operators. The continuous spectrum. Application to wave mechanics in one dimension.

(*Merzbacher Sec. 14.1, 14.2, 14.3, 14.4, 14.5, 14.6, 14.7*)

**UNIT - II**

Quantum Dynamics :

The equation of motion, Quantization postulates, canonical quantization, Constants of motion and invariance properties. Heisenberg picture. Harmonic Oscillator.

(*Merzbacher . Sec. 15.1, 15.2, 15.3, 15.4, 15.6, 15.7*)

**UNIT - III**

Development of time-dependent perturbation theory. The golden rule for constant transition rates.

(*Merzbacher. Chapter. 18 relevant parts*)

Addition of two angular momenta. Tensor operators.

Wigner-Eckart theorem. Matrix elements of vector operators. Parity and time reversal symmetries.

(*Merzbacher . Section. 16.6, 16.8, 16.10, 16.11*)

**UNIT - IV**

Scattering:

Concept of differential cross-section. Scattering of a wave packet. Born approximation. Partial waves and phase shift analysis.

(*Merzbacher. Section. 11.1, 11.2, 11.4, 11.5*)

. Relativistic Quantum Mechanics

Klein – Gordon equation, Dirac equation for a free particle, Equation of continuity, Spin of a Dirac particle, Solutions of free particle Dirac equation, Negative energy states and hole theory

**TEXT BOOKS:**

1. “ Quantum Mechanics” by R.D. Ratna Raju
- 2.“Quantum Mechanics “ by E. Merzbacher

**Reference Books:**

- 1.” Quantum Mechanics” by Thankappan
2. “Quantum Mechanics” by Biswas



**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**M.Sc. PHYSICS**  
**IV SEMESTER**  
**(w.e.f 2009-2010 batch)**

**P.402 : PROPERTIES AND CHARACTERIZATION OF MATERIALS**

**UNIT - I**

**THERMAL PROPERTIES:**

Anharmonic crystal interactions-thermal expansion, thermal conductivity, lattice thermal resistivity, umklapp processes, and imperfections.

**OPTICAL PROPERTIES :**

Lattice Vacancies, Diffusion, Color Centers—F Centers, other centers in alkali halides, Alloys, Order-disorder transformations, Elementary theory of Order.

**UNIT - II**

**MICROSCOPIC EXAMINATION:**

Fundamentals of Transmission electron microscopy and scanning electron microscopy, study of crystal structure using TEM, study of microstructure using SEM.

**UNIT - III**

**RESONANCE METHODS:**

Spin and an applied field—the nature of spinning particles, interaction between spin and a magnetic field, population of energy levels, the Larmor precession, relaxation times—spin- spin relation, spin-lattice relaxation,

Electron Spin Resonance: Introduction, g-factor, experimental methods.

Nuclear Magnetic Resonance—equations of motion, line width, motional narrowing, hyperfine splitting,

Nuclear Gamma Ray Resonance: Principles of Mossbauer Spectroscopy, Line Width, Resonance absorption, Mossbauer Spectrometer, Isomer Shift, Quadrupole Splitting, magnetic field effects, Applications.

**UNIT - IV**

**ELECTRICAL AND MAGNETIC CHARACTERIZATION TECHNIQUES:**

DC & AC Conductivity, Curie temperature, Saturation Magnetization and Susceptibility

**OPTICAL SPECTROSCOPY:**

Fundamentals of Infra-red Spectroscopy and Applications.

**TEXT BOOKS:**

Solid State Physics, 5<sup>th</sup> edition, C.Kittel

Fundamentals of Molecular Spectroscopy CN Banwell

Mossbauer Effect and its Applications VG Bhide

**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**M.Sc PHYSICS, and SPACE PHYSICS**  
**IV SEMESTER**

(w.e.f 2009-2010 batch)

**P 403 , SP 403 COMMUNICATION ELECTRONICS**

(Common for M.Sc. Space Physics and M.Sc Physics)

**UNIT 1. CW Modulation:**

Amplitude Modulation (AM): 8 periods

**Introduction, Amplitude modulation, modulation index, Frequency spectrum, Average power**

for sinusoidal AM, Amplitude modulator and demodulator circuits, Double side band suppressed carrier (DSBSC) Modulation, Super heterodyne receiver.

Single Side Band Modulation (SSB): 4 periods

**SSB principles, Balanced Modulator, SSB generation**

Angle Modulation: 8 periods

**Frequency modulation (FM), sinusoidal FM, Frequency spectrum for sinusoidal FM**

frequency deviation, modulation index, Average power in sinusoidal FM, FM generation

Phase Modulation: Equivalence between PM and FM, FM detectors: Slope detector, Balanced slope detector, Foster – Seley discriminator, Ratio detector, Amplitude limiter, FM receiver.

**UNIT 2. Pulse Modulation:**

Digital Line Codes: Symbols, Functional notation for pulses, Line codes and wave forms: RZ, NRZ, Polar, Unipolar, AMI, HDBn and Manchester codes, M-ary encoding, Differential encoding 8 periods

Sampling theorem, Principles of pulse Amplitude Modulation (PAM) and Pulse Time Modulation (PTM), Pulse code modulation (PCM), quantization, Nonlinear quantization, companding, differential pulse code modulation (DPCM), Delta Modulation (DM).

Digital Carrier Systems: 8 periods

**ASK, PSK, FSK and DPSK**

**UNIT 3. Special Communication Circuits :** 6 periods

**Tuned amplifiers :Single tuned amplifier-Hybrid  $\pi$  – equivalent for the BJT, Short circuit**

**current gain for the BJT in CE and CB amplifiers, CE and CB tuned amplifiers, Cascode amplifier.**

Mixer Circuits : Diode mixer, IC balanced mixer.

Filters : Active filters, Ceramic, Mechanical and crystal filters.

Oscillators: Crystal oscillator, Voltage controlled oscillator, phase locked loop (PLL).

**UNIT 4. Noise in Communication Systems:** 8 periods

Thermal Noise, Shot Noise, Partition noise, Signal - to - Noise ratio, Noise factor, Amplifier input noise in terms of F, Noise factor of amplifiers in cascade (Friss formula), Noise temperature, Noise in AM, Noise in FM systems. Noise in pulse modulation systems: Intersymbol interference (ISI), eye diagrams.

**Text Books:**

1. Electronic Communications D. Roody and John Coolin
2. Electronic Communications Systems G. Kennedy
3. Modern Analog & Digital Communications B.P. Lathi.

**ANDHRA UNIVERSITY**

**DEPARTMENT OF PHYSICS**

M.Sc. PHYSICS and M.Sc. SPACE PHYSICS,

**IV SEMESTER (w.e.f 2009-2010 batch)**

*(Common for M.Sc. Space Physics and M.Sc Physics)*

**P404 , SP404 : ANTENNA THEORY AND RADIOWAVE PROPAGATION**

**UNIT - I**

**Radiation**

Potential functions of electro magnetic fields. Potential function for sinusoidal oscillations. Fields radiated by an alternating current element. Power radiated by a current element and radiation resistance. Radiation from a quarter wave monopole or a half wave dipole. EM field close to an antenna and far field approximation. (*Chapter 10 in Jordan and Balmain* 6 Hrs.

**Antenna Fundamentals**

Definition of an antenna. Antenna properties – radiation pattern, gain, directive gain and directivity. Effective area. Antenna beam width and band width. Directional properties of dipole antennas. (*Chapter 11 in Jordan and Balmain and Chapter 2 in Kraus*) 6 Hrs.

**UNIT - II**

**Antenna Arrays**

Two element array. Linear arrays. Multiplication of patterns and binomial array. Effect of Earth on vertical patterns. Mathematical theory of linear arrays. Antenna synthesis – Tchebycheff polynomial method. Wave polarization. (*Chapter 11 and 12 in Jordan and Balmain and Chapter 4 in Kraus*) 12 Hrs.

**Impedance**

Antenna terminal impedance. Mutual impedance between two antennas. Computation of mutual impedance. Radiation resistance by induced emf method. Reactance of an antenna. Biconical antenna and its impedance. (*Chapter 14 in Jordan and Balmain and Chapters 8.1 –8.5 in Kraus*) 6 Hrs.

**UNIT - III**

**Frequency Independent (FI) Antennas**

Frequency Independence concept. Equiangular spiral. Log Periodic (LP) antennas. Array theory of LP and FI structures. (*Chapter 15 in Jordan and Balmain and Chapter 15 in Kraus*) 4 Hrs.

**Methods of excitation and Practical Antennas**

Methods of excitation and stub matching and baluns. Folded dipole, loop antennas. Parasitic elements and Yagi-Uda arrays and Helical antenna. Complementary screens and slot antennas. Radiation from a rectangular horn antenna. (*Chapter 11.15 in Jordan and Balmain and Chapters 6.1 – 6.4 ,7.1 – 7.8 and 13 in Kraus*) 10 Hrs.

**UNIT - IV**

**Radio Wave Propagation**

Elements of Ground wave and Space wave propagation. Tropospheric propagation and Troposcatter. Fundamentals of Ionosphere. Sky wave propagation – critical frequency, MUF and skip distance. (*Chapter 16 and 17 in Jordan and Balmain*) 6 Hrs.

**BOOKS**

1. "Electromagnetic waves and Radiating Systems" by E.C.Jordan and K.G.Balmain
2. "Antennas" by J.D.Kraus. (Second Edition)

**M.Sc PHYSICS,**  
**IV SEMESTER**  
**(w.e.f 2009-2010 batch)**

**P 405 : MICROPROCESSOR LAB**

- 1. Decimal addition of 8 – bit numbers**
- 2 Addition of two 16 – bit numbers**
- 3 Multibyte addition**
- 4. Sum of series of 16 – bit numbers**
- 5. Word Disassembly**
- 6. Largest number in an array**
- 7. Ascending order of array of 8 - bit number**
- 8. Interfacing of 8255 PPI: generation of square wave and rectangular waves**
- 9. Interfacing of 8253 programmable timer: Mode 1, Mode2, Mode3, Mode 4, Mode5**
- 10 0800 DAC interfacing : generation of square, triangular and stair case wave forms**

ANDHRA UNIVERSITY  
DEPARTMENT OF PHYSICS  
M.Sc. PHYSICS  
**IV SEMESTER**  
(w.e.f 2009-2010 batch)

P 406 : COMMUNICATION LAB  
LIST OF EXPERIMENTS

1. **AMPLITUDE MODULATION**
2. **FREQUENCY MODULATION AND DETECTION**
3. **MIXER**
4. **BUTTERWORTH FIRST ORDER LOWPASS AND HIGHPASS FILTERS**
5. **CHEBYSHEV SECOND ORDER LOWPASS FILTER**
6. **PHASE LOCKED LOOP (PLL)**
7. **PULSE MODULATION-PAM-AND SAMPLING**
8. **STUDY OF PRE- EMPHASIS AND DE- EMPHASIS CIRCUITS**
9. **GENERATION OF PWAM, AND PPM USING PLL AND 555 TIMER**
10. **STUDY OF FSK TRANSMISSION AND RECEPTION**
11. **OPTICAL FIBRE –BENDING LOSSES AND NUMERICAL APERTURE**
12. **MEASUREMENT OF BIT ERROR RATE (BER)**
13. **MEASUREMENT OF SPEED OF LIGHT IN OPTICAL FIBRE**
14. **DETERMINATION OF FREQUENCY AND WAVELENGTH IN A RECTANGULAR WAVEGUIDE IN  $TE_{1,0}$**
15. **DETERMINATION OF STANDING WAVE RATIO AT REFLECTION COEFFICIENT**
16. **STUDY OF ISOLATOR /CIRCULATOR**
  17. **MEASUREMENT OF GAIN ,FRONT TO BACK RATIO,BEAM WIDTH OF RADIATION PATTERN IN HALF WAVE DIPOLE**
18. **FIVE ELEMENT YAGI UDA ANTENNA**
19. **HELICAL ANTENNA**
20. **CUT –PARABOIDAL REFLECTOR ANTENNA**



**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**

**Common for M.Sc. Physics and M.Sc. Space Physics**  
**I Semester**  
**(w.e.f 2009-10 batch)**

**P101,SP101: CLASSICAL MECHANICS.**

**UNIT-I:** Mechanics of a particle. Mechanics of a system of particles, constraints, D'Alembert's principle and Lagrange's equations, Velocity Dependent potentials and the Dissipation function Simple applications of the Lagrangian Formulation

**5 Hrs.**

Chapter : 1. Section : 1, 2, 3, 4,5 & 6 .

Hamilton's principle, some techniques of the calculus of variations. Derivation of Lagrange's equations from Hamilton's principle. Conservation theorems and symmetry properties, Energy function and the conservation of Energy

**6 Hrs.**

Chapter : 2. Section : 1, 2, 3, 5, 6

**UNIT-II:** Reduction to the equivalent one body problem. The equation of motion and first Integrals, The equivalent One – Dimensional problem and classification of orbits, The differential equation for the orbit, and Integrable power –law potentials, Conditions for closed orbits (Bertrand's theorem), The Kepler problem inverse square law of force , The motion in time in the Kepler problem, Scattering in a central force field..

Chapter : 3. Section. 1, 2, 3, 5, 6, 7, 8

**7 Hrs**

Legendre transformations and Hamilton's equations of motion. Cyclic Coordinates and conservation theorems, Derivation of Hamilton's equation of motion from variational principle, Principle of Least Action.

**6 Hrs**

Chapter : 7 Section: 1, 2,3,4 5 .

**UNIT-III:** Equations of canonical transformation, Examples of Canonical transformations, The harmonic Oscillator, Poisson brackets and other Canonical invariants, Equations of motion, Infinitesimal canonical transformations, and conservation theorems in the poisson bracket formulation, the angular momentum poisson bracket relations.

**5Hrs**

Chapter : 8. Section : 1 , 2 ,4, 5, 6 & 7.

Hamilton – Jacobi equation of Hamilton's principal function, The Harmonic oscillator problem as an example of the Hamilton – Jacobi Method, Hamilton –Jacobi equation for Hamilton's characteristic function. Action – angle variables in systems of one degree of freedom.

**8 Hrs.**

Chapter : 9. Section : 1, 2, 3, & 5.

**UNIT-IV:** Independent coordinates of rigid body. , The Euler angles, Euler's theorem on the Motion of a rigid body, Infinitesimal rotations, Rate of change of a vector, The Coriolis Effect.

Chapter : 4. Section : 1, 4, 6, 8, 9 .

The Inertia tensor and the moment of inertia, The Eigenvalues of the inertia tensor and the principal axis transformation, Solving rigid body problems and Euler equations of motion, Torque – free motion of a rigid body

**6 Hrs**

Chapter 5 Section: 3, 4, 5 & 6.

The Eigenvalue equation and the principal axis transformation, Frequencies of free vibration, and normal coordinates, Free vibrations of a linear triatomic molecule

Chapter 10 Section: 2, 3 & 4 .

**6**

**Hrs**

**TEXT BOOKS :** Classical Mechanics H.Goldstein (Addison-Wiley, 1<sup>st</sup> & 2<sup>nd</sup> ed)

**REFERENCE BOOK:** Classical Dynamics of Particles and Systems J.B.Marion.

**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**

**Common for M.Sc. Physics and M.Sc. Space Physics**  
**I Semester**  
**(w.e.f 2009-10 batch)**

**P102,SP102 : INTRODUCTORY QUANTUM MECHANICS**

**UNIT-I:** The Conceptual aspect :Wave particle duality,Bohr's complementarity principle.Wave function and its interpretation -Principle of superposition-Wave packets – phase velocity and group velocity-Uncertainty relation Postulates of Quantum Mechanics - Schrodinger wave equation - Conservation of probability

**UNIT-II:** Operators and their properties - Equation of Motion for operators, Hermitian operators and their Eigen values and eigen functions Stationary states, Bohr's correspondence principle - Coordinate and Momentum representation- Ehrenfest's theorem Commutator Algebra.- Dirac Delta function, definition and properties. Dirac Delta Normalization

**UNIT-III:** One dimensional problems - Free Particle, Particle in a box- Potential step, potential Well, Rectangular Potential Barrier - Linear Harmonic Oscillator Angular Momentum, Angular Momentum in spherical polar coordinates, Eigenvalues and eigenfunctions of  $L^2$ ,  $L_z$ ,  $L_+$  and  $L_-$  operators. Eigen values and eigen functions of Rigid rotator and Hydrogen atom. Commutation relations, electron spin.

**UNIT-IV:** Time- independent perturbation theory for(i) non degenerate systems and application to Hydrogen atom: Kinetic energy correction, spin-orbit interaction, fine structure. Ground state of Helium atom.

ii) degenerate systems, application to linear stark effect in Hydrogen.  
Variation method and its application to Helium atom.  
Exchange energy and low lying excited states of Helium atom.  
Interaction of electromagnetic radiation with matter. Selection rules.

**Text Book :**

Quantum Mechanics R.D. RATNA RAJU

**Reference Books :**

1. Quantum Mechanics Aruldas
2. Quantum Mechanics G. S. Chaddha
3. Quantum Mechanics B.H.Bransden and C.J.Joachain
4. Quantum Mechanics E. Merzbacher
5. Quantum Mechanics Richard Liboff



**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**

**Common for M.Sc. Physics and M.Sc. Space Physics**  
**I Semester**  
**(w.e.f 2009-10 batch)**

**P103,SP103: Mathematical Methods of Physics**

**Unit I : Complex Variables**

**15 Hrs**

Function of complex number- definition-properties, analytic function-Cauchy –Riemann conditions-polar form-problems, Complex differentiation, complex integration –Cauchy’s integral theorem-Cauchy’s integral formulae-multiply connected region- problems, Infinite series-Taylor’s theorem-Laurent’s theorem-Problems, Cauchy’s Residue theorem- evaluation of definite integrals-problems.

**Text Book:** 1. Mathematical Methods of Physics-G.Arffen, Academic Press

2. Mathematical Physics-Satya Prakash, Sultan Chand & co, New Delhi

3. Complex Variables ( Schaum’s out line series) Murray R. Spiegel

**Ref Book:** Mathematical Methods B.D.Gupta

**Unit II : Beta , Gamma functions & Special functions**

**10 Hrs**

Beta & Gamma functions -definition, relation between them- properties-evaluation of some integrals

Special Functions- Legendre Polynomial, Hermite Polynomial, Laguerre Polynomial-Generating function-recurrence relations-Rodrigue’s formula-orthonormal property-associated Legendre polynomial- simple recurrence relation-orthonormal property-spherical harmonics

**Text Book:** 1. Mathematical Methods of Physics-G.Arffen, Academic Press

2. Mathematical Physics-Satya Prakash, Sultan Chand & co, New Delhi

3. Mathematical Physics B S Rajput

**Ref book :** Special Functions .M.D.Raisinghania

**Unit III : Laplace Transforms & Fourier series, Fourier Transforms**

**15 Hrs**

Laplace Transforms – definition- properties – Laplace transform of elementary functions-Inverse Laplace transforms-properties- evaluation of Inverse Laplace Transforms-elementary function method-Partial fraction method-Heavyside expansion method-Convolution method-complex inversion formula method-application to differential equations Fourier series-evaluation of Fourier coefficients- Fourier integral theorem-problems-square wave-rectangular wave-triangular wave

Fourier Transforms- infinite Fourier Transforms-Finite Fourier Transforms-Properties-problems-application to Boundary value problem

**Text Book:** 1. Mathematical Methods of Physics-G.Arffen, Academic Press

2. Mathematical Physics-Satya Prakash, Sultan Chand & co, New Delhi

3. Laplace n Fourier Transforms Goyal & Gupta,

**Ref books:** Integral Transforms M.D.Raisinghanna

Integral Transforms Goyal & Gupta

Mathematical Physics B S Rajput

**Unit IV: Numerical Analysis**

**10 Hrs**

Solutions of algebraic and Transcendental equations-Bisection method-method of successive approximations-method of false position Iteration method-Newton Rapson method

Simultaneous linear algebraic equations-Gauss elimination method-Gauss Jordan method-Matrix inversion method-jacobi method – Gauss-Siedel method

Interpolation with equal intervals-Finite differences-Newton Forward & Backward

Interpolation formulæ Interpolation with unequal intervals-Newtons divided difference

formula-Lagrange interpolation formula Numerical Integration-General Quadrature formula-Trapezoidal rule -Simpson’ 1/3 rule & 3/8 rule

**Text Books:** **Introductory methods of Numerical analysis S.S.Sastry**

**Numerical Methods V.N.Vedamurthy & N.Ch.S.N.Iyengar**

**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**  
Common for M.Sc. Physics and M.Sc. Space Physics  
I Semester  
(w.e.f 2009-2010 admitted batch of students)  
**P104,SP104: ELECTRONIC DEVICES AND CIRCUITS**

**UNIT-I**

**SEMICONDUCTOR DEVICES: 10 Hrs.**  
Tunnel diode, photo diode, solar cell, LED, Silicon controlled Rectifier,  
Uni Junction Transistor, Field Effect Transistor, (JFET & MOSFET), CMOS

**UNIT-II**

**MICROWAVE DEVICES: 15 Hrs.**  
Varactor diode, Parametric Amplifier, Thyristors, Klystron, Reflex Klystron,  
Gunn Diode, Magnetron, CFA, TWT, BWO, IMPATT, TRAPATT, APD, PIN Diode,  
Schottky Barrier Diode.

**UNIT-III**

**OPERATIONAL AMPLIFIERS : 10 Hrs.**  
The ideal Op Amp – Practical inverting and Non inverting Op Amp stages. Op Amp  
Architecture – differential stage, gain stage, DC level shifting, output stage, offset  
voltages and currents  
Operational Amplifier parameters- input offset voltage, input bias current ,  
Common Mode Rejection Ratio, Slew Rate

**UNIT-IV**

**OP- AMP APPLICATIONS: 15 Hrs.**  
Summing amplifier, Integrator, Differentiator,  
Voltage to Current converter, Current to Voltage converter  
Oscillators – Phase shift oscillator, Wien-Bridge Oscillator, Voltage Controlled Oscillator,  
Schmitt Trigger  
Special applications – Monostable and Astable multivibrators using 555, Phase locked  
Loop, Voltage regulators.

**TEXT BOOKS:**

1. Integrated Electronics - Jacob Millman & C.C. Halkies (TMH)
2. Op.Amps and Linear Integrated Circuits – Ramakant A.Gayakwad (PHI)
3. Electronic Communication Systems – George Kennedy (PHI)

**REFERENCE BOOKS:**

1. Microelectronics - Jacob Millman & Arvin Grabel (McGraw Hill)
2. Electronic Devices and Circuits – G.K. Mithal (Khanna)
3. Op-amps and Linear Integrated Circuits – D. Mahesh Kumar (MacMillan).

**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**

Common for M.Sc. Physics and M.Sc. Space Physics  
I Semester  
(w.e.f 2009-10 batch)

**P105 / SP105 : MODERN PHYSICS LAB - I**

1. Atomic Spectrum of Zinc.
  - a) Verification of Lande's interval rule
  - b) Study of relative intensities
  
2. Grating spectrometer
  - a) Wavelengths of Hg spectrum,
  - b) wavelength of Balmer series, Rydberg constant
  
3. Reciprocal dispersion curve
4. Application of Point Groups.
  - a) Identification of symmetry operations in  $H_2O$ ,  $BH_3$ ,  $NH_3$  and  $H_2CO$
  - b) Reducible representations and Vibrational modes of  $H_2O$ .
5. Determination of Planck's constant, work function and threshold frequency
6. Band gap of a semiconductor. (Two Probe Method)
7. Thermo emf
8. The Franck-Hertz experiment
9. Band spectrum of CN in the violet
  - a) conversion of given wavelengths to wavenumbers and assignment of  $(\nu, \nu')$
  - b) Deslandres' table and Vibrational constants.

**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**Common for M.Sc. Physics and M.Sc. Space Physics**  
**I Semester**  
**(w.e.f 2009-10 batch)**  
**P106/SP106: ELECTRONICS LAB -I**

**LIST OF EXPERIMENTS**

- |                                     |              |
|-------------------------------------|--------------|
| 1. FET amplifier                    | (BFW 10/11 ) |
| 2. Negative feedback amplifier      | (BC 147 )    |
| 3. Colpitts Oscillator              | (BF 194)     |
| 4. Phase shift Oscillator           | (BC 147)     |
| 5. Astable Multivibrator            | (BF 194)     |
| 6. Op.Amp.Characteristics           | (IC 741 )    |
| 7. Power Supply                     |              |
| 8. UJT Characteristics              | (2 N 2646 )  |
| 9. R.F.Amplifier                    | (BF 194)     |
| 10. Boot-strap time based generator | (2N 2222)    |

**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**

Common for M.Sc. Physics and M.Sc. Space Physics  
I Semester (w.e.f 2009-10 batch)

**P101,SP101: CLASSICAL MECHANICS.**

**UNIT-I:** Mechanics of a particle. Mechanics of a system of particles, constraints, D'Alembert's principle and Lagrange's equations, Velocity Dependent potentials and the Dissipation function Simple applications of the Lagrangian Formulation

**5 Hrs.**

Chapter : 1. Section : 1, 2, 3, 4,5 & 6 .

Hamilton's principle, some techniques of the calculus of variations. Derivation of Lagrange's equations from Hamilton's principle. Conservation theorems and symmetry properties. Energy function and the conservation of Energy

**6 Hrs.**

Chapter : 2. Section : 1, 2, 3, 5, 6

**UNIT-II:** Reduction to the equivalent one body problem. The equation of motion and first Integrals, The equivalent One – Dimensional problem and classification of orbits, The differential equation for the orbit, and Integrable power –law potentials, Conditions for closed orbits (Bertrand's theorem), The Kepler problem inverse square law of force , The motion in time in the Kepler problem, Scattering in a central force field..

Chapter : 3. Section. 1, 2, 3, 5, 6, 7, 8

**7 Hrs**

Legendre transformations and Hamilton's equations of motion. Cyclic Coordinates and conservation theorems, Derivation of Hamilton's equation of motion from variational principle, Principle of Least Action.

**6 Hrs**

Chapter : 7 Section: 1, 2,3,4 5 .

**UNIT-III:** Equations of canonical transformation, Examples of Canonical transformations, The harmonic Oscillator, Poisson brackets and other Canonical invariants, Equations of motion, Infinitesimal canonical transformations, and conservation theorems in the poisson bracket formulation, the angular momentum poisson bracket relations.

**5Hrs**

Chapter : 8. Section : 1, 2, 4, 5, 6 & 7.

Hamilton – Jacobi equation of Hamilton's principal function, The Harmonic oscillator problem as an example of the Hamilton – Jacobi Method, Hamilton –Jacobi equation for Hamilton's characteristic function. Action – angle variables in systems of one degree of freedom.

**8 Hrs.**

Chapter : 9. Section : 1, 2, 3, & 5.

**UNIT-IV:** Independent coordinates of rigid body. , The Euler angles, Euler's theorem on the Motion of a rigid body, Infinitesimal rotations, Rate of change of a vector, The Coriolis Effect.

Chapter : 4. Section : 1, 4, 6, 8, 9 .

The Inertia tensor and the moment of inertia, The Eigenvalues of the inertia tensor and the principal axis transformation, Solving rigid body problems and Euler equations of motion, Torque – free motion of a rigid body

**6 Hrs**

Chapter 5 Section: 3, 4, 5 & 6.

The Eigenvalue equation and the principal axis transformation, Frequencies of free vibration, and normal coordinates, Free vibrations of a linear triatomic molecule

Chapter 10 Section: 2, 3 & 4 .

**6 Hrs**

**TEXT BOOKS :** Classical Mechanics H.Goldstein (Addison-Wiley, 1<sup>st</sup> & 2<sup>nd</sup> ed)

**REFERENCE BOOK :** Classical Dynamics of Particles and Systems J.B.Marion.

**P102,SP102 : INTRODUCTORY QUANTUM MECHANICS**

**UNIT-I:** The Conceptual aspect :Wave particle duality,Bohr's complementarity principle.Wave function and its interpretation - Principle of superposition-Wave packets – phase velocity and group velocity-Uncertainty relation Postulates of Quantum Mechanics - Schrodinger wave equation - Conservation of probability

**UNIT-II:** Operators and their properties - Equation of Motion for operators, Hermitian operators and their Eigen values and eigen functions Stationary states, Bohr's correspondence principle - Coordinate and Momentum representation- Ehrenfest's theorem Commutator Algebra.- Dirac Delta function, definition and properties. Dirac Delta Normalization

**UNIT-III:** One dimensional problems - Free Particle, Particle in a box- Potential step, potential Well, Rectangular Potential Barrier - Linear Harmonic Oscillator Angular Momentum, Angular Momentum in spherical polar coordinates, Eigenvalues and eigenfunctions of  $L^2$ ,  $L_z$ ,  $L_+$  and  $L_-$  operators. Eigen values and eigen functions of Rigid rotator and Hydrogen atom. Commutation relations, electron spin.

**UNIT-IV:** Time- independent perturbation theory for(i) non degenerate systems and application to Hydrogen atom: Kinetic energy correction, spin-orbit interaction, fine structure. Ground state of Helium atom.

ii) degenerate systems, application to linear stark effect in Hydrogen.

Variation method and its application to Helium atom.

Exchange energy and low lying excited states of Helium atom.

Interaction of electromagnetic radiation with matter. Selection rules.

**Text Book :**

Quantum Mechanics R.D. RATNA RAJU

**Reference Books :**

6. Quantum Mechanics Aruldas
7. Quantum Mechanics G. S. Chaddha
8. Quantum Mechanics B.H.Brandsen and C.J.Joachain
9. Quantum Mechanics E. Merzbacher
10. Quantum Mechanics Richard Liboff

P103,SP103: Mathematical Methods of Physics

**Unit I : Complex Variables**

**15 Hrs**

Function of complex number- definition-properties, analytic function-Cauchy –Riemann conditions-polar form-problems, Complex differentiation, complex integration –Cauchy’s integral theorem- Cauchy’s integral formulae-multiply connected region- problems, Infinite series-Taylor’s theorem- Laurent’s theorem-Problems, Cauchy’s Residue theorem- evaluation of definite integrals-problems.

**Text Book:** 1. Mathematical Methods of Physics-G.Arken, Academic Press  
2. Mathematical Physics-Satya Prakash, Sultan Chand & co, New Delhi  
3. Complex Variables ( Schaum’s out line series) Murray R. Spiegel

**Ref Book:** Mathematical Methods B.D.Gupta

**Unit II : Beta , Gamma functions & Special functions**

**10 Hrs**

Beta & Gamma functions -definition, relation between them- properties-evaluation of some integrals

**Special Functions-** Legendre Polynomial, Hermite Polynomial, Laguerre Polynomial-Generating function-recurrence relations- Rodrigue’s formula-orthonormal property-associated Legendre polynomial- simple recurrence relation-orthonormal property-spherical harmonics

**Text Book:** 1. Mathematical Methods of Physics-G.Arken, Academic Press  
2. Mathematical Physics-Satya Prakash, Sultan Chand & co, New Delhi  
3. Mathematical Physics B S Rajput

**Ref book :** Special Functions .M.D.Raisinghania

**Unit III : Laplace Transforms & Fourier series, Fourier Transforms**

**15 Hrs**

Laplace Transforms – definition- properties – Laplace transform of elementary functions-Inverse Laplace transforms-properties-evaluation of Inverse Laplace Transforms-elementary function method-Partial fraction method-Heavyside expansion method-Convolution method-complex inversion formula method-application to differential equations Fourier series-evaluation of Fourier coefficients- Fourier integral theorem-problems-square wave-rectangular wave-triangular wave  
Fourier Transforms- infinite Fourier Transforms-Finite Fourier Transforms-Properties-problems-application to Boundary value problem

**Text Book:** 1. Mathematical Methods of Physics-G.Arken, Academic Press  
2. Mathematical Physics-Satya Prakash, Sultan Chand & co, New Delhi  
3. Laplace n Fourier Transforms Goyal & Gupta,

**Ref books:** Integral Transforms M.D.Raisinghanna  
Integral Transforms Goyal & Gupta  
Mathematical Physics B S Rajput

**Unit IV: Numerical Analysis**

**10 Hrs**

Solutions of algebraic and Transcendental equations-Bisection method-method of successive approximations-method of false position Iteration method-Newton Rapson method Simultaneous linear algebraic equations-Gauss elimination method-Gauss Jordan method-Matrix inversion method-jacobi method – Gauss-Siedel method  
Interpolation with equal intervals-Finite differences-Newton Forward & Backward Interpolation formulæ Interpolation with unequal intervals-Newton’s divided difference formula-Lagrange interpolation formula Numerical Integration-General Quadrature formula-Trapezoidal rule -Simpson’s 1/3 rule & 3/8 rule

**Text Books:** Introductory methods of Numerical analysis S.S.Sastry  
Numerical Methods V.N.Vedamurthy & N.Ch.S.N.Iyengar

P104,SP104: ELECTRONIC DEVICES AND CIRCUITS

**UNIT-I: SEMICONDUCTOR DEVICES:**

**10 Hrs.**

Tunnel diode, photo diode, solar cell, LED, Silicon controlled Rectifier, Uni Junction Transistor, Field Effect Transistor, (JFET & MOSFET), CMOS

**UNIT-II: MICROWAVE DEVICES:**

**15 Hrs.**

Varactor diode, Parametric Amplifier, Thyristors, Klystron, Reflex Klystron, Gunn Diode, Magnetron, CFA, TWT, BWO, IMPATT, TRAPATT, APD, PIN Diode, Schottky Barrier Diode.

**UNIT-III: OPERATIONAL AMPLIFIERS :**

**10 Hrs.**

The ideal Op Amp – Practical inverting and Non inverting Op Amp stages. Op Amp Architecture – differential stage, gain stage, DC level shifting, output stage, offset voltages and currents

Operational Amplifier parameters- input offset voltage, input bias current , Common Mode Rejection Ratio, Slew Rate

**UNIT-IV**

**15 Hrs.**

**OP- AMP APPLICATIONS:**

Summing amplifier, Integrator, Differentiator, Voltage to Current converter, Current to Voltage converter  
Oscillators – Phase shift oscillator, Wien-Bridge Oscillator, Voltage Controlled Oscillator, Schmitt Trigger  
Special applications – Monostable and Astable multivibrators using 555, Phase locked Loop, Voltage regulators.

**TEXT BOOKS:**

1. Integrated Electronics - Jacob Millman & C.C. Halkies (TMH)
2. Op.Amps and Linear Integrated Circuits – Ramakant A.Gayakwad (PHI)
3. Electronic Communication Systems – George Kennedy (PHI)

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3. Op-amps and Linear Integrated Circuits – D. Mahesh Kumar (MacMillan).

DEPARTMENT OF PHYSICS  
ANDHRA UNIVERSITY  
Common for M.Sc. Physics and M.Sc. Space Physics  
I Semester(w.e.f 2009-10 batch)

**P105 / SP105 : MODERN PHYSICS LAB - I**

1. Atomic Spectrum of Zinc.
  - a) Verification of Lande's interval rule
  - b) Study of relative intensities
2. Grating spectrometer
  - a) Wavelengths of Hg spectrum,
  - b) wavelength of Balmer series, Rydberg constant
3. Reciprocal dispersion curve
4. Application of Point Groups.
  - a) Identification of symmetry operations in  $H_2O$ ,  $BH_3$ ,  $NH_3$  and  $H_2CO$
  - b) Reducible representations and Vibrational modes of  $H_2O$ .
5. Determination of Planck's constant, work function and threshold frequency
6. Band gap of a semiconductor. (Two Probe Method)
7. Thermo emf
8. The Franck-Hertz experiment
9. Band spectrum of CN in the violet
  - a) conversion of given wavelengths to wavenumbers and assignment of ( $\nu'$ ,  $\nu''$ )
  - b) Deslandres' table and Vibrational constants.

ANDHRA UNIVERSITY  
DEPARTMENT OF PHYSICS  
Common for M.Sc. Physics and M.Sc. Space Physics  
I Semester (w.e.f 2009-10 batch)

**P106/SP106: ELECTRONICS LAB -I**

**LIST OF EXPERIMENTS**

- |                                     |              |
|-------------------------------------|--------------|
| 1. FET amplifier                    | (BFW 10/11 ) |
| 2. Negative feedback amplifier      | (BC 147 )    |
| 3. Colpitts Oscillator              | (BF 194)     |
| 4. Phase shift Oscillator           | (BC 147)     |
| 5. Astable Multivibrator            | (BF 194)     |
| 6. Op.Amp.Characteristics           | (IC 741 )    |
| 7. Power Supply                     |              |
| 8. UJT Characteristics              | (2 N 2646 )  |
| 9. R.F.Amplifier                    | (BF 194)     |
| 10. Boot-strap time based generator | (2N 2222)    |





**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**

**Common for M.Sc. Physics and M.Sc. Space Physics**  
**II Semester (w.e.f 2009-10 batch)**

		<b>MARKS</b>
<b>P 201.</b>	<b>ELECTRODYNAMICS</b>	<b>85+15=100</b>
<b>P 202.</b>	<b>STATISTICAL MECHANICS</b>	<b>85+15=100</b>
<b>P203</b>	<b>ATOMIC AND MOLECULAR PHYSICS</b>	<b>85+15=100</b>
<b>P 204.</b>	<b>NUCLEAR AND PARTICLE PHYSICS</b>	<b>85+15=100</b>
<b>P205</b>	<b>Modern Physics lab - II Practical -75 + record-25</b>	<b>100</b>
<b>P206</b>	<b>ELECTRONICS LAB –II Practical -75 + record-25</b>	<b>100</b>
<b>TOTAL MARKS</b>		<b>600</b>
<b>Choice Based Paper for other Departments in University Campus only</b>		
	<b>INTRODUCTORY ATMOSPHERIC AND SPACE PHYSICS</b>	

*For Each Theory Paper 85 marks for semester end exam and 15 marks for internal assessment*

**SCHEME OF EXAMINATION**

<b>Theory pass minimum</b>	<b>40%</b>
<b>Practical pass minimum</b>	<b>50%</b>
<b>Aggregate</b>	<b>50%</b>

**SCHEME OF INSTRUCTION :**

<b>Teaching Hours</b>	<b>4 Periods per week</b>
<b>Tutorial</b>	<b>1 Period per week</b>
<b>Practical</b>	<b>6 Periods per week</b>

**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**  
**Common for M.Sc. Physics and M.Sc. (Space Physics)**  
**II Semester**  
**(w.e.f 2009-10 batch)**  
**P201,SP201: ELECTRO DYNAMICS.**

**UNIT-I:** Gauss Theorem, Poission's equation, Laplaces equation, solution to Lapalaces equation in cartesian coordiantes, spherical coordinates, cylidrical coordinates, use of Laplaces equation in the solutions of electrostatic problems.  
**6Hrs**

Ampere's circuital law, magnetic vector potential, displacement current, Faraday's law of electromagnetic induction,  
**4Hrs**

**UNIT-II;** Maxwell's equations, differential and integral forms, physical significance of Maxwell's equations.  
**4 Hrs**

Wave equation, plane electromagnetic waves in free space , in nonconducting isotropic medium, in conducting medium, electromagnetic vector and scalar potentials, uniqueness of electromagnetic potentials and concept of gauge, Lorentz gauge, Coulomb gauge,  
**6Hrs**

charged particles in electric and magnetic fields: charged particles in uniform electric field, charged particles in homogorous magnetic fields, charged particles in simultaneous electric and magnetic fields, charged particles in nonhomogeneous magnetic fields.  
**6Hrs**

**UNIT-III:** Lienard-Wiechert potentials, electromagnetic fields from Lienard-wiechert potentials of a moving charge, electromagnetic fields of a uniformly moving charge, radiation due to non-relativistic charges, radiation damping, Abraham-Lorentz formula, cherenkov radiation, radiation due to an oscillatory electric dipole, radiation due to a small current element. Condition for plasma existence, occurrence of plasma, magneto hydrodynamics, plasma waves  
**10 Hrs**

**UNIT-IV:** Transformation of electromagentic potentials, Lorentz condition in covariant form, invariance or covariance of Maxwell field eqations in terms of 4 vectors, electromagnetic field tensor, Lorentz transformation of electric and magnetic fields.  
**12 Hrs**

**Text books:**

1. Classical Electrodynamics : - J.D. Jackson
2. Introduction to Electrodynamics : - D.R. Griffiths
3. .Electromagnetic Theory and Electrodynamics - Satyaprakash
4. Electrodynamics - KL Kakani

**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**  
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**II Semester**  
**(w.e.f 2009-10 batch)**  
**P202,SP202: STATISTICAL MECHANICS**

**UNIT-I : Basic Methods and Results of Statistical Mechanics: 13 Hrs**

Specification of the state of a system, phase space and quantum states, Liouville's theorem, Basic postulates, Probability calculations, concept of ensembles, thermal interaction, Mechanical interaction, quasi static process, distribution of energy between systems in equilibrium, statistical calculations of thermo dynamic quantities, Isolated systems(Microcanonical ensemble). Entropy of a perfect gas in microcanonical ensemble. Canonical ensemble - system in contact with heat reservoir, system with specified mean energy, connection with thermodynamics, Energy fluctuations in the canonical ensemble. Grand canonical ensemble, Thermodynamic function for the grand canonical ensemble. Density and energy fluctuations in the grand canonical ensemble. Thermodynamic equivalence of ensembles. Reif Ch:2, 3.3,3.12 Ch:6

**UNIT-II : Simple Applications of Statistical Mechanics: 12 Hrs**

Partition functions and their properties. Calculation of thermo dynamic quantities to an ideal mono atomic gas. Gibbs paradox, validity of the classical approximation. Proof of the equipartition theorem. Simple applications – mean K.E. of a molecule in a gas. Brownian motion. Harmonic Oscillator, Specific heats of solids (Einstein and Debye model of solids), Paramagnetism, Partition function for polyatomic molecules, Electronic energy, vibrational energy and rotational energy of a diatomic molecule. Effect of Nuclear spin-ortho and para Hydrogen. Reif Ch:7, Ch:9.12

**UNIT-III: Quantum Statistics: 15 Hrs**

Formulation of the statistical problem. Maxwell–Boltzmann statistics. Photon statistics, Bose-Einstein statistics, Fermi–Dirac statistics, Quantum statistics in the classical limit, calculation of dispersion for MB, BE & FD statistics Equation of state of an Ideal Bose Gas, Black body radiation, Bose-Einstein condensation, Equation of state for a weakly degenerate and strongly degenerate ideal Fermi gas. Thermionic emission. The theory of white dwarf stars. Reif Ch:9

**UNIT-IV: Non Ideal Classical Gas: 10 Hrs**

Calculation of the partition function for low densities. Equation of state and virial coefficients (Van Der Waals equation) Reif Ch:10.3,10.4

**Phase Transitions and Critical Phenomena:**

Phase transitions, conditions for Phase equilibrium, First order Phase transition – the Clausius–Clayperon equation, Second order phase transition, The critical indices, Van der Waals theory of liquid gas transition. Order parameter, Landau theory. Sinha Ch:10

**Text Books**

1. Fundamentals of Statistical and Thermal Physics F. Reif
2. Statistical Mechanics, Theory and Applications S.K. Sinha
3. Statistical Mechanics R.K. Pathria

**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**  
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**II Semester (w.e.f 2009-10 batch)**  
**P203,SP203: ATOMIC AND MOLECULAR PHYSICS.**

**UNIT-I**

**12 Hrs**

**ONE ELECTRON ATOMS :** Quantum numbers, Term values . Relation between Magnetic dipole moment and angular momentum of an orbiting electron. Stern–Gerlach experiment and electron spin . Spin- orbit interaction, relativistic kinetic energy correction and dependence of energy on J value only. Selection rules. Fine structure of Balmer series of Hydrogen and Fowler series of ionized Helium. Hyperfine structure of H $\alpha$  line of hydrogen ( $I = \frac{1}{2}$ ).

**ONE VALENCE ELECTRON ATOMS:** Modified term values (quantum defect) due to lifting of orbital degeneracy by core penetration (penetrating orbits) and core polarization (non-penetrating orbits) by nl electrons. Term values and fine structure of chief spectral series of sodium. Intensity rules and application to doublets of sodium. Hyperfine structure of  $^2P-^2S$  of sodium ( $I= 3/2$ ).

**UNIT-II**

**10 Hrs**

**MANY ELECTRON ATOMS :** Indistinguishable particles, bosons, fermions. Pauli's principle. Ground states. LS coupling and Hund's rules based on Residual coulombic interaction and spin-orbit interaction. Lande's interval rule. Equivalent and non-equivalent electrons. Spectral terms in LS and JJ coupling (ss,s<sup>2</sup>, pp,p<sup>2</sup> configurations). Exchange force and Spectral series of Helium.

**Lasers-** spontaneous emission, stimulated emission, population inversion, Einstein coefficients, metastable levels, resonance transfer and population inversion in He-Ne laser.

**UNIT- III**

**8 Hrs**

**ATOMS IN EXTERNAL MAGNETIC FIELD:** Quantum theory of Zeeman and Paschen-Back effects and application to  $^2P-^2S$ ,  $^3P-^3S$ , transitions.

**ATOMS IN EXTERNAL ELECTRIC FIELD:** Linear stark pattern of H $\alpha$  line of hydrogen and Quadratic stark pattern of D<sub>1</sub> and D<sub>2</sub> lines of Sodium.

**UNIT-IV**

**20 Hrs**

**DIATOMIC MOLECULES:** Molecular quantum numbers. Bonding and anti-bonding orbitals from LCAO's. Explanation of bond order for N<sub>2</sub> and O<sub>2</sub> and their ions. Rotational spectra and the effect of isotopic substitution. Effect of nuclear spin functions on Raman rotation spectra of H<sub>2</sub> (Fermion) and D<sub>2</sub> (Boson). Vibrating rotator. Spectrum. Combination relations and evaluation of rotational constants (infrared and Raman). Intensity of vibrational bands of an electronic band system in absorption.(The Franck-Condon principle). Sequences and progressions. Deslandre's table and vibrational constants.

**MOLECULAR VIBRATIONS :** Symmetry operations and identification of point Groups of HCN, CO<sub>2</sub> , BH<sub>3</sub> , NH<sub>3</sub> , H<sub>2</sub>O molecules. Properties of irreducible representations and C<sub>2v</sub> character table. Reducible representation and symmetry of fundamental vibrations of H<sub>2</sub>O

**BOOKS :**

- |   |                |
|---|----------------|
| 1. Atomic and Molecular Spectra           | - Rajkumar     |
| 2. Fundamentals of Molecular Spectroscopy | - C.N.Banwell. |
| 3. Group Theory                           | - K.V.Raman.   |
| 4. Introduction to Atomic Spectra         | - H.E.White.   |

**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**  
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**II Semester**  
**(w.e.f 2009-10 batch)**  
**P204,SP204: NUCLEAR AND PARTICLE PHYSICS**

**UNIT - I**

**INTRODUCTION :**

Objective of Studying Nuclear Physics, Nomenclature, nuclear radius, mass & Binding energy, angular momentum, magnetic dipole moment, Electric quadrupole moment, parity and symmetry, domains of instability, Energy levels, mirror nuclei.

**NUCLEAR FORCES** : Simple theory of the deuteron, scattering cross-sections, qualitative discussion of neutron- proton and proton- proton scattering, charge independence and charge symmetry of nuclear forces, exchange forces, Yukawa's Potential, Characteristics of Nuclear Forces.

**UNIT - II**

**NUCLEAR MODELS** . Liquid drop model:, Weissacker's semi-empirical mass formula, Mass – parabolas. Nuclear shell model : Spin orbit interaction, magic numbers, prediction of angular momenta and parities for ground states, Collective model., More-realistic models

**NUCLEAR DECAY** : Alpha decay process, Energy release in Beta-decay, Fermi's Theory of  $\beta$  - decay, selection rules, parity violation in  $\beta$ -decay, Detection and properties of neutrino, . Energetics of gamma decay, selection rules, angular correlation, Mossbauer effect.

**NUCLEAR REACTIONS** : Types of reactions and conservation laws, the Q – equation, Optical model, heavy ion Reactions

**UNIT - III**

**NUCLEAR ENERGY** Stability limit against spontaneous fission, Characteristics of fission, delayed neutrons, Four factor formula for controlled fission, Nuclear fusion, prospects of continued fusion energy.

**ELEMENTARY PARTICLE PHYSICS:** Particle interactions and families, symmetries and conservation laws ( energy and momentum, angular momentum, parity, Baryon number, Lepton number, isospin, strangeness quantum number( Gellmann and Nishijima formula) and charm), Elementary ideas of CP and CPT invariance, SU(2), SU(3) multiplets, Quark model.

**UNIT - IV**

**DETECTING NUCLEAR RADIATION:** Interaction of radiation with matter. Gas filled counters, scintillation detectors, semiconductor detectors, energy measurements, coincidence measurements and time resolution, magnetic spectrometers.

**ACCELERATORS:** Electrostatic accelerators, cyclotron accelerators, synchrotrons, linear accelerators, colliding beam accelerators.

**APPLICATIONS OF NUCLEAR PHYSICS:** Trace Element Analysis, Rutherford Back-scattering, Mass spectrometry with accelerators, Diagnostic Nuclear Medicine, Therapeutic Nuclear Medicine.

**TEXT BOOKS** : “Introductory Nuclear Physics” Kenneth S. Krane

**Reference Books:**

1. “Introduction to Nuclear Physics “ Harald A. Enge
2. “Concepts of Nuclear Physics “ Bernard L. Cohen.
3. “ Introduction to High Energy physics” D.H. Perkins
4. “ Introduction to Elementary Particles” D. Griffiths

## Department of Physics, Andhra University

### Introductory Atmospheric and Space Physics

(Choice based course to be offered in the Department of Physics during II Semester with a minimum intake of 15 and maximum 25)  
With effect from 2009-2010 admitted batch)

Target aspirants: PG students from departments of Meteorology and Oceanography, Geophysics, Environmental sciences, Geography, Geo-engineering and Electronics and Communication engineering)

**Unit I :** The Neutral atmosphere, atmospheric nomenclature, the Hydrostatic equation, geopotential height, expansion and contraction, fundamental forces in the atmosphere, apparent forces, atmospheric composition, solar radiation interaction with the neutral atmosphere, climate change.

**Unit II:** Electromagnetic radiation and propagation of waves: EM Radiation, fundamentals of EM waves, effects of environment, Antennas- basic considerations, types of antennas. Propagation of waves: ground wave, sky wave, and space wave propagation, troposcatter communication and extra terrestrial communication.

**Unit III:** The Ionosphere, morphology of ionosphere, the D, E and F-regions, chemistry of the ionosphere, ionospheric parameters, E and F region anomalies and irregularities in the ionosphere.

**Unit IV:** Global Positioning systems (GPS)- basic concepts, overview of GPS system, augmentation services, GPS system segment, GPS signal characteristics, GPS errors, multi path effects, GPS performance, satellite navigation system and applications.

#### Reference Books:

1. An Introduction to Dynamic Meteorology by James R Holton, Academic Press Inc.
2. Climatology, An atmospheric Science by John E. Oliver and John J. Hindore, Pearson Education
3. Electronic Communication systems by George Kennedy and Bernard Davis, Tata McGraw Hill publishing Co., Ltd.
4. Introduction to Ionospheric Physics by Henry Rishbeth and Owen K. Garriot, Academic press
5. Understanding GPS principles and applications by Elliot D. Kaplan and Christopher J. Hegarty, Artech House, Boston.

**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**LIST OF EXPERIMENTS FOR**  
**COMMON FOR M.SC.PHYSICS AND M.SC. (SPACE PHYSICS)**

**II Semester**

**(w.e.f 2009-10 batch)**

**P205,SP205: MODERN PHYSICS LAB -II**

- 1. Atomic Spectrum of Sodium.**
  - a) identification of sharp and diffuse doublets**
  - b) doublet separation**
  - c) assignment of principal quantum numbers**
- 2. Raman Spectrum of Carbon Tetrachloride**
  - a) Raman shifts**
  - b) Fermi resonance**
- 3. Vibrational analysis of AlO Green system.**
  - a) identification of sequences, assignment of vibrational quantum numbers,**
  - b) Deslandre's table and Vibrational constants.**
- 4. Determination of Specific Charge of an electron by Thomson's Method.**
- 5. Experiments with He- Ne laser .**
  - a) Polarization of laser light**
  - b) Divergence of laser beam and monochromaticity.**
- 6. Band gap of a semiconductor (Four probe method).**
- 7. Dielectric constant as a function of temperature and determination of Curie Temperature**
- 8. Susceptibility of a substance Gouy's method**
- 9. Dissociation energy of Iodine molecule from the given data.**

**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**LIST OF EXPERIMENTS FOR**  
**COMMON FOR M.SC.PHYSICS AND M.Sc. SPACE PHYSICS**  
**II Semester**  
**(w.e.f 2009-10 batch)**  
**P206,SP206: ELECTRONICS LAB -II**

**List of Experiments (Any SIX of the following)**

- 1. Active Low pass and High Pass filters (IC 741 )**
- 2. Twin -T filter (IC 741 )**
- 3. Logarithmic Amplifier (IC 741 )**
- 4. Wein Bridge Oscillator (IC 741 )**
- 5. Monostable multivibrator (IC 555 )**
- 6. Voltage Regulator (IC 723 )**
- 7. Phase Shift Oscillator (IC 741 )**
- 8. Astable multivibrator (IC 555 )**
- 9. Active band pass filter (IC 741 )**
- 10. Voltage controlled oscillator ((IC 741, IC 555 )**



**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**M.Sc. PHYSICS,**  
**III SEMESTER.**

		<b>MARKS</b>
<b>P301.</b>	<b>SOLID STATE PHYSICS (85+15)</b>	<b>100</b>

<b>P302.</b>	<b>LASERS AND FIBER OPTICS (85+15)</b>	<b>100</b>
<b>P303.</b>	<b>DIGITAL ELECTRONICS &amp; MICROPROCESSORS (85+15)</b>	<b>100</b>

**Special paper**

<b>P304</b>	<b>RADAR SYSTEMS AND SATELLITE COMMUNICATION (85+15)</b>	<b>100</b>
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<b>P305</b>	<b>DIGITAL ELECTRONICS LAB practical-75 +record-25</b>	<b>100</b>
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<b>P306</b>	<b>SOLID STATE PHYSICS LAB practical-75+record-25</b>	<b>100</b>
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**Total Marks                      600**

Choice Based Paper for other Departments in University Campus Only

	<b>ANALYTICAL TECHNIQUES</b>	
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**SCHEME OF EXAMINATION**

<b>Theory pass minimum</b>	<b>40%</b>
<b>Practical pass minimum</b>	<b>50%</b>
<b>Aggregate</b>	<b>50%</b>

**SCHEME OF INSTRUCTION :**

<b>Teaching Hours</b>	<b>4 Periods per week</b>
<b>Tutorial</b>	<b>1 Period per week</b>
<b>Practical</b>	<b>6 Periods per week</b>

**DEPARTMENT OF PHYSICS**  
**ANDHRA UNIVERSITY**  
**M.Sc. Physics**  
**III Semester**  
**(w.e.f 2009-10 batch)**  
**P301: SOLID STATE PHYSICS.**

**UNIT-I: CRYSTAL STRUCTURE: 14 Hrs**

Periodic array of atoms—Lattice translation vectors and lattices, symmetry operations, The Basis and the Crystal Structure, Primitive Lattice cell, Fundamental types of lattices—Two Dimensional lattice types, three Dimensional lattice types, Index system for crystal planes, simple crystal structures-- sodium chloride, cesium chloride and diamond structures.

**UNIT-II: CRYSTAL DIFFRACTION AND RECIPROCAL LATTICE: 14 Hrs**

Bragg's law, Experimental diffraction methods-- Laue method and powder method, Derivation of scattered wave amplitude, indexing pattern of cubic crystals and non-cubic crystals (analytical methods). Geometrical Structure Factor, Determination of number of atoms in a cell and position of atoms. Reciprocal lattice, Brillouin Zone, Reciprocal lattice to bcc and fcc Lattices.

**UNIT-III: PHONONS AND LATTICE VIBRATIONS: 6 Hrs**

Vibrations of monoatomic lattices, First Brillouin Zone, Group velocity, Long wave length, Lattice with two atoms per primitive cell, Quantization of Lattice Vibrations-Phonon momentum.

**FREE ELECTRON FERMI GAS: 6 Hrs**

Energy levels and density of orbitals in one dimension, Free electron gas in 3 dimensions, Heat capacity of the electron gas, Experimental heat capacity of metals, Motion in Magnetic Fields-Hall effect, Ratio of thermal to electrical conductivity.

**UNIT-IV: THE BAND THEORY OF SOLIDS: 10 Hrs**

. Nearly free electron model, Origin of the energy gap, The Bloch Theorem, Kronig-Penny Model, wave equation of electron in a periodic potential, Crystal momentum of an electron- Approximate solution near a zone boundary, Number of orbitals in a band--metals and isolators. The distinction between metals, insulators and semiconductors

**TEXT BOOKS:**

- 1.Introduction to Solid State Physics, C.Kittel, 5<sup>th</sup> edition,
- 2.Solid State Physics, A.J.DEKKER.

**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**M.Sc. PHYSICS**  
**III Semester**  
**(w.e.f 2009-10 batch)**

**P302: Lasers and Fiber optics**

**UNIT-I**

**LASER SYSTEMS** :Light Amplification and relation between Einstein A and B Coefficients. Rate equations for three level and four level systems. Laser systems: Ruby laser, Nd-YAG laser, CO<sub>2</sub> Laser, Dye laser, Excimer laser, Semiconductor laser.

**UNIT – II:**

**LASER CAVITY MODES:** Line shape function and Full Width at half maximum (FWHM) for Natural broadening, Collision broadening, Doppler broadening, Saturation behavior of broadened transitions, Longitudinal and Transverse modes. ABCD matrices and cavity Stability criteria for confocal resonators. Quality factor, Q-Switching, Mode Locking in lasers. Expression for Intensity for modes oscillating at random and modes locked in phase. Methods of Q-Switching and Mode locking.

**UNIT-III**

**OPTICAL FIBER WAVEGUIDES** : Basic optical laws and Self focusing. Optical fiber modes and configurations Fiber types, Rays and Modes, Step-index fiber structure. Ray optics representation, wave representation. Mode theory of circular step-index wave guides. Wave equation for step-index fibers, modes in step-index fibers and power flow in step-index fibers. Graded – index fiber structure, Graded-index numerical aperture, modes in Graded-index fibers.

**UNIT-IV**

**FIBER CHARACTERISTICS** : Signal Degradation In Fibers - Attenuation, Absorption, Scattering and Bending losses in fibers, radiative losses, Core and Cladding losses. Signal distortion in optical wave guides: Group delay, material dispersion, waveguide dispersion and intermodal dispersion. Pulse broadening in optical fibers. Power launching in Optical fibers, Source-output pattern, Lensing schemes. Fiber-to-fiber joints: Mechanical misalignment, fiber related losses, Fiber and face preparation. fiber splicing techniques, fiber connectors.

**TEXT BOOKS:**

1. **Lasers -Theory and Applications – K.Thyagarajan and A.K. Ghatak. (MacMillan)**
2. **Optical fiber Communications – Gerd Keiser (Mc Graw-Hill)**

**REFERENCE BOOKS:**

1. **Laser fundamentals – William T. Silfvast (Cambridge)**
2. **Introduction to fiber optics – Ajoy Ghatak and K. Thyagarajan (Cambridge)**
3. **Optical Electronics – Ajoy Ghatak and K.Thyagarajan (Cambridge)**
4. **Opto- electronics – J. Wilson and J.F.B. Hawkes (Printice Hall)**

ANDHRA UNIVERSITY  
DEPARTMENT OF PHYSICS  
M.Sc. PHYSICS, SPACE PHYSICS

**III Semester**

**(w.e.f 2009-10 batch)**

P303, SP303: Digital Electronics & Microprocessors  
(Common for M.Sc.Space Physics and M.Sc.Physics)

## **UNIT - I**

**Digital Circuits (i) Number Systems and Codes:** Binary, Octal, Hexadecimal number systems, Gray code, BCD code, ASCII code. (ii) Logic Gates and Boolean Algebra: OR, AND, NOT, NOR, NAND gates, Boolean theorems, DeMorgan laws.

**II) Combinational Logic Circuits:** (i) Simplification of Boolean Expressions: Algebraic method, Karnaugh Map method, EX-OR, EX-NOR gates, ENCODER, DECODER, Multiplexer, Demultiplexers.

(ii) Digital Arithmetic Operations and Circuits: Binary addition, Design of Adders and Subtractors, Parallel binary adder, IC parallel adder. (iii) Applications of Boolean Algebra: Magnitude Comparator, Parity generator, Checker, Code converter, Seven-segment decoder/ Driver display.

### **UNIT - II**

**Sequential Logic Circuits:** (i) Flip-Flops and Related Devices: NAND latch, NOR latch, Clocked flip-flops, Clocked S-C flip-flop, J-K flip-flop, D flip-flop, D latch, Asynchronous inputs, Timing problem in flip-flops. (ii) Counters: Asynchronous counters (Ripple), Counters with MOD number  $< 2^N$ , Asynchronous down counter, Synchronous counters, Up-down counter, Presettable counter. (iii) Registers: Shift Register, Integrated Circuit registers, Parallel In Parallel Out (PIPO), SISO, SIPO, PISO (iv) Applications of Counters: Frequency Counter and Digital clock.

**A/D and D/A Converter Circuits:** D/A Converter, Linear weighted and ladder type, An integrated circuit DAC; Analog-to-Digital Conversion, Digital Ramp ADC, Successive Approximation Method, Sample and Hold Circuit, Digital Voltmeter.

### **UNIT - III**

**Intel 8085 Microprocessor:**

Architecture, Functional diagram, Pin description, Timing Diagram of Read Cycle, Timing diagram of write Cycle.

**Programming the 8085 Microprocessor:**

(i) Addressing Methods, Instruction set, Assembly language programming.

(ii) Examples of Assembly Language Programming: Simple Arithmetic - Addition/Subtraction of two 8-bit/16-bit numbers, Addition of two decimal numbers, Masking of digits, word disassembly.

(iii) Programming using Loops: Sum of series of 8-bit numbers, Largest element in the array, Multiple byte addition, Delay sub-routine.

### **UNIT - IV**

**Data Transfer Technique:**

Serial transfer, Parallel transfer, Synchronous, Asynchronous, DMA transfer, Interrupt driven Data transfer.

**8085 Interfacing:**

I/O Interfacing: Programmable Peripheral Interfacing, 8255, Programmable Peripheral Interval Timer 8253, Programmable Communication Interface 8251, DAC 0800 and ADC 0800 interfacing.

### **TEXT & REFERENCE BOOKS:**

1. "Digital Systems – Principles and applications" – Ronald.J.Tocci,
2. "Fundamentals of Microprocessors & Microcomputers" - B. RAM.
3. " Introduction to Microprocessors for Engineers and Scientists" - P.K.Ghosh and P.R.Sridhar
4. "Microprocessor Architecture, Programming and Applications with the 8085 /8080A" – Ramesh. S. Gaonkar.

**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**M.Sc. PHYSICS AND M.Sc. SPACE PHYSICS**

**III Semester**

**(w.e.f 2009-10 batch)**

**(Common for M.Sc. Space Physics and M.Sc. Physics)**

**P304 , SP 304 - RADAR SYSTEMS & SATELLITE COMMUNICATION**

**UNIT - I**

**Radar Systems:**

Fundamental – A simple RADAR – overview of frequencies – Antenna gain Radar Equation – Accuracy and Resolution – Integration time and the Doppler shift (Ch 1 of Text Book 1)

Designing a surveillance radar – Radar and surveillance – Antenna beam – width consideration – pulse repetition frequency – unambiguous range and velocity – pulse length and sampling – radar cross section – clutter noise (Ch 2 of Text Book 1)

Tracking Radar – Sequential lobbing – conical scanning – Monopoles Radar – Tracking accuracy and Process – Frequency Agility – Radar guidance (Ch3 of Text Book 1)

**UNIT - II**

Signal and Data Processing – Properties of clutter – Moving Target Indicator Processing Shareholding – Plot extraction – Tract Association, Initiation and Tracking (Ch 5 of Text Book 1)

Radar Antenna – Antenna parameters – Antenna Radiation Pattern and aperture distribution – Parabolic reflector – cosecant squared antenna pattern – effect of errors on radiation pattern – Stabilization of antennas (Ch7 of Text Book 2).

**UNIT - III**

**Satellite Communication**

Satellite System – Historical development of satellites – communication satellite systems – communication satellites – orbiting satellites – satellite frequency bands – satellite multiple access formats (Ch1 of Text Book 3).

Satellite orbits and inclination – Look angles, orbital perturbations, space craft and its subsystems – attitude and orbit control system – Telemetry, Tracking and Command – Power system – Transponder – Reliability and space qualification – launch vehicles  
(Ch2 & 3 of Text Book 4)

**UNIT - IV**

Multiple Access Techniques – Time division multiple access – Frequency division multiple access – Code division multiple access – Space domain multiple access  
(Ch 7 of Text Book 4).

Earth Station technology – Subsystem of an earth station – Transmitter – Receiver Tracking and pointing – Small earth station – different types of earth stations – Frequency coordination – Basic principles of special communication satellites – INMARSAT VSAT, GPS, RADARSAT, INTELST

(Ch 10 & 11 of Text Book 4).

**Text Books:**

1. Understanding Radar Systems – Simon Kingsley and Shaun Quegan.
2. Introduction to Radar Systems – MI Skolnik
3. Satellite Communication – Robert M. Gagliardi
4. Satellite Communication – Manojit Mitra

**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**M.Sc. PHYSICS AND M.Sc. SPACE PHYSICS**  
**III Semester**  
**(w.e.f 2009-10 batch)**  
**P 305 : DIGITAL ELECTONICS Lab**

**I Digital electronics**

1. Verification of Gates: AND, OR, NOT, NAND, NOR, EX –OR, EX – NOR gates
2. Encoder and Decoder
3. Multiplexer and De multiplexer
4. Adders: Half adder, Full Adder, Paraller Adder
5. Flip Flops ( 7400,7402,7408,7446)
6. Decade Counter (IC 7490)
7. Seven segment Decoder/ Driver (7490,7447)
8. UP/DOWN Counter IC 74193
9. Digital Comparator ( 7485)
10. Microprocessor 8085
  - Addition/ subtraction of 8 bit numbers
  - Sum of series of 8 – bit numbers

**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**M.Sc. PHYSICS**

**III Semester**

**(w.e.f 2009-10 batch)**

**P 306: PRACTICALS : Solid State Physics Lab**

**LIST OF EXPERIMENTS**

(Any six of the following)

1. LATIC DYNAMICS – STUDY OF PHONON DISPERSION CHARACTERISTICS.
2. DETERMINATION OF DIELECTRIC CONSTANT-DETERMINATION OF GUIDE WAVELENGTH OF AN X-BAND TEST BENCH AND DETERMINATION OF DIELECTRIC CONSTANT OF BENZENE.
3. HALL EFFECT: DETERMINATION OF HALL COEFFICIENT AND ESTIMATION OF CARRIER CONCENTRATION
4. ESR STUDIES AND DPPH- DETERMINATION OF 'G' VALUE OF AN ELECTRON
5. COUPLED OSCILLATIONS AND STUDY OF THE STRENGTH OF THE COUPLING CONSTANT.
6. X-RAY DIFFRACTION STUDIES
7. DETERMINATION OF ELASTIC CONSTANT.
8. THERMOLUMINESCENCE-DETERMINATION OF ACTIVATION ENERGY OF ELECTRONS.
9. DETERMINATION OF MAGNETIC RESISTANCE
10. STUDY OF MAGNETIC HYSTERESIS LOOPS OF FERROMAGNETIC MATERIALS (BH CURVE)

**Department of Physics, A.U**  
**ANALYTICAL TECHNIQUES**

(Choice Based Paper to be offered in the Dept., of Physics during 3<sup>rd</sup> Semester for  
Other Dept., students in AU Campus only)  
(W.e.f. 2009 – 2010 admitted batch)

**Unit I**

Concepts of interaction of electromagnetic radiation with matter, wave and particle properties of electromagnetic radiation, electromagnetic spectrum, absorption laws, electronic transitions, optical and molecular spectra, molecular energies, Raman spectra, photoelectric effect, photoelectric cells, Compton effect, radiation sources, detectors, lasers

**References :**

- 1) Instrumental methods of analysis, Willard, Merritt, Dean, Settle (CBS Pub.)
- 2) Instrumental methods of chemical analysis, H. Kaur (Pragati Prakasan Pub.)

**Unit II : Ultrasonic techniques**

Acoustic Plane waves-Elastic behavior of fluids, plane wave equation, velocity of sound in fluids, energy density acoustic intensity, specific acoustic impedance. Transmission phenomenon-transmission from one fluid medium to another reflection at the surface of a solid, transmission through three media normal incidence and oblique incidence. Resonators & filters- Helmholtz resonator, acoustic impedance, acoustic analogue. Ultrasonic & sonar transducers-piezoelectric effect equivalent electrical circuit, generalized theory, quality factor, piezoelectric relations. Architectural acoustics-classical Ray theory decay of sound in live room & dead rooms. Applications of Ultrasonics

**References:**

- 1) Fundamentals of Acoustics-Kinsler & Fray Wiley Eastern.Limited
- 2) Ultrasonics , Jack Blitz
- 3) Physical Ultrasonics-Beyer & Letcher Academic Press

**Unit III : Magnetic Resonance Techniques**

1) Electron Spin Resonance: Basic Concepts, g-factor and nuclear hyperfine interaction,, essential features of an ESR spectrometer, Applications of ESR: in Physical Sciences and biological systems.

2) Nuclear Magnetic Resonance: Basic principles, continuous wave and pulsed NMR, Fourier Transform NMR, measurement of spin -lattice and spin- spin relaxation times, proton and C-13 NMR, basic pulsed Fourier Transform NMR spectrometer, 2D NMR, applications of NMR in physical and biological sciences, basic features of MRI.

3) Nuclear quadrupole resonance: Basic principle and applications

**References**

- 1) Electron Paramagnetic Resonance : Elementary Theory and practical Applications, J.A.Weil, J.R.Bolton and J.E.Wertz (Wiley) N.Y, 1994
- 2) Principles of Nuclear Magnetic Resonance in One and Two Dimensions, R.R.Ernst, G.Bodenhausen and A.Wokun,(Oxford)1987
- (3) Basics of NMR, Joseph. P. Hornack, Free Online Text
- (4) Nuclear Quadrupole Coupling Constants, E.A.C. Lucken (A.P ) 1969

**Unit IV : Structural characterization techniques**

X-ray diffraction, indexing pattern of cubic crystals and non-cubic crystals (analytical methods), crystal structure identification and determination of lattice parameters.

Fundamentals of Transmission Electron Microscopy (TEM) and Scanning Electron Microscopy (SEM), major components in SEM and TEM, study of crystal structure using TEM, study of microstructure using SEM.

**References :**

- 1) Elements of X-ray Diffraction, B.D. Cullity, Addison-Wesley Publishing Co. Inc., USA (1977).
- 2) Physical Methods of Materials Characterization (Second Edition), PEJ Flewitt and RK Wild, Institute of Physics Publishing, Bristol, UK.





**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**M.Sc. PHYSICS.**  
**IV SEMESTER**  
(w.e.f 2009-2010 admitted batch)

**P401: ADVANCED QUANTUM MECHANICS .**

**UNIT - I**

Linear Vector Spaces in Quantum Mechanics:

Vectors and operators, change of basis, Dirac's bra and ket notations. Eigen value problem for operators. The continuous spectrum. Application to wave mechanics in one dimension.

(*Merzbacher Sec. 14.1, 14.2, 14.3, 14.4, 14.5, 14.6, 14.7*)

**UNIT - II**

Quantum Dynamics :

The equation of motion, Quantization postulates, canonical quantization, Constants of motion and invariance properties. Heisenberg picture. Harmonic Oscillator.

(*Merzbacher . Sec. 15.1, 15.2, 15.3, 15.4, 15.6, 15.7*)

**UNIT - III**

Development of time-dependent perturbation theory. The golden rule for constant transition rates.

(*Merzbacher. Chapter. 18 relevant parts*)

Addition of two angular momenta. Tensor operators.

Wigner-Eckart theorem. Matrix elements of vector operators. Parity and time reversal symmetries.

(*Merzbacher . Section. 16.6, 16.8, 16.10, 16.11*)

**UNIT - IV**

Scattering:

Concept of differential cross-section. Scattering of a wave packet. Born approximation. Partial waves and phase shift analysis.

(*Merzbacher. Section. 11.1, 11.2, 11.4, 11.5*)

. Relativistic Quantum Mechanics

Klein – Gordon equation, Dirac equation for a free particle, Equation of continuity, Spin of a Dirac particle, Solutions of free particle Dirac equation, Negative energy states and hole theory

**TEXT BOOKS:**

1. “ Quantum Mechanics” by R.D. Ratna Raju
- 2.“Quantum Mechanics “ by E. Merzbacher

**Reference Books:**

- 1.” Quantum Mechanics” by Thankappan
2. “Quantum Mechanics” by Biswas

**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**M.Sc. PHYSICS**  
**IV SEMESTER**  
**(w.e.f 2009-2010 batch)**

**P.402 : PROPERTIES AND CHARACTERIZATION OF MATERIALS**

**UNIT - I**

**THERMAL PROPERTIES:**

Anharmonic crystal interactions-thermal expansion, thermal conductivity, lattice thermal resistivity, umklapp processes, and imperfections.

**OPTICAL PROPERTIES :**

Lattice Vacancies, Diffusion, Color Centers—F Centers, other centers in alkali halides, Alloys, Order-disorder transformations, Elementary theory of Order.

**UNIT - II**

**MICROSCOPIC EXAMINATION:**

Fundamentals of Transmission electron microscopy and scanning electron microscopy, study of crystal structure using TEM, study of microstructure using SEM.

**UNIT - III**

**RESONANCE METHODS:**

Spin and an applied field—the nature of spinning particles, interaction between spin and a magnetic field, population of energy levels, the Larmor precession, relaxation times—spin- spin relation, spin-lattice relaxation,

Electron Spin Resonance: Introduction, g-factor, experimental methods.

Nuclear Magnetic Resonance—equations of motion, line width, motional narrowing, hyperfine splitting,

Nuclear Gamma Ray Resonance: Principles of Mossbauer Spectroscopy, Line Width, Resonance absorption, Mossbauer Spectrometer, Isomer Shift, Quadrupole Splitting, magnetic field effects, Applications.

**UNIT - IV**

**ELECTRICAL AND MAGNETIC CHARACTERIZATION TECHNIQUES:**

DC & AC Conductivity, Curie temperature, Saturation Magnetization and Susceptibility

**OPTICAL SPECTROSCOPY:**

Fundamentals of Infra-red Spectroscopy and Applications.

**TEXT BOOKS:**

Solid State Physics, 5<sup>th</sup> edition, C.Kittel

Fundamentals of Molecular Spectroscopy CN Banwell

Mossbauer Effect and its Applications VG Bhide

**ANDHRA UNIVERSITY**  
**DEPARTMENT OF PHYSICS**  
**M.Sc PHYSICS, and SPACE PHYSICS**  
**IV SEMESTER**

(w.e.f 2009-2010 batch)

**P 403 , SP 403 COMMUNICATION ELECTRONICS**

(Common for M.Sc. Space Physics and M.Sc Physics)

**UNIT 1. CW Modulation:**

Amplitude Modulation (AM): 8 periods

**Introduction, Amplitude modulation, modulation index, Frequency spectrum, Average power**

for sinusoidal AM, Amplitude modulator and demodulator circuits, Double side band suppressed carrier (DSBSC) Modulation, Super heterodyne receiver.

Single Side Band Modulation (SSB): 4 periods

**SSB principles, Balanced Modulator, SSB generation**

Angle Modulation: 8 periods

**Frequency modulation (FM), sinusoidal FM, Frequency spectrum for sinusoidal FM**

frequency deviation, modulation index, Average power in sinusoidal FM, FM generation

Phase Modulation: Equivalence between PM and FM, FM detectors: Slope detector, Balanced slope detector, Foster – Seley discriminator, Ratio detector, Amplitude limiter, FM receiver.

**UNIT 2. Pulse Modulation:**

Digital Line Codes: Symbols, Functional notation for pulses, Line codes and wave forms: RZ, NRZ, Polar, Unipolar, AMI, HDBn and Manchester codes, M-ary encoding, Differential encoding 8 periods

Sampling theorem, Principles of pulse Amplitude Modulation (PAM) and Pulse Time Modulation (PTM), Pulse code modulation (PCM), quantization, Nonlinear quantization, companding, differential pulse code modulation (DPCM), Delta Modulation (DM).

Digital Carrier Systems: 8 periods

**ASK, PSK, FSK and DPSK**

**UNIT 3. Special Communication Circuits :** 6 periods

**Tuned amplifiers :Single tuned amplifier-Hybrid  $\pi$  – equivalent for the BJT, Short circuit**

**current gain for the BJT in CE and CB amplifiers, CE and CB tuned amplifiers, Cascode amplifier.**

Mixer Circuits : Diode mixer, IC balanced mixer.

Filters : Active filters, Ceramic, Mechanical and crystal filters.

Oscillators: Crystal oscillator, Voltage controlled oscillator, phase locked loop (PLL).

**UNIT 4. Noise in Communication Systems:** 8 periods

Thermal Noise, Shot Noise, Partition noise, Signal - to - Noise ratio, Noise factor, Amplifier input noise in terms of F, Noise factor of amplifiers in cascade (Friss formula), Noise temperature, Noise in AM, Noise in FM systems. Noise in pulse modulation systems: Intersymbol interference (ISI), eye diagrams.

**Text Books:**

1. Electronic Communications D. Roody and John Coolin
2. Electronic Communications Systems G. Kennedy
3. Modern Analog & Digital Communications B.P. Lathi.

**ANDHRA UNIVERSITY**

**DEPARTMENT OF PHYSICS**

M.Sc. PHYSICS and M.Sc. SPACE PHYSICS,

**IV SEMESTER (w.e.f 2009-2010 batch)**

*(Common for M.Sc. Space Physics and M.Sc Physics)*

**P404 , SP404 : ANTENNA THEORY AND RADIOWAVE PROPAGATION**

**UNIT - I**

**Radiation**

Potential functions of electro magnetic fields. Potential function for sinusoidal oscillations. Fields radiated by an alternating current element. Power radiated by a current element and radiation resistance. Radiation from a quarter wave monopole or a half wave dipole. EM field close to an antenna and far field approximation. (*Chapter 10 in Jordan and Balmain* 6 Hrs.

**Antenna Fundamentals**

Definition of an antenna. Antenna properties – radiation pattern, gain, directive gain and directivity. Effective area. Antenna beam width and band width. Directional properties of dipole antennas. (*Chapter 11 in Jordan and Balmain and Chapter 2 in Kraus*) 6 Hrs.

**UNIT - II**

**Antenna Arrays**

Two element array. Linear arrays. Multiplication of patterns and binomial array. Effect of Earth on vertical patterns. Mathematical theory of linear arrays. Antenna synthesis – Tchebycheff polynomial method. Wave polarization. (*Chapter 11 and 12 in Jordan and Balmain and Chapter 4 in Kraus*) 12 Hrs.

**Impedance**

Antenna terminal impedance. Mutual impedance between two antennas. Computation of mutual impedance. Radiation resistance by induced emf method. Reactance of an antenna. Biconical antenna and its impedance. (*Chapter 14 in Jordan and Balmain and Chapters 8.1 –8.5 in Kraus*) 6 Hrs.

**UNIT - III**

**Frequency Independent (FI) Antennas**

Frequency Independence concept. Equiangular spiral. Log Periodic (LP) antennas. Array theory of LP and FI structures. (*Chapter 15 in Jordan and Balmain and Chapter 15 in Kraus*) 4 Hrs.

**Methods of excitation and Practical Antennas**

Methods of excitation and stub matching and baluns. Folded dipole, loop antennas. Parasitic elements and Yagi-Uda arrays and Helical antenna. Complementary screens and slot antennas. Radiation from a rectangular horn antenna. (*Chapter 11.15 in Jordan and Balmain and Chapters 6.1 – 6.4 ,7.1 – 7.8 and 13 in Kraus*) 10 Hrs.

**UNIT - IV**

**Radio Wave Propagation**

Elements of Ground wave and Space wave propagation. Tropospheric propagation and Troposcatter. Fundamentals of Ionosphere. Sky wave propagation – critical frequency, MUF and skip distance. (*Chapter 16 and 17 in Jordan and Balmain*) 6 Hrs.

**BOOKS**

1. "Electromagnetic waves and Radiating Systems" by E.C.Jordan and K.G.Balmain
2. "Antennas" by J.D.Kraus. (Second Edition)

**M.Sc PHYSICS,**  
**IV SEMESTER**  
**(w.e.f 2009-2010 batch)**

**P 405 : MICROPROCESSOR LAB**

- 1. Decimal addition of 8 – bit numbers**
- 2 Addition of two 16 – bit numbers**
- 3 Multibyte addition**
- 4. Sum of series of 16 – bit numbers**
- 5. Word Disassembly**
- 6. Largest number in an array**
- 7. Ascending order of array of 8 - bit number**
- 8. Interfacing of 8255 PPI: generation of square wave and rectangular waves**
- 9. Interfacing of 8253 programmable timer: Mode 1, Mode2, Mode3, Mode 4, Mode5**
- 10 0800 DAC interfacing : generation of square, triangular and stair case wave forms**

ANDHRA UNIVERSITY  
DEPARTMENT OF PHYSICS  
M.Sc. PHYSICS  
**IV SEMESTER**  
(w.e.f 2009-2010 batch)

P 406 : COMMUNICATION LAB  
LIST OF EXPERIMENTS

1. **AMPLITUDE MODULATION**
2. **FREQUENCY MODULATION AND DETECTION**
3. **MIXER**
4. **BUTTERWORTH FIRST ORDER LOWPASS AND HIGHPASS FILTERS**
5. **CHEBYSHEV SECOND ORDER LOWPASS FILTER**
6. **PHASE LOCKED LOOP (PLL)**
7. **PULSE MODULATION-PAM-AND SAMPLING**
8. **STUDY OF PRE- EMPHASIS AND DE- EMPHASIS CIRCUITS**
9. **GENERATION OF PWAM, AND PPM USING PLL AND 555 TIMER**
10. **STUDY OF FSK TRANSMISSION AND RECEPTION**
11. **OPTICAL FIBRE –BENDING LOSSES AND NUMERICAL APERTURE**
12. **MEASUREMENT OF BIT ERROR RATE (BER)**
13. **MEASUREMENT OF SPEED OF LIGHT IN OPTICAL FIBRE**
14. **DETERMINATION OF FREQUENCY AND WAVELENGTH IN A RECTANGULAR WAVEGUIDE IN  $TE_{1,0}$**
15. **DETERMINATION OF STANDING WAVE RATIO AT REFLECTION COEFFICIENT**
16. **STUDY OF ISOLATOR /CIRCULATOR**
17. **MEASUREMENT OF GAIN ,FRONT TO BACK RATIO,BEAM WIDTH OF RADIATION PATTERN IN HALF WAVE DIPOLE**
18. **FIVE ELEMENT YAGI UDA ANTENNA**
19. **HELICAL ANTENNA**
20. **CUT –PARABOIDAL REFLECTOR ANTENNA**

# ADIKAVI NANNAYA UNIVERSITY



# M.Sc Physics SYLLABUS



**Annexure-III**  
**Course Structure for M.Sc physics**  
 (With effect from 2017-18admitted batch)

**M.Sc Physics-I semester**

Theory code	Title	L	T	P	Tot Hrs	Exam Marks	Mid marks	Total Marks	Credits
P-101	Classical Mechanics	4	1		5	75	25	100	4
P-102	Atomic and molecular physics	4	1		5	75	25	100	4
P-103	Mathematical methods of physics	4	1		5	75	25	100	4
P-104	Electronic Devices & circuits	4	1		5	75	25	100	4
P-105	Electronics/Modern physics lab Record Comprehensive Viva			1 2	12	100 50 50			8
	Total	16	4	12	32	500	100	600	24

L: lecture Hours, T-Tutorial Hours, P-Practical Hours

**M.Sc Physics-II semester**

Theory code	Title	L	T	P	Tot Hrs	Exam Marks	Mid sem marks	Total Marks	Credits
P-201	Statistical Mechanics	4	1		5	75	25	100	4
P-202	Electrodynamics	4	1		5	75	25	100	4
P-203	Numerical methods and programming with C	4	1		5	75	25	100	4
P-204	Nuclear & particle physics	4	1		5	75	25	100	4
P-205	Modern physics/Electronics lab Record Comprehensive Viva			1 2	12	100 50 50			8
	Total	16	4	12	32	500	100	600	24

L: lecture Hours, T-Tutorial Hours, P-Practical Hours

**M.Sc Physics-III semester**

Theory code	Title	L	T	P	Tot Hrs	Exam Marks	Mid sem marks	Total Marks	Credits
P-301	Introductory quantum mechanics	4	1		5	75	25	100	4
P-302	Solid State Physics	4	1		5	75	25	100	4
P-303	Lasers & Non-linear optics	4	1		5	75	25	100	4
P-304	Digital Electronics & Microprocessors	4	1		5	75	25	100	4
P-305	Digital(Including Microprocessor)& Communication Electronics Lab/Solid state physics lab Record Comprehensive Viva			1 2	12	100  50 50			8
	Total	1 6	4	1 2	32	500	100	600	24

L: lecture Hours, T-Tutorial Hours, P-Practical Hours

**M.Sc Physics-IV semester**

Theory code	Title	L	T	P	Tot Hrs	Exam Marks	Mid sem marks	Total Marks	Credits
P-401	Advanced Quantum Mechanics	4	1		5	75	25	100	4
P-402	Properties & Characterization of Materials	4	1		5	75	25	100	4
P-403	Communication electronics	4	1		5	75	25	100	4
P-404	Antenna theory & Radio Wave propagation	4	1		5	75	25	100	4
P-405	Solid state physics lab/ Digital(Including Microprocessor)& Communication Electronics Lab Record Comprehensive Viva			1 2	12	100  50 50			8
	Total	1 6	4	1 2	32	500	100	600	24

L: lecture Hours, T-Tutorial Hours, P-Practical Hours

Project for 100 marks

**Scheme of Examination at the end of each semester:**

Theory pass Minimum - 40%

Practical pass minimum - 50% (including practical, Record and Viva)

Aggregate - 50%

**ADIKAVI NANNAYA UNIVERSITY****I Semester****M.Sc. Physics****(w.e.f 2017-18 Admitted batch)****P101: CLASSICAL MECHANICS**

**UNIT-I:** Mechanics of a particle. Mechanics of a system of particles, constraints, D'Alembert's principle and Lagrange's equations, Velocity Dependent potentials and the Dissipation function Simple applications of the Lagrangian Formulation **5 Hrs.**

Chapter : 1. Section : 1, 2, 3, 4,5 & 6 .

Hamilton's principle, some techniques of the calculus of variations. Derivation of Lagrange's equations from Hamilton's principle. Conservation theorems and symmetry properties, Energy function and the conservation of Energy **6 Hrs.**

Chapter : 2. Section : 1, 2, 3, 5, 6

**UNIT-II:** Reduction to the equivalent one body problem. The equation of motion and first Integrals, The equivalent One – Dimensional problem and classification of orbits, The differential equation for the orbit, and Integrable power –law potentials, Conditions for closed orbits (Bertrand's theorem), The Kepler problem inverse square law of force , The motion in time in the Kepler problem, Scattering in a central force field.. **7 Hrs**

Chapter : 3. Section. 1, 2, 3, 5, 6, 7, 8

Legendre transformations and Hamilton's equations of motion. Cyclic Coordinates and conservation theorems, Derivation of Hamilton's equation of motion from variational principle, Principle of Least Action.

**6 Hrs**

Chapter : 7 Section: 1, 2,3,4 5 .

**UNIT-III:** Equations of canonical transformation, Examples of Canonical transformations, The harmonic Oscillator, Poisson brackets and other Canonical invariants, Equations of motion, Infinitesimal canonical transformations, and conservation theorems in the poisson bracket formulation, the angular momentum poisson bracket relations. **5Hrs**

Chapter : 8. Section : 1 , 2 ,4, 5, 6 & 7.

Hamilton – Jacobi equation of Hamilton's principal function, The Harmonic oscillator problem as an example of the Hamilton – Jacobi Method, Hamilton –Jacobi equation for Hamilton's characteristic function. Action – angle variables in systems of one degree of freedom. **8 Hrs.**

Chapter : 9. Section : 1, 2, 3, & 5.

**UNIT-IV:** Independent coordinates of rigid body. , The Euler angles, Euler's theorem on the Motion of a rigid body, Infinitesimal rotations, Rate of change of a vector, The Coriolis Effect. Chapter : 4. Section : 1, 4, 6, 8, 9

The Inertia tensor and the moment of inertia, The Eigenvalues of the inertia tensor and the principal axis transformation, Solving rigid body problems and Euler equations of motion, Torque – free motion of a rigid body **6 Hrs**

Chapter 5 Section: 3, 4, 5 & 6.

The Eigenvalue equation and the principal axis transformation, Frequencies of free vibration, and normal coordinates, Free vibrations of a linear triatomic molecule

Chapter 10 Section: 2, 3 & 4 .

**6 Hrs**

**TEXT BOOKS :** Classical Mechanics H.Goldstein (Addison-Wiley, 1<sup>st</sup> & 2<sup>nd</sup> ed)

**REFERENCE BOOKS:** Classical Dynamics of Particles and Systems J.B.Marion.

Convenor, BOS in Physics ,ANUR

**ADIKAVI NANNAYA UNIVERSITY****M.Sc. Physics****I Semester****(w.e.f 2017-18 Admitted batch)****P102 : ATOMIC AND MOLECULAR PHYSICS.****UNIT-I****12 Hrs**

**ONE ELECTRON ATOMS :** Quantum numbers, Term values . Relation between Magnetic dipole moment and angular momentum of an orbiting electron. Stern–Gerlach experiment and electron spin . Spin- orbit interaction, relativistic kinetic energy correction and dependence of energy on J value only. Selection rules. Fine structure of Balmer series of Hydrogen and Fowler series of ionized Helium. Hyperfine structure of H line of hydrogen ( $I = \frac{1}{2}$ ) .

**ONE VALENCE ELECTRON ATOMS:** Modified term values (quantum defect) due to lifting of orbital degeneracy by core penetration (penetrating orbits) and core polarization (non-penetrating orbits) by nl electrons. Term values and fine structure of chief spectral series of sodium. Intensity rules and application to doublets of sodium. Hyperfine structure of  $^2P-^2S$  of sodium ( $I= 3/2$ ).

**UNIT-II****10 Hrs**

**MANY ELECTRON ATOMS :** Indistinguishable particles, bosons, fermions. Pauli's principle. Ground states. LS coupling and Hund's rules based on Residual coulombic interaction and spin-orbit interaction. Lande's interval rule. Equivalent and non-equivalent electrons. Spectral terms in LS and JJ coupling ( $ss, s^2, pp, p^2$  configurations). Exchange force and Spectral series of Helium.

**UNIT- III****8 Hrs**

**ATOMS IN EXTERNAL MAGNETIC FIELD:** Normal and Anomalous Zeeman Effects, Experimental study of Zeeman effect, Explanation of Normal and Anomalous Zeeman Effects, Quantum theory of Zeeman and Paschen-Back effects and its applications, Transition from weak to strong field, Examples of Zeeman effect in some transitions

**ATOMS IN EXTERNAL ELECTRIC FIELD:** Linear stark pattern of H line of hydrogen, weak field and strong field Stark effects in Hydrogen, Quadratic stark pattern of D<sub>1</sub> and D<sub>2</sub> lines of Sodium.

**UNIT-IV****20 Hrs**

**DIATOMIC MOLECULES:** Molecular quantum numbers. Bonding and anti-bonding orbitals from LCAO's. Explanation of bond order for N<sub>2</sub> and O<sub>2</sub> and their ions. Rotational spectra and the effect of isotopic substitution. Effect of nuclear spin functions on Raman rotation spectra of H<sub>2</sub> (Fermion) and D<sub>2</sub> (Boson). Vibrating rotator. Spectrum. Combination relations and evaluation of rotational constants (infrared and Raman). Intensity of vibrational bands of an electronic band system in absorption.(The Franck-Condon principle). Sequences and progressions. Deslandre's table and vibrational constants.

**BOOKS :**

- |   |                |
|---|----------------|
| 1. Atomic and Molecular Spectra           | - Rajkumar     |
| 2. Fundamentals of Molecular Spectroscopy | - C.N.Banwell. |
| 3. Group Theory                           | - K.V.Raman.   |
| 4. Introduction to Atomic Spectra         | - H.E.White.   |

**ADIKAVI NANNAYA UNIVERSITY****M.Sc. Physics****I Semester****(w.e.f 2017-18 Admitted batch)****P103 : Mathematical Methods of Physics****Unit I : Complex Variables****15 Hrs**

Function of complex number- definition-properties, analytic function-Cauchy –Riemann conditions-polar form-problems, Complex differentiation, complex integration –Cauchy’s integral theorem- Cauchy’s integral formulae-multiply connected region- problems, Infinite series-Taylor’s theorem- Laurent’s theorem-Problems, Cauchy’s Residue theorem- evaluation of definite integrals-problems.

**Text Book:**1.Mathematical Methods of Physics-G.Arffen,Academic Press

2.Mathematical Physics-Satya Prakash, Sultan Chand &amp; co,New Delhi

3.Complex Variables ( Schaum’s out line series) MurrayR.Spiegel

**Ref Book:** Mathematical Methods B.D.Gupta**Unit II : Beta , Gamma functions &Special functions****10 Hrs**

Beta & Gamma functions -definition, relation between them- properties-evaluation of some integrals  
Special Functions- Legendre Polynomial, Hermite Polynomial, Laguerre Polynomial-Generating function-recurrence relations-Rodrigue’s formula-orthonormal property-associated Legendre polynomial- simple recurrence relation-orthonormal property-spherical harmonics

**Text Book:** 1.Mathematical Methods of Physics-G.Arffen,Academic Press

2.Mathematical Physics-Satya Prakash, Sultan Chand &amp; co,New Delhi 3.

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**Ref book :** Special Functions .M.D.Raisinghania**Unit III : Laplace Transforms****15 Hrs**

Laplace Transforms – definition- properties – Laplace transform of elementary functions-Inverse Laplace transforms-properties- evaluation of Inverse Laplace Transforms-elementary function method-Partial fraction method-Heavyside expansion method-Convolution method-complex inversion formula method-application to differential equations

**Text Book:** 1.Mathematical Methods of Physics-G.Arffen,Academic Press

2.Mathematical Physics-Satya Prakash, Sultan Chand &amp; co,New Delhi

3. Laplace n Fourier Transforms Goyal &amp; Gupta,

**Ref books:** Integral Transforms M.D.Raisinghanna

Integral Transforms Goyal &amp; Gupta

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**Unit IV: Fourier series, Fourier Transforms**

Fourier series-evaluation of Fourier coefficients- Fourier integral theorem-problems-square wave-rectangular wave-triangular wave

Fourier Transforms- infinite Fourier Transforms-Finite Fourier Transforms-Properties-problems-application to Boundary value problem

**Text Book:** 1.Mathematical Methods of Physics-G.Arffen,Academic Press

2.Mathematical Physics-Satya Prakash, Sultan Chand &amp; co,New Delhi

3. Laplace n Fourier Transforms Goyal &amp; Gupta,

**Ref books:** Integral Transforms M.D.Raisinghanna

Integral Transforms Goyal &amp; Gupta

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**ADIKAVI NANNAYA UNIVERSITY****M.Sc. Physics****I Semester****(w.e.f 2017-2018 batch)****P104 : ELECTRONIC DEVICES AND CIRCUITS****UNIT-I****SEMICONDUCTOR DEVICES:****10 Hrs.**

Tunnel diode, photo diode, solar cell, LED, APD, PIN Diode, Schottky Barrier Diode, Silicon controlled Rectifier, Uni Junction Transistor, Field Effect Transistor, (JFET & MOSFET), CMOS ( Principle, working and Applications for all devices)

**UNIT-II****MICROWAVE DEVICES: 15 Hrs.**

Varactor diode, Parametric Amplifier, Thyristors, Klystron, Reflex Klystron, Gunn Diode, Magnetron, CFA, TWT, BWO, IMPATT, TRAPATT (Principle, working and Applications for all devices)

**UNIT-III**

**OPERATIONAL AMPLIFIERS : 10 Hrs.** The ideal Op Amp – Practical inverting and Non inverting Op Amp stages. Op Amp Architecture – differential stage, gain stage, DC level shifting, output stage, offset voltages and currents

Operational Amplifier parameters- input offset voltage, input bias current, Common Mode Rejection Ratio, Slew Rate

**UNIT-IV****15 Hrs.****OP- AMP APPLICATIONS:**

Summing amplifier, Integrator, Differentiator, Voltage to Current converter, Current to Voltage converter  
Oscillators – Phase shift oscillator, Wien-Bridge Oscillator, Voltage Controlled Oscillator, Schmitt Trigger  
Special applications – Monostable and Astable multivibrators using 555, Phase locked Loop, Voltage regulators.

**TEXT BOOKS:**

1. Integrated Electronics - Jacob Millman & C.C. Halkies (TMH)
2. Op.Amps and Linear Integrated Circuits – Ramakant A.Gayakwad (PHI)
3. Electronic Communication Systems – George Kennedy (PHI)

**REFERENCE BOOKS:**

1. Microelectronics - Jacob Millman & Arvin Grabel (McGraw Hill)
2. Electronic Devices and Circuits – G.K. Mithal (Khanna)
3. Op-amps and Linear Integrated Circuits – D. Mahesh Kumar (MacMillan).

**ADIKAVI NANNAYA UNIVERSITY****M.Sc. Physics****I Semester****(w.e.f 2017-18 Admitted batch)****P105 : MODERN PHYSICS LAB****(Any ten of the following experiments)**

1. Atomic Spectrum of Zinc.
  - a) Verification of Lande's interval rule
  - b) Study of relative intensities
2. Grating spectrometer
  - a) Wavelengths of Hg spectrum,
  - b) wavelength of Balmer series, Rydberg constant
3. Reciprocal dispersion curve
4. Application of Point Groups.
  - a) Identification of symmetry operations in H<sub>2</sub>O, BH<sub>3</sub>, NH<sub>3</sub> and H<sub>2</sub>CO
  - b) Reducible representations and Vibrational modes of H<sub>2</sub>O.
5. Determination of Planck's constant, work function and threshold frequency
6. Band gap of a semiconductor. (Two Probe Method)
7. Thermo emf
8. The Franck-Hertz experiment
9. Band spectrum of CN in the violet
  - a) conversion of given wavelengths to wavenumbers and assignment of ( $\nu_1, \nu_2$ )
  - b) Deslandres' table and Vibrational constants.
10. Atomic Spectrum of Sodium.
  - a) identification of sharp and diffuse doublets
  - b) doublet separation
  - c) assignment of principal quantum numbers
11. Raman Spectrum of Carbon Tetrachloride
  - a) Raman shifts
  - b) Fermi resonance
12. Vibrational analysis of AIO Green system.
  - a) identification of sequences, assignment of vibrational quantum numbers,
  - b) Deslandre's table and Vibrational constants.
13. Determination of Specific Charge of an electron by Thomson's Method.
14. Experiments with He-Ne laser.
  - a) Polarization of laser light
  - b) Divergence of laser beam and monochromaticity.
15. Band gap of a semiconductor (Four probe method).
16. Dielectric constant as a function of temperature and determination of Curie Temperature
17. Susceptibility of a substance Gouy's method
18. Dissociation energy of Iodine molecule from the given data.

**ADIKAVI NANNAYA UNIVERSITY****M.Sc. Physics****I Semester****(w.e.f 2017-18 Admitted batch)****P105 : ELECTRONICS LAB****LIST OF EXPERIMENTS****(Any ten of the following experiments)**

1. FET amplifier (BFW 10/11 )
2. Negative feedback amplifier (BC 147 )
3. Colpitts Oscillator (BF 194)
4. Phase shift Oscillator (BC 147)
5. Astable Multivibrator (BF 194)
6. Op.Amp.Characteristics (IC 741 )
7. Power Supply
8. UJT Characteristics (2 N 2646 )
9. R.F.Amplifier (BF 194)
10. Boot-strap time base generator (2N 2222)
11. Active Low pass and High Pass filters (IC 741 )
12. Twin -T filter (IC 741 )
13. Logarithmic Amplifier (IC 741 )
14. Wein Bridge Oscillator (IC 741 )
15. Monostable multivibrator (IC 555 )
16. Voltage Regulator (IC 723 )
17. Phase Shift Oscillator (IC 741 )
18. Astable multivibrator (IC 555 )
19. Active band pass filter (IC 741 )
20. Voltage controlled oscillator ((IC 741, IC 555 )



**ADIKAVI NANNAYA UNIVERSITY**  
**I SEMESTER**

**M.Sc. PHYSICS**  
**(Effective from 2017-2018 admitted batch)**  
**P101 : CLASSICAL MECHANICS.**  
**MODEL QUESTION PAPER**

**Time: 3 Hrs.**

**Max.Marks:75.**

**SECTION –A.**

**Answer ALL Questions.**

**4 x 15 = 60.**

1. a) State D'Alembert's principle and derive Lagrange's equation of motion using it. 10  
b) Write the equation of constraint and the Lagrangian for a particle moving on the surface of a sphere under gravity. 5

OR

- c) Obtain Lagrange's equation of motion from Hamilton's principle for conservative systems. 10  
d) For a conservative system when constraints are independent of time show explicitly that total energy is conserved. 5
2. a) What is the first integral of motion? Show that the orbit of a planet moving around the sun under the inverse square law of force is a conic 10  
b) What are generalized co-ordinates? When is a co-ordinate cyclic? What is its physical significance? 5

OR

- c) Obtain Rutherford's formula for the scattering of a charged particle from scattering center. 10  
d) Explain rainbow Scattering. 5
3. a) Define moment of inertia tensor. Derive Euler's equations of rotational motion of a rigid body. 10  
b) What are Euler angles? Show them in a diagram. 5

OR

- c) Using Hamilton – Jacobi technique solve the problem of one dimensional harmonic oscillator. 10  
d) Show that the solutions are time integrals of the Lagrangian. 5
4. a) What are the normal co-ordinates for a system of linear symmetrical tri-atomic molecule. 10  
b) Obtain an expression for the normal frequencies of oscillations. 5

OR

- c) Derive Hamilton's equations of motion using Legendre transformations. Give the Physical significance of the Hamiltonian. 10  
d) Express canonical equations of motion in Poisson bracket form. 5

**PART - B.****Answer any FIVE Questions.****5 x 5 = 25.**

2. A block of mass 'm' sits on a horizontal frictionless table. It is attached by a massless string to another block of mass M. The string passes over a frictionless pulley. Use Lagrange's equation to solve the motion of the system.
3. Construct the Hamiltonian and hence obtain the equation of motion of a simple pendulum.
7. Prove the Jacobian Identity. What is its significance ?
8. Define Action angle variable. Determine the frequency of periodic motion using Action-angle variable.
9. Explain central forces. In the central force motion show that a real velocity is constant.
10. Obtain conservation theorem for total angular momentum of a system of particles.
11. Using variational principle show that the shortest distance between two points is a straight line.
12. Show that the Poisson bracket is invariant under canonical transformation.

**ADIKAVI NANNAYA UNIVERSITY**  
**II SEMETER**  
**M.Sc PHYSICS**  
**(Effective from 2017-18 Admitted Batch)**  
**P102: ATOMIC AND MOLECULAR PHYSICS**  
**MODEL QUESTION PAPER**

Time: 3 Hrs

Max.Marks:75

## SECTION-A

Answer ALL Questions

4×15=60

1. a) With the help of schematic diagram, describe the Stern-Gerlach experiment and evidence for the Spin of an electron. 10
- b) Establish the relation between magnetic dipole moment and angular momentum of an orbiting electron. 5
- (OR)
- c) Explain the quantum numbers associated with an electron of an atom. 10
- d) Explain the fine structure of chief spectral series of sodium. 5
  
2. a) Explain the spectral features of helium. Compare the higher energy levels of helium with Hydrogen. 10
- b) Explain Hund's rule based on residual columbic interaction. 5
- (OR)
- c) Explain the concept of indistinguishible particles and state Pauli's exclusion principle. 10
- d) What is L-S coupling? Deduce the various interaction energy terms for L-S coupling. 5
  
3. a) Give Quantum mechanical treatment of Zeeman effect. 10
- b) Calculate the Zeeman splitting of the terms  $2p_{3/2}$  and  $5F_1$  in terms of applied magnetic field. 5
- (OR)
- c) What is Paschen-Back effect? 5
- d) Explain the weak field and strong field stark effects in Hydrogen. 10
  
- 4.a) Explain the bonding and anti bonding orbital's from linear combination of atomic orbital's . 10
- b) Explain the Bond order for  $N_2$ . 5
- (OR)
- c) State Frank-Condon principle. 5
- d) Describe the principle features of vibrating rotator. 10

## PART-B

Answer any FIVE of the following.

5×3=15

5. Show the fine structure of  $H_\alpha$  line of Hydrogen.
6. What is Lande's interval rule?
7. What is Normal and Anomalous Zeeman effect?
8. What are penetrating and non-penetrating orbits?
9. Draw the Paschen-Back pattern for 2P-2S transition of sodium.
10. Show that separation between consecutive rotational lines of pure rotational spectrum of Molecule is constant.
11. Explain briefly the rotational spectrum of a molecule.
12. Draw the quadratic stark pattern for 2P-2S transition of sodium.

**ADIKAVI NANNAYA UNIVERSITY**  
**I SEMESTER**  
**M.Sc. PHYSICS**  
**(Effective from 2017-2018 admitted batch)**  
**P103 :MATHEMATICAL METHODS OF PHYSICS.**  
**MODEL QUESTION PAPER**

Time: 3 Hrs.

Max.Marks:75

## SECTION –A.

Answer all Questions 15 X 4 =60

1. a) State and prove the Taylor's theorem. 10  
 b) Prove that  $H_n'(x) = 2nH_{n-1}(x)$  5  
 (OR)  
 c) State and prove the necessary and sufficient condition for the function to be analytic in a region R. 10  
 d) Show that 5
- $$\int \frac{x^2 dx}{(x^2 - 1)^2 (x^2 - 2x - 2)}$$
- 7 / 50
2. a) Starting from the generating function of Laguerre polynomial obtain the differential equation satisfied  $L_n(x)$ . 9  
 b) Obtain two fundamental recurrence relations of Hermite polynomials 6  
 (OR)  
 c) Obtain the relation between Beta and Gamma functions 8  
 d) Evaluate the value of Gamma (1/2) 7
3. a) Define Fourier series and write the conditions of its existence and also define the Fourier Transform .7M  
 b) Find the Fourier Transform of (i)  $\sin \omega t$  (ii)  $\cos \omega t$  8M  
 (OR)  
 c) State and Prove Fourier Integral Theorem 15
4. a) State and Prove Initial & Final Value theorems of the Laplace Transformation 10  
 b) Evaluate the inverse Laplace transform of 5  

$$\frac{7}{s^2} - \frac{5}{9s} + \frac{1}{2s^3}$$
 OR  
 c) Solve  $(D^4 + 2D^2 + 1) Y(t) = 0$  where  $Y(0) = 0$ ,  $Y'(0) = 1$ ,  $Y''(0) = 2$  and  $Y'''(0) = 3$  using Laplace transforms 10  
 d) State and Prove Convolution Theorem 5

**SECTION B**  
**Answer Any Five Questions**      **5 X 5 = 25**

5. Prove orthogonal property of Laguerre polynomials

6. Given  $u = 3x^2y + 2x^2 - y^3 - 2y^2$  Find  $v$  such that  $w(z) = u + iv$  is analytic

7. Evaluate  $\int_0^{\cos aux} \frac{1}{x^2 - 1} dx$

8. Evaluate  $H_0(x)$ ,  $H_1(x)$ ,  $H_2(x)$ ,  $H_3(x)$  from Rodrigue's formula for Hermite polynomials.

9. Find the Fourier transform of

$$f(x) = \begin{cases} x, & x < a \\ 0, & x > a \end{cases}$$

10. Apply convolution theorem to evaluate

$$L_1 \left\{ \frac{s}{s^2 + a^2} \right\}$$

11. Find the Fourier series for function defined by

$$f(x) = -x \quad \text{if } -\pi < x < 0$$

$$f(x) = x \quad \text{if } 0 < x < \pi$$

12. State and prove Cauchy's Theorem.

**ADIKAVI NANNAYA UNIVERSITY**  
**I SEMESTER**  
**M.Sc. PHYSICS**  
**(Effective from 2017-2018 admitted batch) P104**  
**:ELECTRONIC DEVICES AND CIRCUITS MODEL**  
**QUESTION PAPER**

**Time : 3 Hrs**

**Max. Marks:75**

SECTION - A

**Answer ALL Questions**

**4 x 15 = 60**

1. a) Describe the working of a FET and explain its Characteristics. 10  
 b) Explain briefly the small signal model of FET. 5  

**OR**

 c) Give the construction and Characteristics of an SCR and explain its working. 10  
 d) Show how an SCR can be used to control power in a circuit. 5
  
2. a) Describe the working of Reflex Klystron and explain its Characteristics 10  
 b) Explain briefly the working of diac 5  

**OR**

 c) Describe the working of Magnetron and explain its Characteristics 10  
 d) Explain why magnetron is called as CFA 5
  
3. a) What are the important parameters of an operational amplifier. 5  
 b) Describe the method of their measurement. 10  

**OR**

 c) Explain the terms differential gain and DC level shifting of an op-amp 10  
 d) What are the characteristics of an ideal op-amp 5
  
4. a) Draw the circuit diagram of a V C O and discuss its operation 10  
 b) Mention some its applications 5  

**OR**

 c) Describe with necessary theory, the working of a wein-bridge oscillator using op-amp 10  
 d) How do you account for its frequency stability. 5

**SECTION - B**  
**Answer any FIVE Questions      5 x 5 = 25 Marks**

5. Explain the principle and working of solar cells.
6. Explain the characteristics of a varactor diode.
7. Explain the working of an Astable Multivibrator using 555.
8. Explain the principle of working of a series voltage regulator.
9. Explain what is meant by negative resistance in a tunnel diode.
10. Explain how an UJT can be used as a relaxation oscillator.
11. Explain the working of op-amp as voltage to current converter
12. Explain the working of a Schmitt trigger.



**ADIKAVI NANNAYA UNIVERSITY****M.Sc. Physics****II Semester****(w.e.f 2017-18 Admitted batch)****P201 : STATISTICAL MECHANICS****UNIT-I : Basic Methods and Results of Statistical Mechanics:****13 Hrs**

Specification of the state of a system, phase space and quantum states, Liouville's theorem, Basic postulates, Probability calculations, concept of ensembles, thermal interaction, Mechanical interaction, quasi static process, distribution of energy between systems in equilibrium, statistical calculations of thermo dynamic quantities, Isolated systems(Microcanonical ensemble). Entropy of a perfect gas in microcanonical ensemble. Canonical ensemble - system in contact with heat reservoir, system with specified mean energy, connection with thermodynamics, Energy fluctuations in the canonical ensemble . Grand canonical ensemble, Thermodynamic function for the grand canonical ensemble. Density and energy fluctuations in the grand canonical ensemble. Thermodynamic equivalence of ensembles. Reif Ch:2, 3.3,3.12 Ch:6

**UNIT-II : Simple Applications of Statistical Mechanics:****12 Hrs**

Partition functions and their properties. Calculation of thermo dynamic quantities to an ideal mono atomic gas. Gibbs paradox, validity of the classical approximation. Proof of the equipartition theorem. Simple applications – mean K.E. of a molecule in a gas. Brownian motion. Harmonic Oscillator, Specific heats of solids (Einstein and Debye model of solids), Paramagnetism, Partition function for polyatomic molecules, Electronic energy, vibrational energy and rotational energy of a diatomic molecule. Effect of Nuclear spin-ortho and para Hydrogen. Reif Ch:7, Ch:9.12

**UNIT-III: Quantum Statistics:****15 Hrs**

Formulation of the statistical problem. Maxwell–Boltzmann statistics. Photon statistics, Bose-Einstein statistics, Fermi–Dirac statistics, Quantum statistics in the classical limit, calculation of dispersion for MB, BE & FD statistics Equation of state of an Ideal Bose Gas, Black body radiation, Bose-Einstein condensation, Equation of state for a weakly degenerate and strongly degenerate ideal Fermi gas. Thermionic emission. The theory of white dwarf stars. Reif Ch:9

**UNIT – IV: RELATIVISTIC MECHANICS**

Introduction: Postulates of relativistic mechanics. Minkowski Space, Geometrical representation of Lorentz transformation of space and time. Application to Lorentz transformation. Geometrical representation of Simultaneity, length-contraction and time dilation. Space like and time like intervals. Relativistic classification of particle, Basic ideas of general theory of relativity.

**(Sathya Praksah)****Text Books**

1. Fundamentals of Statistical and Thermal Physics F. Reif
2. Statistical Mechanics, Theory and Applications S.K. Sinha
3. Statistical Mechanics R.K. Pathria
4. Statistical Mechanics, B.K. Agarwal and M. Eisner, New International (P) Ltd., New Delhi, 2007.
5. Relativistic Mechanics, Satya Prakash, Pragathi Prakashan, Meerut, 1987.

**ADIKAVI NANNAYA UNIVERSITY****II Semester****M.Sc. Physics****(w.e.f 2017-18 Admitted batch)****P202 : ELECTRO DYNAMICS.**

**UNIT-I:** Gauss Theorem, Poission's equation, Laplaces equation, solution to Lapalaces equation in cartesian coordiantes, spherical coordinates, cylidrical coordinates, use of Laplaces equation in the solutions of electrostatic problems. **6Hrs**

Ampere's circuital law, magnetic vector potential, displacement current, Faraday's law of electromagnetic inducation, **4Hrs**

**UNIT-II:**

Maxwell's equations, differential and integral forms, physical significance of Maxwell's equations. **4 Hrs**

Wave equation, plane electromagnetic waves in free space , in nonconducting isotropic medium, in conducting medium, electromagnetic vector and scalar potentials, uniqueness of electromagnetic potentials and concept of gauge, Lorentz gauge, Coulomb gauge **6Hrs**

Charged particles in electric and magnetic fields: charged particles in uniform electric field, charged particles in homogerous magnetic fields, charged particles in simultaneous electric and magnetic fields, charged particles in nonhomogeneous magnetic fields. **6Hrs**

**UNIT-III:** Lienard-Wiechert potentials, electromagnetic fields from Lienard-wiechert potentials of a moving charge, electromagnetic fields of a uniformly moving charge, radiation due to non-relativistic charges, radiation damping, Abraham-Lorentz formula, cherenkov radiation, radiation due to an oscillatory electric dipole, radiation due to a small current element. Condition for plasma existence, occurrence of plasma, magneto hydrodynamics, plasma waves **10Hrs**

**UNIT-IV:** Transformation of electromagentic potentials, Lorentz condition in covariant form, invariance or covariance of Maxwell field eqations in terms of 4 vectors, electromagnetic field tensor, Lorentz transformation of electric and magnetic fields. **12 Hrs**

**Text books:**

- |  |                  |
|--|------------------|
| 1. Classical Electrodynamics :                 | - J.D. Jackson   |
| 2. Introduction to Electrodynamics :           | - D.R. Griffiths |
| 3. .Electromagnetic Theory and Electrodynamics | - Satyaprakash   |
| 4. Electrodynamics                             | - KL Kakani      |

**ADIKAVI NANNAYA UNIVERSITY****M.Sc. Physics****II Semester****(w.e.f 2017-18 Admitted batch)****203 – NUMERICAL TECHNIQUES & COMPUTER PROGRAMMING****UNIT- I: NUMERICAL TECHNIQUES**

Solution of algebraic and transcendental equations: Bisection method, Method of false position and Newton-Raphson method. Principle of least squares – fitting of polynomials.

Interpolation: Finite differences(forward, backward and central difference), Newton's formula for Interpolation, Central difference Interpolation formula (Gauss's & Sterling formula), Lagrange's Interpolation formula, Inverse Interpolation.  
**(Sastry)**

**UNIT-II: NUMERICAL DIFFERENTIATION & INTEGRATION**

Differentiation: Cubic Spline Method, Maximum and Minimum values of a Tabulated function

Numerical Integration: Trapezoidal Rule, Simpson's 1/3 Rule and 3/8 Rule. Solutions of linear systems- Direct methods: Matrix Inversion method, Gaussian Elimination method, Modification of Gaussian Elimination method(Gauss-Jordan Method). Iterative methods: Jacobi method, Gauss Seidel method. Numerical solutions of ordinary differential equations: Solution by Taylor's series, Picard's method of successive approximations, Euler's method (Error estimates for the Euler's method, Modified Euler's method) and Range-Kutta method.  
**(Das & Sastry)**

**UNIT- III: INTRODUCTION TO 'C' LANGUAGE**

Character Set, C tokens, Key words and Identifiers, Constants and Variables, Data types, Declaration of variables. Operators and expressions: Arithmetic, Relational, Logical, Assignment, Increment and Decrement operators, Conditional, Bitwise and special operators. Precedence in evaluating arithmetic operators. Reading and Writing a character. IF, IF-ELSE, Nesting IF-ELSE, ELSE IF ladder and GOTO statements, WHILE, DO, FOR loop statements. Simple programs

**(Balaguruswamy & Kanethkar)****UNIT- IV: PROGRAMMING IN C -LANGUAGE**

Arrays: One and Two dimensional arrays, Declaring and initializing string variables. Reading strings from terminal and writing strings to screen. User defined functions: definition of functions, Return values and their types. Function calls and function declaration. Pointers: Declaring and initializing pointers, Accessing a variable through its pointer. C- Programming: Linear regression, Sorting of numbers, Calculation of standard deviation and matrix multiplication

**(Balaguruswamy & Kanethkar)****BOOKS FOR STUDY:**

1. Numerical Methods. B.S.Gopal& S.N.Mittal
2. Numerical Methods. S.Sastry
3. Mathematical Physics. H.K.Das, S.Chand & Co.
4. Programming in ANSI C, E Balaguruswamy, TMH New Delhi, 2004.
5. Let us C, Yashavant Kanetker, BPB Publications, New Delhi, 1999.

**ADIKAVI NANNAYA UNIVERSITY****M.Sc. Physics****II Semester****(w.e.f 2017-18 Admitted batch)****P204 : NUCLEAR AND PARTICLE PHYSICS****UNIT - I****INTRODUCTION :**

Objective of Studying Nuclear Physics, Nomenclature, nuclear radius, mass & Binding energy, angular momentum, magnetic dipole moment, Electric quadrupole moment, parity and symmetry, domains of instability, mirror nuclei.

**NUCLEAR FORCES** : Simple theory of the deuteron, scattering cross-sections, qualitative discussion of neutron- proton and proton- proton scattering, exchange forces, Yukawa's Potential, Characteristics of Nuclear Forces. 15 hrs

**UNIT - II**

**NUCLEAR MODELS** . Liquid drop model:, Weissacker's semi-empirical mass formula, Mass – parabolas. Nuclear shell model : Spin orbit interaction, magic numbers, prediction of angular momenta and parities for ground states, Collective model

**NUCLEAR DECAY** : Fermi's Theory of  $\beta$ - decay, parity violation in  $\beta$ -decay, detection and properties of neutrino. Energetics of gamma decay, selection rules, angular correlation, Mossbauer effect.

15 hrs

**UNIT – III**

**NUCLEAR REACTIONS** : Types of reactions and conservation laws, the Q – equation, Optical model.

**NUCLEAR ENERGY** Stability limit against spontaneous fission, Characteristics of fission, delayed neutrons, Four factor formula for controlled fission, Nuclear fusion, prospects of continued fusion energy.

**DETECTING NUCLEAR RADIATION**: Interaction of radiation with matter. Gas filled counters, scintillation detectors, semiconductor detectors, energy measurements, bubble chamber, magnetic spectrometers. 10 hrs.

**UNIT - IV**

**ACCELERATORS**: Electrostatic accelerators, cyclotron accelerators, synchrotrons, linear accelerators, colliding beam accelerators.

**ELEMENTARY PARTICLE PHYSICS**: Particle interactions and families, conservation laws ( energy and momentum, angular momentum, parity, Baryon number, Lepton number, isospin, strangeness quantum number( Gellmann and Nishijima formula) and charm), Elementary ideas of CP and CPT invariance, Quark model.

**TEXT BOOKS** ∴ “Introductory Nuclear Physics” Kenneth S. Krane

**Reference Books:**

1. “Introduction to Nuclear Physics “ Harald A. Enge
2. “Concepts of Nuclear Physics “ Bernard L. Cohen.
3. “ Introduction to High Energy physics” D.H. Perkins
4. “ Introduction to Elementary Particles” D. Griffiths

**ADIKAVI NANNAYA UNIVERSITY****II SEMESTER****M.Sc.PHYSICS****(Effective from 2017-2018 admitted batch)****P201 :STATISTICAL MECHANICS.****MODEL QUESTION PAPER****Time : 3 Hrs.****Max. Marks:75****SECTION - A****Answer ALL Questions. 4 x 5 = 60.**

1. a) State and prove the equipartition theorem.  
b) Calculate the specific heat at constant volume of an ideal gas with  $i$  degrees of freedom.  
OR  
c) Explain the concept of ensemble. Mention the different types and their properties.  
d) Derive an expression for the most probable distribution of energy among the various systems of a canonical ensemble.
2. a) Distinguish between classical, Bose – Einstein and Fermi Dirac Statistics.  
b) Obtain an expression for Fermi – Dirac distribution law.  
OR  
c) Derive the Planck formula for black body radiation using Bose-Einstein Statistics.  
d) Calculate the pressure of the electromagnetic radiation in a cavity of volume  $V$ .
3. a) Derive an expression for the specific heat of diatomic gases.  
b) Discuss how the results compare with experiments.  
OR  
c) Discuss in detail the Einstein's theory of specific heat of solids.  
d) Mention the salient features of the theory.
4. Derive the Expression for Lorentz Transformations. 15Marks  
OR  
b) Explain Time Dilation as well as length Contract with Mathematical Analysis 10M  
c) Briefly write general theory of relativity 5M

**P A R T - B**

**Answer any FIVE Questions      5 x 5 = 25 Marks.**

5. Explain the phenomena of thermionic emission.
6. Explain the Vander walls theory of liquid gas transition.
7. Calculate the average energy per particle of the Fermions at absolute Zero temperature.
8. Show that at low temperatures a diatomic gas behaves like a monoatomic gas.
9. Explain the ortho and para states of hydrogen.
10. State and prove Liouville's theorem.
11. Explain Gibbs paradox
12. Explain Relativistic classification of particle

**ADIKAVI NANNAYA UNIVERSITY****II SEMESTER****M.Sc. PHYSICS****(EFFECTIVE FROM 2017-2018 ADMITTED BATCH)****P 202 : ELECTRO DYNAMICS****Time : 3 Hours****MODEL QUESTION PAPER****Marks 75****Part A****Answer all questions****15 x 4 = 60**

1. a) State and prove Gauss Theorem.  
b) Derive Laplace's and Poisson's equations from Gauss law.  
OR  
b) Explain the method of separation of variables in spherical polar co-ordinates. Obtain potentials inside and outside a dielectric sphere in a uniform electric field.
2. a) State Ampere's circuital law. Define magnetic vector potential and discuss its utility in magnetostatics  
OR  
b) Write down Maxwell equations in differential and integral forms. Explain their physical significance.
3. a) What are Liénard–Wiechert potentials. Calculate the electric and magnetic field using these potentials.  
OR  
b) What are gauge transformations. Explain Coulomb and Lorentz gauges. Mention their importance.
4. a) Discuss the conditions for the existence of plasma. Discuss the motion of a charged particle in uniform electric and magnetic fields  
OR  
d) Show that the Maxwell's electromagnetic field equations are invariant under the Lorentz transformation

**PART B**

Answer any FIVE Questions     $5 \times 5 = 25$

5. Cherenkov radiation
6. Radiation damping
7. Displacement current
8. Electromagnetic field tensor
9. Faraday's law of electromagnetic induction
10. Electromagnetic scalar and vector potentials
11. Significance of retarded potentials
12. Maxwell's equations in terms of scalar and vector potentials.



**ADIKAVI NANNAYA UNIVERSITY**

**II SEMESTER  
M.Sc.PHYSICS**

**(Effective from 2017-2018 admitted batch) P203 : NUMERICAL METHODS  
AND PROGRAMMING WITH C MODEL QUESTION PAPER**

**Time : 3 Hrs**

**Marks :75**

**SECTION - A**

**Answer all Questions**

**4 X 15 = 60.**

1.(a). Find the root of the following equation using (i) Bisection Method and (ii) Newton-Raphson method as, correct the result upto 3 decimal places  $x^3 - 3x - 5 = 0$ .

(OR)

(b) Find  $f(2)$  for the data  $f(0) = 1$ ,  $f(1) = 3$  and  $f(3) = 55$ . By using Newton's divided difference formula and Lagrange's formula

2.(a) Solving a system of equations by the Gauss-Seidel method

$$4x_1 + x_2 - x_3 = 3$$

$$2x_1 + 7x_2 + x_3 = 19$$

$$x_1 - 3x_2 + 12x_3 = 31$$

(OR)

(b) 1 From the following table, find the area bounded by the curve and x axis from  $x=7.47$  to  $x=7.52$  using trapezoidal, simpson 1/3, simpson 3/8 rule.

x	7.47	7.48	7.49	7.50	7.51	7.52
f(x)	1.93	1.95	1.98	2.01	2.03	2.06

(c) Evaluate  $I = \int_1^2 \frac{1}{x} dx$  by using simpson's rule with  $h=0.25$  and  $h=0.5$

3. (a) What is keyword? Write any five keywords and explain them.

(b) Distinguish between local and global variables.

(c) Write a program to compute roots of quadratic equation using switch-case statement. (OR)

(d) Write the precedence rules for arithmetic operators and give example.

(f) What are loops? Explain various loop statements with suitable example.

4. a) Explain the following concepts associated with functions: i) Function declaration ii) Function definition iii) Function call.

b) Explain various parameter passing mechanisms.

(OR)

C) What is a Pointer? How is it initialized? What is the function of a pointer variable? What are its uses?

b) Explain the concept of pointers to structures with suitable example.

**PART B**

Answer any FIVE Questions     $5 \times 5 = 25$

- 5.Explain Principle of least squares Techinque
- 6.Discuss about Gaussian Elimination method for solution of equations
- 7.write about Increment and Decrement operators in C language with their Syntax
- 8.Write the various Character Sets in C
- 9..How to Declaring and initializing string variables in C
- 10.Briefly write Picard's method of successive approximations
11. Find the root of the following equation using Bisection Method correct the result upto 2 decimal places  $x^2 - 3x - 3 = 0$ .
- 12.Draw the flow chart for calculation of Linear regression

**ADIKAVI NANNAYA UNIVERSITY**

**II SEMESTER  
M.Sc.PHYSICS  
(Effective from 2017-2018 admitted batch)  
P204 :NUCLEAR AND PARTICLE PHYSICS  
MODEL QUESTION PAPER**

**Time : 3 Hrs**

**Marks :75**

**SECTION - A**

Answer all Questions

**4 X 15 = 60.**

- |    |   |     |
|----|---|-----|
| 1  | a) What is meant by Nuclear spin and nuclear magnetic moment? How the magnetic moment is determined experimentally  | 5+5 |
|    | b) Discuss one important method used to study the nuclear size  | 5   |
|    | OR  |     |
|    | c) What is a tensor force? Explain how it accounts for the observed quadrupole moment of deuteron                   | 10  |
|    | d) Briefly explain the characteristics of nuclear forces  | 5   |
| 2. | a) Discuss the formulation of Weizacker's semi – empirical mass formula and obtain the condition for stable isotope | 8+2 |
|    | b) Briefly discuss the collective model of the nucleus.   | 5   |
|    | OR  |     |
|    | c) Give a brief account of Fermi's theory of $\beta$ – decay.   | 10  |
|    | d) Discuss two important selection rules in $\beta$ – decay.  | 5   |
| 3. | a) What are different types of nuclear reactions  | 8   |
|    | b) Describe the Q- equation of a nuclear reaction. What information can you get from the Q- equation                | 5+2 |
|    | OR  |     |
|    | c) Discuss Bohr – Wheeler theory of nuclear fission and derive stability limit against spontaneous fission          | 10  |
|    | d) Explain carbon – nitrogen cycle in nuclear fusion  | 5   |
| 4. | a) With the help of a diagram explain the classification of elementary particles                                    | 5   |
|    | b) Explain briefly various interactions among the elementary particles  | 10  |
|    | OR  |     |
|    | c) Discuss the conservation laws that explain the behaviour of elementary particles                                 | 10  |
|    | d) Briefly explain the charge conjugation   | 5   |

## PART - B

Answer any Five Questions

5 x 5 = 25

5. Explain the parity and symmetry of the nucleus
6. Briefly explain the nature of information that you can get from scattering experiments
7. Discuss what are Schmidt's limits of the nuclear magnetic moments
8. What are the selection rules in  $\gamma$  – decay
9. Discuss briefly about synchrotron
10. Explain the operation of colliding beam accelerators
11. Discuss briefly about Rutherford back scattering experiment
12. Briefly explain the quark model of the nucleus

**ADIKAVI NANNAYA UNIVERSITY****III Semester****M.Sc. Physics****(w.e.f 2017-18 Admitted batch)****P301 : INTRODUCTORY QUANTUM MECHANICS**

## Unit-I:

Wave nature of particles, The uncertainty Principle, the principle of superposition, wave packet, Time Dependent Schrodinger wave equation, Interpretation of wave function, Ehrenfest's Theorem, Time Independent Schrodinger Equation, Stationary states, Admissibility conditions on wave function

## Unit –II:

Linear Vector Space, Linear Vector operators, Eigen Values and Eigen functions, Hermitian Operator, Postulates of Quantum mechanics, Dirac Notation, Equations of motion, Momentum representation, Heisenberg method, Matrix representation of wave function, Matrix representation of operator, Properties of Matrix Elements, Schrodinger Equation in Matrix form, Eigen value problems, Unitary Transformations

## Unit –III

## One Dimension Problem:

Free Particle, Square well potential with rigid walls, Square well potential with finite walls, Square potential barrier, Linear Harmonic Oscillator- Schrodinger as well as operator method Three Dimensional Problem:

System of two interacting particles, Rigid Rotator, Hydrogen Atom, Free Particle in Three dimensions, Three dimensional square well potential

## Unit –IV

The Angular momentum operators, Angular momentum commutation relations, Eigen values and Eigen functions of  $L^2$  and  $L_z$ , General Angular momentum, Eigen values of  $J^2$  and  $J_z$ , Angular Momentum Matrices, Spin angular Momentum, Spin Vector for spin (1/2) system, Addition of Angular Momenta.

**Text Book :**

Quantum Mechanics Aruldas

Quantum Mechanics R.D. RATNA RAJU

**Reference Books :**

Quantum Mechanics G. S. Chaddha

Quantum Mechanics B.H.Bransden and C.J.Joachain

Quantum Mechanics E. Merzbacher

Quantum Mechanics Richard Liboff

**ADIKAVI NANNAYA UNIVERSITY****M.Sc. Physics****III Semester****(w.e.f 2017-18 Admitted batch)****P302: SOLID STATE PHYSICS.****UNIT-I:****CRYSTAL STRUCTURE:**

Periodic array of atoms—Lattice translation vectors and lattices, symmetry operations, The Basis and the Crystal Structure, Primitive Lattice cell, Fundamental types of lattices—Two Dimensional lattice types, three Dimensional lattice types, Index system for crystal planes, simple crystal structures-- sodium chloride, cesium chloride and diamond structures.

**CRYSTAL DIFFRACTION AND RECIPROCAL LATTICE:**

Bragg's law, Experimental diffraction methods-- Laue method and powder method, Derivation of scattered wave amplitude, indexing pattern of cubic crystals and non-cubic crystals (analytical methods). Geometrical Structure Factor, Determination of number of atoms in a cell and position of atoms. Reciprocal lattice, Brillouin Zone, Reciprocal lattice to bcc and fcc Lattices.

**UNIT-II:****PHONONS AND LATTICE VIBRATIONS:**

Vibrations of monoatomic lattices, First Brillouin Zone, Group velocity, Long wave length, Lattice with two atoms per primitive cell, Quantization of Lattice Vibrations-Phonon momentum.

**FREE ELECTRON FERMI GAS:**

Energy levels and density of orbitals in one dimension, Free electron gas in 3 dimensions, Heat capacity of the electron gas, Experimental heat capacity of metals, Motion in Magnetic Fields- Hall effect, Ratio of thermal to electrical conductivity.

**UNIT-III:****THE BAND THEORY OF SOLIDS:**

Nearly free electron model, Origin of the energy gap, The Bloch Theorem, Kronig-Penny Model, wave equation of electron in a periodic potential, Crystal momentum of an electron-Approximate solution near a zone boundary, Number of orbitals in a band--metals and insulators. The distinction between metals, insulators and semiconductors

**UNIT IV:****SUPERCONDUCTIVITY**

Concept of zero resistance, Magnetic behavior, distinction between a perfect conductor and superconductor . Meissner effect, Isotope effect—specific heat behavior. Two-fluid model. Expression for entropy difference between normal and superconducting states. London's equations. Penetration depth. BCS theory. Josephson junctions—SQUIDS and its applications . Applications of superconductors. High T<sub>c</sub> superconductors, Preparation, Properties.

**TEXT BOOKS:**

- 1.Introduction to Solid State Physics, C.Kittel, 5<sup>th</sup> edition,
- 2.Solid State Physics, A.J.DEKKER.
- 3.Solid State Physics – S O Pillai
- 4.Solid State Physics – Gupta & Saxena

ADIKAVI NANNAYA UNIVERSITYM.Sc. PHYSICS

III Semester

(w.e.f 2017-18 Admitted batch)

P303: Lasers and Nonlinear Optics

## UNIT-I

LASER SYSTEMS :Light Amplification and relation between Einstein A and B Coefficients. Rate equations for three level and four level systems. Laser systems: Ruby laser, Nd-YAG laser, CO<sub>2</sub> Laser, Dye laser, Excimer laser, Semiconductor laser.

## UNIT – II:

LASER CAVITY MODES: Line shape function and Full Width at half maximum (FWHM) for Natural broadening, Collision broadening, Doppler broadening, Saturation behavior of broadened transitions, Longitudinal and Transverse modes. ABCD matrices and cavity Stability criteria for confocal resonators. Quality factor, Q-Switching, Mode Locking in lasers. Expression for Intensity for modes oscillating at random and modes locked in phase. Methods of Q-Switching and Mode locking. UNIT-III

OPTICAL FIBER WAVEGUIDES : Basic optical laws and Self focusing. Optical fiber modes and configurations Fiber types, Rays and Modes, Step-index fiber structure. Ray optics representation, wave representation. Mode theory of circular step-index wave guides. Wave equation for step-index fibers, modes in step-index fibers and power flow in step-index fibers. Graded – index fiber structure, Graded-index numerical aperture, modes in Graded-index fibers.

FIBER CHARACTERISTICS : Signal Degradation In Fibers - Attenuation, Absorption, Scattering and Bending losses in fibers, radiative losses, Core and Cladding losses. Signal distortion in optical wave guides: Group delay, material dispersion, waveguide dispersion and intermodal dispersion. Pulse broadening in optical fibers. Power launching in Optical fibers, Source-output pattern, Lensing schemes. Fiber-to-fiber joints: Mechanical misalignment, fiber related losses, Fiber and face preparation. fiber splicing techniques, fiber connectors.

## UNIT-IV

## HOLOGRAPHY AND FOURIER OPTICS

Introduction to Holography: Basic theory of Holography , Recording and reconstruction of Hologram, Fourier transform Holography, Acoustic and Holographic Microscopy, Pattern recognition and Applications of Holography.

Fringe contrast variation. Fourier Transformation spectroscopy. Michelson interferometer. Advantages of Fourier transforms. Optical data processing. Diffraction. (Meyer. Fowles)

## TEXT BOOKS:

1. Lasers -Theory and Applications – K.Thyagarajan and A.K. Ghatak. (MacMillan)
2. Optical fiber Communications – Gerd Keiser (Mc Graw-Hill)
3. Introduction to Classical and Modern Optics. J.R. Meyer.
4. Lasers and Non Linear Optics. B.B.Laud, New Age International Publishers
5. Introduction to Modern Optics. Grant R. Fowles, Holt, Rinehart and Winston, Inc New York (1968)

REFERENCE BOOKS:

1. Laser fundamentals – William T. Silfvast (Cambridge)
2. Introduction to fiber optics – Ajoy Ghatak and K. Thyagarajan (Cambridge)
3. Optical Electronics – Ajoy Ghatak and K.Thyagarajan (Cambridge)
4. Opto- electronics – J. Wilson and J.F.B. Hawkes (Printice Hall)

**ADIKAVI NANNAYA UNIVERSITY****M.Sc. PHYSICS****III Semester****(w.e.f 2017-18 Admitted batch)****P304 : Digital Electronics & Microprocessors****UNIT - I**

**Digital Circuits (i) Number Systems and Codes:** Binary, Octal, Hexadecimal number systems, Gray code, BCD code, ASCII code.(ii) Logic Gates and Boolean Algebra: OR, AND, NOT, NOR, NAND gates, Boolean theorems, DeMorgan laws.

**II) Combinational Logic Circuits:** (i) Simplification of Boolean Expressions: Algebraic method, Karnaugh Map method, EX-OR, EX-NOR gates, ENCODER, DECODER, Multiplexer, Demultiplexers.

(ii) Digital Arithmetic Operations and Circuits: Binary addition, Design of Adders and Subtractors, Parallel binary adder, IC parallel adder.(iii) Applications of Boolean Algebra: Magnitude Comparator, Parity generator, Checker, Code converter, Seven-segment decoder/ Driver display.

**UNIT - II**

**Sequential Logic Circuits:**(i) Flip-Flops and Related Devices: NAND latch, NOR latch, Clocked flip-flops, Clocked S-C flip-flop, J-K flip-flop, D flip-flop, D latch, Asynchronous inputs, Timing problem in flip-flops.(ii) Counters: Asynchronous counters (Ripple), Counters with MOD number  $< 2^N$ , Asynchronous down counter, Synchronous counters, Up-down counter, Presetable counter.

(iii) Registers: Shift Register, Integrated Circuit registers, Parallel In Parallel Out (PIPO), SISO, SIPO, PISO

(iv) Applications of Counters: Frequency Counter and Digital clock.

**A/D and D/A Converter Circuits:** D/A Converter, Linear weighted and ladder type, An integrated circuit DAC; Analog-to-Digital Conversion, Digital Ramp ADC, Successive Approximation Method, Sample and Hold Circuit, Digital Voltmeter.

**UNIT - III****Intel 8085 Microprocessor:**

Architecture, Functional diagram, Pin description, Timing Diagram of Read Cycle, Timing diagram of write Cycle.

**Programming the 8085 Microprocessor:**

(i) Addressing Methods, Instruction set, Assembly language programming.

(ii) Examples of Assembly Language Programming: Simple Arithmetic - Addition/Subtraction of two 8-bit/16-bit numbers, Addition of two decimal numbers, Masking of digits, word disassembly.

(iii) Programming using Loops: Sum of series of 8-bit numbers, Largest element in the array, Multiple byte addition, Delay sub-routine.

**UNIT - IV****Data Transfer Technique:**

Serial transfer, Parallel transfer, Synchronous, Asynchronous, DMA transfer, Interrupt driven Data transfer.

**8085 Interfacing:**

I/O Interfacing: Programmable Peripheral Interfacing, 8255, Programmable Peripheral Interval Timer 8253, Programmable Communication Interface 8251, DAC 0800 and ADC 0800 interfacing.

**TEXT & REFERENCE BOOKS:**

1. "Digital Systems – Principles and applications" –Ronald.J.Tocci,
2. "Fundamentals of Microprocessors & Microcomputers" - B. RAM.
3. " Introduction to Microprocessors for Engineers and Scientists" - P.K.Ghosh and P.R.Sridhar
4. "Microprocessor Architecture, Programming and Applications with the 8085 /8080A" – Ramesh. S. Gaonkar.



**ADIKAVI NANNAYA UNIVERSITY**

M.Sc. PHYSICS

III/IV Semesters

(w.e.f 2017-18 Admitted batch)

**P 305 : Digital (including Microprocessors) and Communication Electronics Lab**

(Any ten of the following experiments)

Digital electronics

1. Encoder and Decoder , Multiplexer and De multiplexer
2. Adders: Half adder, Full Adder, Paraller Adder
3. Flip Flops ( 7400,7402,7408,7446)
4. Decade Counter (IC 7490) and Seven segment Decoder/ Driver (7490,7447)
- 5 UP/DOWN Counter IC 74193
1. Digital Comparator ( 7485)

Micprocessor Lab

1. Addition/ subtraction of 8 bit numbers and Sum of series of 8 – bit numbers
2. Word Disassembly and Largest number in an array
3. Addition of two 16 – bit numbers and sum of series of 16-bit numbers
4. Interfacing of 8255 PPI: generation of square wave and rectangular waves
5. Interfacing of 8253 programmble timer: Mode 1, Mode2, Mode3, Mode 4, Mode5
6. 0800 DAC interfacing : generation of square, triangular and stair case wave forms

COMMUNICATION LAB

1. AMPLITUDE MODULATION and MIXER
2. BUTTERWORTH FIRST ORDER LOWPASS, HIGHPASS FILTERS and CHEBYSHEV SECOND ORDER LOWPASS FILTER
3. PHASE LOCKED LOOP (PLL) and SAMPLE AND HOLD CIRCUIT
4. FREQUENCY MODULATION
- 5..DETERMINATION OF FREQUENCY AND WAVELENGTH IN A RECTANGULAR WAVEGUIDE IN  $TE_{1,0}$
6. MEASUREMENT OF GAIN ,FRONT TO BACK RATIO,BEAM WIDTH OF RADIATION PATTERN OF
  - a) HALF WAVE DIPOLE
  - c) FIVE ELEMENT YAGI UDA ANTENNA
  - c) HELICAL ANTENNA
  - d) CUT –PARABOIDAL REFLECTOR ANTENNA

**ADIKAVI NANNAYA UNIVERSITY****M.Sc. PHYSICS**

III/IV Semesters

**(w.e.f 2017-18 Admitted batch)**P 306 : **Solid State Physics Lab**(Any **ten** of the following experiments)

1. Hall Effect: Determination of Hall co-efficient and estimation of charge carrier concentration and mobility.
2. ESR Studies – DPPH - Determination of 'g' value of an electron.
3. Lattice Dynamics: Study of Phonon Dispersion characteristics.
4. Study of Magnetic Hysteresis loops of ferromagnetic materials (B-H Curve)
5. Measurement of Magnetoresistance of Semiconductors (Four probe arrangement).
6. Coupled Oscillators : Study of the normal modes of vibrations of coupled pendulum, strength of the coupling constant and exchange energy.
7. Determination of Dielectric constant – Determination of wavelength of the microwaves in the guide of an x-band test bench and determination of dielectric constant.
8. Measurement of magnetic susceptibility of Paramagnetic solution by Quink's Method.
9. Measurement of magnetic susceptibility of Paramagnetic solids by Gouy's Method.
10. Thermo e.m.f : Calculations of thermo electric power, Fermi energy and carrier concentration of a given sample.
11. Ultrasonic Diffraction study in Liquids.
12. X-ray diffraction studies : Determination of lattice constant and number of atoms per unit cell

## ADIKAVI NANNAYA UNIVERSITY

## I SEMESTER

## M.Sc. PHYSICS

(Effective from 2017-2018 admitted batch) P301 :  
INDRODUCTORY QUANTUM MECHANICS MODEL  
QUESTION PAPER

Time: 3 Hrs. Max.Marks:75.

## SECTION –A.

Answer ALL Questions. 4 x 15 = 60.

1. a) Derive Schrodinger wave equation. Obtain an expression for Probability current density.
- b) What are stationary states? Show that for stationary states probability current density is constant in time.

OR

- c) State and prove Ehrenfest's theorem.
  - d) Write statistical ensemble averaging and Copenhagen interpretations of Quantum Mechanics.
2. a) Show that commuting operators have common Eigen functions.
  - b) Define Dirac Delta function and write its properties.

OR

- c) State the postulates of Quantum Mechanics.
  - d) Write the properties of wave functions and Eigen values of such Operators.
3. a) State the properties of a well behaved wave function
  - b) Solve the Schrodinger equation for a linear harmonic oscillator and obtain eigen values.

OR

- c) Discuss the motion of a particle at a potential step for  $E < V$  and  $E > V$  conditions.
  - d) Derive the wave equation in momentum space.
4. a) Show that  $L^2$  and  $L_z$  commute. Obtain Eigen values and Eigen functions for these operators.
  - b) Write Pauli spin matrices and discuss commutation relations among them

OR

- c).Write about Angular Momentum Matrices
- d) Explain various properties of Angular Momentum Operators

**Part B****Answer any FIVE Questions****5 x 5 = 25**

4. Explain wave and particle duality of microscopic particles.
6. State Heisenberg's uncertainty principle and discuss its origin.
7. Obtain Eigen values of rigid rotator.
8. Show that Eigen functions belonging to different Eigen values are Orthogonal.
9. Discuss the principle of Superposition
10. Find the energy states of the one dimensional step barrier
11. Explain Unitary Transformations
12. Find Eigen values of  $J^2$  and  $J_z$

**ADIKAVI NANNAYA UNIVERSITY****III SEMESTER-M.Sc. PHYSICS**  
**(Effective from 2017-2018 admitted batch)**  
**P302: SOLID STATE PHYSICS.**  
**MODEL QUESTION PAPER****Time: 3 Hrs.****Max.Marks:75.****SECTION –A.****Answer ALL Questions. 4 x 15 = 60.**

1. a) What are the different fundamental types of 3 dimensional lattices
- b) Explain the index system for crystal planes.
- c) In a tetragonal lattice  $a=b=1/4\text{nm}$  and  $c=1/7\text{nm}$ . Deduce the lattice spacing between (111) planes.

OR

- d) What is Bragg's law.
  - e) Describe in detail experimental diffraction methods.
- 2.a) Obtain the dispersion relation for a monoatomic lattice considering interactions among nearest neighbour planes.
  - b) Explain the first Brillouin zone and group velocity for the elastic waves. What is long wave length limit in the continuum theory
- OR
- c) Derive an expression for electron gas in three dimensions.
  - d) Deduce expressions for fermi energy, density of orbitals and electron velocity at the Fermi surface
3. a) State Bloch's theorem
  - b) Obtain the condition for energy states of electrons moving in a periodic Kronig – Penny potential.
  - c) State the interesting conclusions form the above model.
- OR
- d) Distinguish between reduced and periodic Zone schemes for by construction of Fermi surfaces. Describe the construction of Fermi surfaces considering the analysis of a square lattice.
  - e) Show that the slope of bands at Zone boundaries is Zero
  - f)
4. a) Discuss BCS theory of SuperConductors
  - b) Explain Josephson junctions of Super Conductors
- OR
- c) Explain Meissner effect, Isotope effect–specific heat behavior for Super Conductors
  - d) Mention Various Applications of superconductors

## Section B

Answer any FIVE Questions

5 x 5 = 25

4. Describe the crystal structure of diamond and show the reciprocal lattice for B.C.C. is F.C.C. lattice.
5. What are the additional features of vibrational spectrum of a diatomic lattice compared to a monoatomic lattice.
6. State and explain Hall effect. How positive Hall Coefficients can be explained?
7. Obtain the effective number of free electrons in a partially filled band and hence classify solids.
8. What are electron orbits, hole orbits and open orbits.
10. What are extremal orbits. In gold the magnetic moment has a period of  $2 \times 10^{-9}$  gauss<sup>-1</sup>. Calculate the area of extremal orbit.
11. What are extremal orbits. In gold the Explain the concept of crystal momentum of an electron based on the restatement of Bloch's theorem
12. Explain Brillouin zones.

*ADIKAVI NANNAYA UNIVERSITY*

**III SEMESTER**  
**M.Sc PHYSICS**  
**(Effective from 2017-2018 admitted batch)**  
**P303: LASERS AND NONLINEAR OPTICS**  
**Model Question Paper**

**Time 3 Hours****Marks 75****PART A****Answer All Questions****4 x 15 = 60**

1.a) By writing down rate equations, obtain the condition for steady state inversion in a three level system.

OR

b) Explain in detail mechanism of population inversion and working of CO<sub>2</sub> laser. Explain why He and N<sub>2</sub> are used to enhance population inversion.

2.a) Explain emission broadening and arrive at an expression for Full width at half Maximum due to radiative decay of atoms.

OR

b) Derive an expression for Intensity for modes locked in phase. Describe a method of mode Locking.

3. a) Explain the various optical fiber modes and configurations. Evaluate an expression for the modes of polarization in case of a graded – index Fiber.

b) Explain the mode theory of circular wave guides.

OR

c) Describe various types of signal degradation contributing towards signal losses in optical fibers.

d) Explain in detail the various lensing schemes for power coupling

4. a) . Write the Basic theory of Holography, Explain about Recording and reconstruction of Hologram

OR

b). Explain Fourier Transformation spectroscopy

c). Write various Applications of Holography

**PART 'B'****ANSWER ANY five QUESTIONS (5 x5 = 25 marks)**

5. Distinguish between Monomode and Multimode optical fibers.
6. Explain what is meant by Q-switching.
7. Deduce relation between Einstein A and B coefficients.
8. Using paraxial approximation, arrive at matrices for translation and reflection through homogeneous medium
9. Briefly explain about Excimer laser
10. Write a note on fiber splicing technique
11. Explain what is meant by pulse broadening in Optical Fibers.
12. Explain Optical data processing.



**ADIKAVI NANNAYA UNIVERSITY****M.Sc. PHYSICS****III SEMESTER****(Effective from 2017-2018 admitted batch)****P-304: DIGITAL ELECTRONICS & MICROPROCESSORS****Time : 3 hrs****Model Question Paper****Marks : 75****SECTION - A****4 X 15 = 60.****Answer all Questions**

1. a) Construct a 3 to 8 line Decoder and explain its working.  
b) Discuss the functioning of a BCD to seven segment decoder/ driver.  
Or  
c) With neat logic circuit diagram explain the working of a EX-OR and Equivalence gates. Show that EX-OR is compliment of Equivalence  
d) With neat circuit diagram explain the working of a full adder
2. a) Discuss the working of digital frequency counter  
b) Explain with the help of necessary truth table the working of 3 – bit UP/ DOWN COUNTER.  
Or  
c) Explain the principle of a A/D and D/A converter in signal processing  
d) With a neat circuit diagram explain the successive approximation method of A/D conversion
3. a) Explain the functional description of 8085 microprocessor with a block diagram  
b) Explain the different addressing modes of 8085 microprocessor with suitable examples.  
or  
c) Explain the classification of Instruction set of 8085 microprocessor with suitable examples.  
d) Write an assembly language program to find the sum of series of 8-bit numbers
4. a) With the help of neat block diagram explain the functioning of 8255 PPI, Explain the different modes of operation  
b) Explain the control word of 8255  
Or  
c) Draw the block diagram of 8253 programmable interval timer and explain the functioning of each block  
d) Explain the operation of 8253 as square wave generator

## PART - B

Answer any Five

Questions

5 x 5 = 25

5. Explain the DMA data transfer scheme
6. Draw the timing diagram of memory read operation
7. Write a note on USART 8251
8. With a neat circuit diagram explain the Ladder type D/A converter
9. Write the circuit diagram of JK flip flop, Explain its operation What is Toggling
10. Explain the syntax and the operation of following instructions  
(a) LDA (b) LXI (c) LHLD (d) SHLD
11. Explain the functions of  
(a) HOLD and HLDA signals  
(b) SID and SOD signals
12. Construct a ripple counter of MOD number 10 and explain its working.

**ADIKAVI NANNAYA UNIVERSITY**

**M.Sc PHYSICS  
IV SEMESTER  
(w.e.f 2017-2018 batch)  
401- Advanced Quantum Mechanics**

**UNIT-I : IDENTICAL PARTICLES AND MOLECULES**

Identical Particles: Symmetric and anti symmetric wave functions, Indistinguishability of identical particles, Pauli's exclusion principle. Hydrogen molecule ion, Hydrogen molecule: Hitler London treatment. Oscillations and Rotations of H<sub>2</sub>. Concept of Ortho and Para Hydrogen.

**(Gupta Kumar and Sharma, Pauling and Bright Wilson)**

**UNIT-I I: APPROXIMATION METHODS**

Time-independent perturbation method. Effect of anharmonicity on the solution of harmonic oscillator problem. Time-dependent perturbation theory, transition probabilities. Variation technique: application to solve the ground state energy of He atom. WKB approximation method: -particle decay. Sudden and Adiabatic perturbations.

**Gupta Kumar and Sharma)**

**UNIT-III :THEORY OF SCATTERING**

The scattering experiment. The method of partial waves. Scattering by a central potential. Zero energy scattering. Scattering by square-well potential, effective range. Resonance scattering, Born Approximation, Validity of Born Approximation.

**(Aruldas)**

**UNIT-IV : RELATIVISTIC QUANTUM MECHANICS**

Klein-Gordan equation, Probability and current density, Inadequacies of Klein-Gordan equation. Dirac matrices, Dirac relativistic equation for free particles and solution. Concept of negative energy states. Theory of holes.

**(Gupta Kumar and Sharma)**

**BOOKS FOR STUDY**

1. Quantum Mechanics, S.L.Gupta, V.Kumar, H.V.Sharma and R.C. Sharma, Jai Prakash Nath & Co. Meerut,(1996)
2. Quantum Mecanics, G. Aruldas, Prentice Hall of India Pvt. Ltd, New Delhi (2002).
3. Introduction to Quantam Mechanics with applications to chemistry. Linus Pauling and E.Bright Wilson, Jr. McGraw Hill, Book Company, New York 1935 and London.

**REFERENCE BOOKS**

1. Quantum Mechanics. B.K.Agarval and Hariprakash, Prentice-Hall of India Ltd., New Delhi, (1997).
2. Quantum Mechanics. L.I.Schiff, Mc Graw Hill Book Co., Tokyo, (1968)
3. Modern Quantum Mechanics. J.J.Sakurai, Addison- Wesley, Tokyo, (1968).
4. A Text Book of Quantum Mechanics. P.M.Mathews and K.Venkateswaran, Tata McGraw Hill, New Delhi, (1976).
5. Introduction to Quantum Mechanics, R.H.Dicke and J.P.Witke, Addison-Wisley Pub. Co. Inc., London, (1960).
6. Quantum Mechanics, V.K.Tankappan, Wiley-Eastern Ltd., New Delhi, (1985).

**ADIKAVI NANNAYA UNIVERSITY****M.Sc. PHYSICS**  
**IV SEMESTER**  
**(w.e.f 2017-2018 batch)****P.402 : PROPERTIES AND CHARACTERIZATION OF MATERIALS****UNIT - I****THERMAL PROPERTIES:**

Anharmonic crystal interactions-thermal expansion, thermal conductivity, lattice thermal resistivity, umklapp processes, and imperfections.

**OPTICAL PROPERTIES :**

Lattice Vacancies, Diffusion, Color Centers—F Centers, other centers in alkali halides, Alloys, Order-disorder transformations, Elementary theory of Order.

**UNIT - II**

Ferromagnetism and Anti-ferromagnetism

Ferromagnetism: Introduction – Weiss molecular field theory – Temperature dependence of spontaneous magnetization – Heisenberg model – Exchange interaction – Ferromagnetic domains – Magnetic bubbles – Bloch wall – Thickness and energy – Ferromagnetic spin waves – Magnons – Dispersion relations.

Anti-ferromagnetism: Introduction – Two sub lattice model of anti-ferromagnetism – Ferri magnetism - Ferrites – Structure – Applications – Multiferroics.

**MICROSCOPIC EXAMINATION:**

Fundamentals of Transmission electron microscopy and scanning electron microscopy, study of crystal structure using TEM, study of microstructure using SEM.

**UNIT - III****RESONANCE METHODS:**

Spin and an applied field—the nature of spinning particles, interaction between spin and a magnetic field, population of energy levels, the Larmor precession, relaxation times—spin- spin relation, spin-lattice relaxation,

Electron Spin Resonance: Introduction, g-factor, experimental methods.

Nuclear Magnetic Resonance—equations of motion, line width, motional narrowing, hyperfine splitting,

Nuclear Gamma Ray Resonance: Principles of Mossbauer Spectroscopy, Line Width, Resonance absorption, Mossbauer Spectrometer, Isomer Shift, Quadrupole Splitting, magnetic field effects, Applications.

**UNIT - IV****SELECTIONAL AND MAGNETIC CHARACTERIZATION TECHNIQUES:**

DC & AC Conductivity, Curie temperature, Saturation Magnetization and Susceptibility

**OPTICAL SPECTROSCOPY:**

Fundamentals of Infra-red Spectroscopy and Applications.

**TEXT BOOKS:**

Solid State Physics, 5<sup>th</sup> edition, C.Kittel

Fundamentals of Molecular Spectroscopy CN Banwell

Mossbauer Effect and its Applications VG Bhide

ADIKAVI NANNAYA UNIVERSITY**M.Sc PHYSICS****IV SEMESTER****(w.e.f 2017-2018 batch)****P 403 : COMMUNICATION ELECTRONICS****UNIT 1: CW Modulation:**

Amplitude Modulation (AM): 8 periods  
 Introduction, Amplitude modulation, modulation index, Frequency spectrum, Average power for sinusoidal AM, Amplitude modulator and demodulator circuits, Double side band suppressed carrier (DSBSC) Modulation, Super heterodyne receiver.

Single Side Band Modulation (SSB): 4 periods

SSB principles, Balanced Modulator, SSB generation

Angle Modulation: 8 periods

Frequency modulation (FM), sinusoidal FM, Frequency spectrum for sinusoidal FM frequency deviation, modulation index, Average power in sinusoidal FM, FM generation  
 Phase Modulation: Equivalence between PM and FM, FM detectors: Slope detector, Balanced slope detector, Foster – Seley discriminator, Ratio detector, Amplitude limiter, FM receiver.

**UNIT 2 : Pulse Modulation :**

Digital Line Codes: Symbols, Functional notation for pulses, Line codes and wave forms: RZ, NRZ, Polar, Unipolar, AMI , HDBn and Manchester codes, M-ary encoding, Differential encoding 8 periods

Sampling theorem, Principles of pulse Amplitude Modulation ( PAM) and Pulse Time Modulation( PTM) ,Pulse code modulation ( PCM), quantization, Nonlinear quantization, companding, differential pulse code modulation (DPCM), Delta Modulation(DM) .

Digital Carrier Systems: 8 periods

**ASK, PSK, FSK and DPSK****UNIT 3: Special Communication Circuits:**

6 periods

Tuned amplifiers :Single tuned amplifier-Hybrid  $\pi$  – equivalent for the BJT, Short circuit current gain for the BJT in CE and CB amplifiers, CE and CB tuned amplifiers, Cascode amplifier.  
 Mixer Circuits : Diode mixer, IC balanced mixer.

Filters : Active filters, Ceramic, Mechanical and crystal filters.

Oscillators: Crystal oscillator, Voltage controlled oscillator, phase locked loop( PLL).

**UNIT 4: Noise in Communication Systems:**

8 periods

Thermal Noise, Shot Noise, Partition noise, Signal - to – Noise ratio, Noise factor, Amplifier input noise in terms of F, Noise factor of amplifiers in cascade (Friss formula), Noise temperature, Noise in AM, Noise in FM systems. Noise in pulse modulation systems: Intersymbol interference (ISI) , eye diagrams.

**Text Books:**

1. Electronic Communications D. Roody and John Coolin
2. Electronic Communications Systems G. Kennedy
3. Modern Analog & Digital Communications B.P. Lathi.

**ADIKAVI NANNAYA UNIVERSITY**

M.Sc. PHYSICS

IV SEMESTER

(w.e.f. 2017-2018 batch)

**P404 : ANTENNA THEORY AND RADIOWAVE PROPAGATION****UNIT - I****Radiation**

Potential functions of electro magnetic fields. Potential function for sinusoidal oscillations. Fields radiated by an alternating current element. Power radiated by a current element and radiation resistance. Radiation from a quarter wave monopole or a half wave dipole. EM field close to an antenna and far field approximation.

*(Chapter 10 in Jordan and Balmain)*

6 Hrs.

**Antenna Fundamentals**

Definition of an antenna. Antenna properties – radiation pattern, gain, directive gain and directivity. Effective area. Antenna beam width and band width. Directional properties of dipole antennas.

*(Chapter 11 in Jordan and Balmain and Chapter 2 in Kraus)*

8Hrs.

**UNIT - II****Antenna Arrays**

Two element array. Linear arrays. Multiplication of patterns and binomial array. Effect of Earth on vertical patterns. Mathematical theory of linear arrays. Antenna synthesis – Tchebycheff polynomial method. Wave polarization.

*(Chapter 11 and 12 in Jordan and Balmain and Chapter 4 in Kraus)*

10 Hrs.

**Impedance**

Antenna terminal impedance. Mutual impedance between two antennas. Computation of mutual impedance. Radiation resistance by induced emf method. Reactance of an antenna. Biconical antenna and its impedance.

*(Chapter 14 in Jordan and Balmain and Chapters 8.1 –8.5 in Kraus)*

6 Hrs.

**UNIT - III****Frequency Independent (FI) Antennas**

Frequency Independence concept. Equiangular spiral. Log Periodic (LP) antennas. Array theory of LP and FI structures.

*(Chapter 15 in Jordan and Balmain and Chapter 15 in Kraus)*

6Hrs.

**Methods of excitation and Practical Antennas**

Methods of excitation and stub matching and baluns. Folded dipole, loop antennas. Parasitic elements and Yagi-Uda arrays and Helical antenna.

*( Chapter11.15 in Jordan and Balmain)*

6Hrs.

**UNIT - IV****Radio Wave Propagation**

Elements of Ground wave and Space wave propagation. Tropospheric propagation and Troposcatter. Fundamentals of Ionosphere. Sky wave propagation – critical frequency, MUF and skip distance.

*(Chapter 16 and 17 in Jordan and Balmain)*

8Hrs.

**BOOKS**

1. "Electromagnetic waves and Radiating Systems" by E.C.Jordan and K.G.Balmain

2. "Antennas" by J.D.Kraus. (Second Edition)

**ADIKAVI NANNAYA UNIVERSITY****M.Sc. PHYSICS****IV SEMESTER****(Effective from 2017-2018 admitted batch)****P.401: ADVANCED QUANTUM MECHANICS****Time : 3 hrs****Model Question Paper****Max. Marks: 85****SECTION - A****(4 X 15 = 60)****Answer all Questions**

- 1 a) Explain Pauli's exclusion principle and Describe the Oscillations and Rotations of  $H_2$   
  
OR  
Discuss about (i) Symmetric and anti symmetric wave functions  
(ii) Ortho and Para Hydrogen
- b) Solve Harmonic oscillator problem in Heisenberg representation.
2. a) Derive Fermi Golden rule and write its importance in calculating transition probabilities.  
OR  
By using Variation technique find the ground state energy of He atom
3. a) Explain Born Approximation of Scattering and also explain its Validity  
OR  
Describe How Scattering problem can be analyzed with the method of partial waves
3. a) Derive Fermi Golden rule and write its importance in calculating transition probabilities.  
Or  
b) What are tensor operators? Write down the defining equations of irreducible tensor operations. State and prove Wigner Eckart theorem.
4. a) Explain Probability and current density . Explain the Klein-Gordan equation and its , ,  
Inadequacies  
  
Or  
b) Obtain the free particle solutions (Dirac spinors) for a Dirac particle. Explain the probability density and the current density for a Dirac free particle.

## PART - B

Answer any Five Questions (5 x 5 = 25)

5. Write a note on Indistinguishability of identical particles.
6. Describe WKB approximation method
7. Write notes on Sudden and Adiabatic perturbations
8. Write notes on optical theorem used in phase shift analysis.
9. *Explain briefly* Resonance scattering
10. Write the Concept of Hitler London treatment
11. Discuss the negative energy states and hole theory of Dirac.
12. Explain how shortcomings of the Klein – Gordon equation are removed by Dirac's equation.



**ADIKAVI NANNAYA UNIVERSITY****M.Sc. PHYSICS****IV SEMESTER****P. 402 : PROPERTIES AND CHARACTERIZATION OF MATERIALS**

(Effective from 2017-2018 admitted batch)

**Time : 3 Hrs****Model Question Paper****Max.Marks :85****SECTION - A****(4 X 15 = 60)****Answer all Questions**

1. a) Give the salient features of lattice thermal conduction in solids. Mention the importance of lattice thermal conductivity studies with temperature.  
Or  
b) What are anharmonic crystal interactions. Explain how lattice thermal conductivity variation can be explained by umklapp and normal processes
2. a) State and explain Fick's laws of diffusion. Obtain the solution for the Fick's second law of diffusion. Explain its applications.  
Or  
b) What are color centers? Describe the structure, models and production of color centres in crystals.
3. a) Describe in detail the Transmission Electron Microscopy Technique and explain the study of crystal structures using it.  
Or  
b) Explain the principle of ESR and its experimental set up.
4. a) Describe the principle of Mossbauer Spectroscopy and explain the hyperfine interaction using Mossbauer effect.  
Or  
b) Describe the fundamentals of IR Spectroscopy

## PART - B

Answer any Five

Questions

(5 x 5 = 25)

5. Explain the order-disorder transformations in solids
6. What is SEM ? Explain the operation of it.
7. Explain spin – lattice and spin – spin relaxation phenomena
8. Explain the variations of susceptibility and saturation magnetization with temperature
9. What is the significance of g-factor in ESR Spectroscopy. Explain.
10. Write a note on Larmor precession.
11. Discuss AC and DC conductivity of materials
12. Give a brief account on lattice vacancies.

**ADIKAVI NANNAYA UNIVERSITY****M.Sc. PHYSICS****IV SEMESTER**

(Effective from 2017-2018 admitted batch)

**P.403 : COMMUNICATION ELECTRONICS****Time : 3 Hrs****Model Question Paper****Max. Marks :75****SECTION - A****4 X 15 = 60.****Answer all Questions**

1.
  - a) Explain the generation and demodulation of PAM signals
  - b) Explain what is meant by Pulse Time Modulation

Or

  - c) Sketch the PCM transmitter and explain about each block
  - d) Derive an expression for quantization noise in terms of step size
  
2.
  - a) Explain the principle of working of a super hetero dyne receiver with the help of a block diagram
  - b) Explain about image rejection and double spotting in super heterodyne receivers

Or

  - c) Explain in detail the frequency spectrum for sinusoidal FM. Arrive at an equation of average power in sinusoidal FM
  - d) Explain what is meant by FM Radio detection.
  
3.
  - a) Derive an expression for the input impedance of tuned amplifiers
  - b) Draw the circuit diagram of a IC balanced mixer and explain its working

Or

  - c) Distinguish between ceramic and mechanical filters
  - d) Draw the  $\Pi$  equivalent circuit of BJT and explain the various parameters
  
4.
  - a) Explain how thermal noise power varies with (i) temperature (ii) frequency and bandwidth
  - b) Explain why inductances and capacitances do not generate noise.

Or

  - c) Give a detail account of antenna parameters
  - d) Explain what is meant by YAGI –UDA antenna

## PART - B

Answer any Five Questions

5 x 5 = 25

5. Explain the need of Mixer circuits. Draw the circuit diagram of diode mixer
6. Draw the equivalent circuit of piezoelectric crystal and explain how it can be used as a filter
7. Explain the uses of phase locked loop
8. Give a brief sketch of ASK
9. Describe the DPSK transmitter
10. Explain the principle of operation of frequency synthesizer
11. Give a brief account on delta modulation
12. Explain what is meant by DSBSC.

**ADIKAVI NANNAYA UNIVERSITY****M.Sc. PHYSICS  
IV SEMESTER****(Effective from 2017-2018 admitted batch)****P-404 : ANTENNA THEORY AND RADIOWAVE PROPAGATION**  
**Time : 3 Hrs                      Model Question Paper                      Max. Marks :85**  
**SECTION - A                      (4 X 15 = 60)**  
**Answer all Questions**

1. a) Derive an expression for power radiated by a current element and find the radiation resistance.  
Or  
b) Give the mathematical theory for linear arrays.  
c) What are the directional properties of dipole antennas?
2. a) How do you define a resonant length? What is the shortest resonant length of a wire antenna?  
b) Derive expressions for the radiated fields from a quarter wave monopole. Or  
c) Define Schelkunoff's theorems relating linear arrays with polynomials.  
d) Discuss how Schelkunoff's polynomial method can be used in antenna synthesis.
3. a) What do you understand by an optimum radiation pattern?  
b) Discuss in detail the Tschebycheff polynomial method of designing an antenna array that gives optimum pattern.  
Or  
c) Define Huyghen's principle and obtain an expression for the field radiated by a secondary Huyghen's source.  
d) What is an electromagnetic horn? Derive an expression for the field radiated by a horn antenna.
4. a) What are the principal modes of propagation of radiowaves?  
b) Describe tropospheric propagation in detail.  
Or  
c) Describe the structure of ionosphere.  
d) How does the ionosphere effect radiowave propagation?

## PART - B

Answer any Five Questions

(5 x 8 = 40)

5. Explain the terms (a) power gain (b) directivity and (c) effective area.
6. While defining the radiation pattern of an antenna explain briefly the principal plane patterns of a dipole.
7. Write a short note on binomial array.
8. A four element linear array with separation between the elements equal to one half wave length is fed with equal currents in equal phase. How do you obtain the directional characteristic of such an array.
9. Design a five element broadside array having a spacing of half wave length between elements. The pattern is to be optimum with side lobe level 20dB down.
10. Explain Babinet's principle.
11. Define a complementary screen. If  $Z_s$  and  $Z_d$  are impedances of the slot and its complementary dipole and  $Z_0$  is the intrinsic impedance of the surrounding medium, show that  $Z_s Z_d = Z_0^2 / 4$ .
12. Write a short note on log periodic antennas.

## Unit - Paper 9: TOOLS AND TECHNIQUES FOR BIOLOGY

### Unit - I :

#### 1.0. Assay

- 1.1. Definition
- 1.2. Chemical assay
- 1.3. Biological assay
- 1.4. Computer aided techniques.

#### 2.0. Principles and uses of analytical instruments

- 2.1. pH meter
- 2.2. Spectrophotometer
- 2.3. Ultra-centrifuge
- 2.4. Radio activity counter
- 2.5. N.M.R. Spectrophotometer

### Unit - II :

#### 3.0. Microscopy

- 3.1. Principles of light, dark field, phase contrast, fluorescence, transmission electron, scanning EM

#### 4.0. Micro-biological Techniques

- 4.1. Media preparation & sterilization
- 4.2. Inoculation & Growth monitoring
- 4.3. Use of fermentors
- 4.4. Biochemical Mutants & their uses
- 4.5. Microbial assays

### Unit - III :

#### 5.0. Cell culture techniques

- 5.1. Laboratory facilities
- 5.2. Substrates on which cells grow
- 5.3. Treatment of substrate surfaces
- 5.4. Feeder layers
- 5.5. Culture Media

## Unit – IV :

### 6.0. Separation Techniques in biology

- 6.1. Molecular separation by chromatography and electrophoresis
- 6.2. Organelle separation by centrifugation, density gradient separation

### 7.0. Radio Isotopes

- 7.1. Sample preparation for radio active counting
- 7.2. G-M-Counter
- 7.3. Auto-radiography

## Practical :

1. Spectrophotometer – Estimation of biomolecules ✓
2. Centrifugation – Demonstration and working
3. Separation Techniques - Paper chromatography ✓
4. Electrophoresis – Demonstration and usage
5. Demonstration and working of :
  - a) Atomic Absorption Spectrophotometer
  - b) High Pressure Liquid Chromatography
  - c) ELISA Reader, d) Liquid Scintillation counter
6. PH Meter – Preparation of Phosphate buffer ✓
7. Microscope –
  - a) Demonstration of oil immersion – WBC & RBC ✓
  - b) Preparation of tissue for SEM & TEM procedure
8. Cell culture -
  - a) Preparation of media ✓
  - b) Inoculation
9. Biological application of computer techniques.

## Suggested Reading Material :

1. Animal cell culture – A practical approach, Ed. John R.W. Masters, IRI Press
2. Introduction to Instrumental Analysis. Robert Braun, McGraw Hill International Editions
3. A Biologist Guide to Principles and Techniques of Practical Biochemistry. K. Wilson & K.H. Goulding, ELBS Edn.



## Z102. TOOLS AND TECHNIQUES FOR BIOLOGY

### UNIT-I

- 1.0. Assay
  - 1.1. Definition
  - 1.2. Chemical assay
  - 1.3. Biological assay
- 2.0. Principles and uses of analytical instruments
  - 2.1. pH meter
  - 2.2. Spectrophotometer
  - 2.3. Ultra-centrifuge
  - 2.4. Radio activity counter
  - 2.5. NMR Spectrophotometer

### UNIT-II

- 3.0. Microscopy
  - 3.1. Principles of light, dark field, phase contrast, fluorescence, transmission electron, scanning electron microscope
- 4.0. Micro-biological Techniques
  - 4.1. Media preparation & sterilization
  - 4.2. Inoculation & Growth monitoring
  - 4.3. Use of fermentors
  - 4.4. Biochemical Mutants & their uses
  - 4.5. Microbial assays

### UNIT-III

- 5.0. Cell culture techniques
  - 5.1. Laboratory facilities
  - 5.2. Substrates on which cells grow
  - 5.3. Treatment of substrate surfaces
  - 5.4. Feeder layers
  - 5.5. Culture Media

### UNIT-IV

- 6.0. Separation Techniques in biology
  - 6.1. Molecular separation by chromatography and electrophoresis
  - 6.2. Organelle separation by centrifugation, density gradient separation
- 7.0. Radio Isotopes
  - 7.1. Sample preparation for radioactive counting
  - 7.2. G M Counter
- 7.3. Auto-radiography

### Suggested Reading Material:

- 1. Animal cell culture – A practical approach, Ed. John R.W. Masters, IRI Press
- 2. Introduction to Instrumental Analysis. Robert Braun. McGraw Hill International Editions
- 3. A Biologist Guide to Principles and Techniques of Practical Biochemistry. K. Wilson & K.H. Goulding, ELBS Edn.

18  
**AQUACULTURE**

- 1.0. History, General principles and economics of different kinds of aquaculture and productivity of culture ponds
- 2.0. Freshwater Aquaculture:
  - 2.1. Construction of fish farm and reclamation of swamps
  - 2.2. Selection of species for culture – Biological principles
  - 2.3. Preparation and management of nursery ponds, rearing ponds and stocking ponds along with control of weeds, pests and predators

**UNIT-II**

- 3.0. Fish seed resources:
  - 3.1. Procurement and transportation of seed from natural resources
  - 3.2. Transportation of brood stock and induced breeding
  - 3.3. Construction of hatcheries and their management
- 4.0. Freshwater fish culture:
  - 4.1. Common carp; Indian Major carps; Air breathing fishes; Composite Fish Culture; Freshwater prawn culture
  - 4.2. Integrated Fish Farming – Paddy cum Fish Culture and Fish cum Livestock Culture

**UNIT-III**

- 5.0. Fish nutrition  
Nutritional requirements, energy metabolism, formulation and preparation of fish feeds
- 6.0. Brackish water aquaculture:
  - 6.1. Selection of site, principles of pond design; traditional, extensive, modified extensive, semi-intensive, intensive and super intensive culture of shrimps and their management and economics
  - 6.2. Crab culture – Pond design, management of crab farm, fattening process of crab, economics – cage culture and pen culture
  - 6.3. Finfish culture – Mullet (Mugil), Milk fish (Chanos) and sea bass (Lates)

**UNIT-IV**

- 7.0. Hatchery management:
  - 7.1. Principles of shrimp hatchery establishment: Site selection, water source, water management, maturation section, larval and post larval sections, feed management
  - 7.2. Principles of establishment of crab and lobster hatcheries; site selection, water source and management, larval and post larval sections, feed management
- 8.0. Brackish water farm management:
  - 8.1. Water quality management – pH, turbidity, dissolved oxygen, BOD, COD, Nitrates, Phosphates, Ammonia etc.
  - 8.2. Feed management: Feed schedules, protein requirements at different ages of finfish and shellfish, feed formulations, wet and dry feeds
- 9.0. Mariculture:
  - 9.1. Lobster culture
  - 9.2. Mussel culture
  - 9.3. Pearl oyster culture
  - 9.4. Edible oyster culture
  - 9.5. Sea weed culture

**Suggested Reading Material:**

1. Pillay, T.V.R. 1990. Aquaculture – Principles and Practices. Fishing News Books

**MSc. Zoology, IV SEMESTER**

**Paper 19: AQUACULTURE**

40

**Unit – I :**

- 1.0. Concept of Blue Revolution- History, General principles and economics of different kinds of aquaculture and productivity of culture ponds
- 2.0. Freshwater Aquaculture :
  - 2.1. Construction of fish farm and reclamation of swamps
  - 2.2. Selection of species for culture – Biological principles
  - 2.3. Preparation and management of nursery ponds, rearing ponds and stocking ponds along with control of weeds, pests and predators

**Unit – II :**

- 3.0. Fish seed resources :
  - 3.1. Procurement and transportation of seed from natural resources
  - 3.2. Transportation of brood stock and induced breeding
  - 3.3. Construction of hatcheries and their management
- 4.0. Freshwater fish culture :
  - 4.1. Common carp; Indian Major carps; Air breathing fishes; Composite Fish Culture; Freshwater prawn culture
  - 4.2. Integrated Fish Farming – Paddy cum Fish Culture and Fish cum Livestock Culture

**Unit – III :**

- 5.0. Brackish water Aquaculture :

- 5.1. Selection of site, principles of pond design; traditional, extensive, modified extensive, semi-intensive, intensive and super intensive culture of shrimps and their management and economics
  - 5.2. Crab culture - Pond design, management of crab farm, fattening process of crab, economics - cage culture and pen culture
  - 5.3. Finfish culture - Mulletts (Mugil), Milk fish (Chanos) and sea bass (Lates)
- 6.0. Mariculture :
- 6.1. Lobster culture
  - 6.2. Mussel culture
  - 6.3. Pearl oyster culture
  - 6.4. Edible oyster culture, and
  - 6.5. Sea weed culture

#### **Unit - IV :**

- 7.0. Hatchery management :
- 7.1. Principles of shrimp hatchery establishment : Site selection, water source, water management, maturation section, larval and post larval sections, feed management
  - 7.2. Principles of establishment of crab and lobster hatcheries; site selection, water source and management, larval and post larval sections, feed management
- 8.0. Brackish water farm management :
- 8.1. Water quality management - pH, turbidity, dissolved oxygen, BOD, COD, Nitrates, Phosphates, Ammonia etc.
  - 8.2. Feed management: Feed schedules, protein requirements at different ages of finfish and shellfish, feed formulations, wet and dry feeds

# PRINCIPLES OF AQUACULTURE

Periods : 60

Max. Marks : 100

## UNIT - I

### 1.1 Introduction / Basics of Aquaculture :

- 1.1.1 Definition, significance and history of aquaculture.
- 1.1.2 Present status of aquaculture - Global and national scenario.
- 1.1.3 Major cultivable species for aquaculture, freshwater, brackish water and marine.
- \* 1.1.4 Criteria for the selection of species for culture.

## UNIT - II

### 2.1 Types of Aquaculture :

- 2.1.1 Fresh water, brackish water, marine.
- 2.1.2 Concept of monoculture, polyculture, composite culture, monosex culture and integrated fish farming.

### 2.2 Culture Systems :

- 2.2.1 Pond, raceways, cages, pens, rafts and water recirculating aquaculture systems.

### 2.3 Culture Practices :

- 2.3.1 Traditional extensive, modified extensive, semi intensive and intensive cultures of fish and shrimp.

## UNIT - III

### 3.1 Design and construction of aquafarms :

- 3.1.1 Criteria for the selection of site for fresh water and brackish water pond farms.
- 3.1.2 Design and construction of fish and shrimp farms.

### 3.2 Seed resources :

- 3.2.1 Natural seed resources and Procurement of seed for stocking : Carp and shrimp culture.

### 3.3 Nutrition and feeds :

- 3.3.1 Nutritional requirements of a cultivable fish and shell fish.
- 3.3.2 Natural food and Artificial feeds and their importance in fish and shrimp culture.

## UNIT - IV

### 4.1 Management of carp culture ponds :

- 4.1.1 Culture of Indian major carps : Pre-stocking management - Dewatering, drying, Ploughing/ desilting ; Predators, weeds and algal blooms and their control, Liming and fertilization ; Stocking management - Stocking density and stocking ; Post - stocking \* management - Feeding, Water Quality, growth and health care : and Harvesting of ponds.

### 4.2 Culture of giant freshwater prawn :

- 4.2.1 *Macrobrachium rosenbergii*

## UNIT - V

### 5.1 Culture of Shrimp :

- 5.1.1 *Penaeus monodon* or *Litopenaeus vannamei*

### \*5.2 Culture of pearl Oysters :

### 5.3 Culture of Seaweeds :

- 5.3.1 Species cultured, culture techniques, important by-products, prospects.

### 5.4 Culture of ornamental fishes :

- 5.4.1 Setting up and maintenance of aquarium and breeding.

\* Additional Input

### BLUE PRINT

Unit	Essay	Short
I	2	1
II	2	1
III	2	1
IV	2	1
V	2	1



## BIO DIVERSITY & ANIMAL CONSERVATION

### UNIT – I

1. **Biodiversity:** Definition and significance; biodiversity at global, national and local levels; magnitude and distribution of biodiversity.
2. **Patterns of biodiversity:** Latitudinal and altitudinal gradients; species area relationship. 232
3. **Biogeographic realms** of the world. 215
4. Biogeographic zones of India and faunal diversity; Hotspots in the world and in India.

### UNIT – II

1. **Hierarchical components** of biodiversity: Species diversity, genetic diversity and ecosystem diversity.
2. **Biodiversity values:** Direct values and indirect values.
3. **Biodiversity in peril:** Causes of biodiversity losses and extinction; anthropogenic impact on biodiversity.
4. **Biodiversity and biotechnology:** DNA based wildlife forensics; genetically modified organisms and Bioremediation.

### UNIT – III

#### Biodiversity management and conservation

1. Conservation Biology- introduction. Threats to Biological diversity, habitat degradation, fragmentation and destruction, extinction, overexploitation, global warming. Protected areas-Parks, nature reserves, wildlife and wild life corridors. Restoration Ecology.
2. IUCN classification of wildlife.
3. Biodiversity threats; *In-situ* conservation and *Ex-situ* conservation.

### UNIT – IV

1. Gene banks; conservation of genetic resource; cryopreservation, Biological databases.
2. Wildlife protection acts; organizations involved in protection of Biodiversity.
3. Satellite Remote Sensing and GIS programmes; Environmental Impact Assessment (EIA).

### REFERENCE BOOKS

1. Agarwal KC. 1998. *Biodiversity*. India.
2. Peggy I. Fieldler and Perer M. Kareiva. 1997. *Conservation Biology*.
3. Prabodh K. Maiti and Paulami Maiti. 2011: *Biodiversity: Perception, Peril and Preservation*.
4. Saharia VV. 1982. *Wildlife in India*. Natraco Publishers, Dehradun.
5. Tandon RK. 1999. *Biodiversity, Taxonomy & Ecology*. Prithipal singh Scientific Publishers, Jodhpur.
6. T.K. Attwood & D.J. Parry-Smith 1999. *Introduction to Bioinformatics*. Pearson Education Asia.
7. Stephen Misener & S.A. Krawez 2000. *Bioinformatics: Methods and Protocol*.

**ADIKAVI NANNAYA UNIVERSITY**  
**M.Sc ZOOLOGY & AQUACULTURE**  
**I SEMESTER**  
**Z101. BIOSYSTEMATICS & TAXONOMY**

**UNIT-I**

- 1.0. Definition and basic concepts of biosystematics and taxonomy
  - 1.1. Historical resume of systematics
  - 1.2. Importance and applications of biosystematics in biology
  - 1.3. Material basis of biosystematics – different attributes

**UNIT-II**

- 2.0. Trends in biosystematics – concepts of different conventional and newer aspects
  - 2.1. Chemotaxonomy
  - 2.2. Cytotaxonomy
  - 2.3. Molecular taxonomy
- 3.0. Molecular perspective on the conservation of diversity
  - 3.1. Diversity and ecosystem process: Theory, achievements and future directions

**UNIT-III**

- 4.0. Dimensions of speciation and taxonomy characters
  - 4.1. Dimensions of speciation- types of lineage changes, production of additional lineage ✓
  - 4.2. Mechanisms of speciation in panmictic and apomictic species
  - 4.3. Species concepts – species category, different species concepts: sub-species and other infra specific categories ✓
  - 4.4. Theories of biological classification, hierarchy of categories ✓
  - 4.5. Taxonomic characters – different kinds, origin of reproductive isolation – biological mechanism of genetic incompatibility

**UNIT-IV**

- 5.0. Procedure keys in taxonomy
  - 5.1. Taxonomic procedures – taxonomic collections, preservation, curation process of identification
  - 5.2. Taxonomic keys – different kinds of taxonomic keys, their merits and demerits
  - 5.3. Systematic publications – different kinds of publications
  - 5.4. Process of typification and different Zoological types
  - 5.5. International Code of Zoological Nomenclature (ICZN) – its operative principles, interpretation and application of important rules, Zoological nomenclature, formation of scientific names of various taxa

**Suggested Reading Material:**

1. M. Kato. The Biology of Biodiversity, Springer.
2. J.C. Avise. Molecular Markers. Natural History and Evolution, Chapman & Hall, New York.
3. E.O. Wilson. Biodiversity, Academic Press, Washington.
4. G.G. Simpson. Principles of Animal Taxonomy. Oxford IBH Pub. Co.
5. E. Mayer. Elements of Taxonomy.
6. E.O. Wilson. The Diversity of Life (The College Edition), W.W. Northern & Co.
7. B.K. Tikadar. Threatened Animals of India, ZSI Publication, Calcutta.



**SYLLABUS – I SEMESTER**  
**Paper 1: BIOSYSTEMATICS & TAXONOMY**

**Unit – I :**

- 1.0. Definition and basic concepts of biosystematics and taxonomy
  - 1.1. Historical resume of systematics
  - 1.2. Importance and applications of biosystematics in biology
  - 1.3. Material basis of biosystematics – different attributes

**Unit – II :**

- 2.0. Trends in biosystematics – concepts of different conventional and newer aspects
  - 2.1. Chemotaxonomy
  - 2.2. Cytotaxonomy
  - 2.3. Molecular taxonomy
- 3.0. Molecular perspective on the conservation of diversity
  - 3.1. Diversity and ecosystem process: Theory, achievements and future directions

**Unit – III :**

- 4.0. Dimensions of speciation and taxonomy characters
  - 4.1. Dimensions of speciation- types of lineage changes, production of additional lineage
  - 4.2. Mechanisms of speciation in panmictic and apomictic species
  - 4.3. Species concepts – species category, different species concepts: sub-species and other infra specific categories
  - 4.4. Theories of biological classification, hierarchy of categories
  - 4.5. Taxonomic characters – different kinds, origin of reproductive isolation – biological mechanism of genetic incompatibility

**Unit – IV :**

- 5.0. Procedure keys in taxonomy

- 5.1. Taxonomic procedures - taxonomic collections, preservation, curation process of identification
- 5.2. Taxonomic keys - different kinds of taxonomic keys, their merits and demerits
- 5.3. Systematic publications - different kinds of publications
- 5.4. Process of typification and different Zoological types
- 5.5. International Code of Zoological Nomenclature (ICZN) - its operative principles, interpretation and application of important rules, Zoological nomenclature, formation of scientific names of various taxa

### **Practical :**

1. A practical approach towards Biosystematics and taxonomy
2. Examples representing the different taxa in the order of evolution
3. Molecular perspective of diversity - Identification of species by molecular separation of proteins by examples
4. Diversity and similarity index.
5. Methods of collection, preservation and identification of plankton and representative forms of terrestrial and aquatic fauna

### **Suggested Reading Material :**

1. M. Kato. The Biology of Biodiversity, Springer.
2. J.C. Avise. Molecular Markers. Natural History and Evolution, Chapman & Hall, New York.
3. E.O. Wilson. Biodiversity, Academic Press, Washington.
4. G.G. Simpson. Principle of Animal Taxonomy. Oxford IBH Pub. Co.
5. E. Mayer. Elements of Taxonomy.
6. E.O. Wilson. The Diversity of Life (The College Edition), W.W. Northern & Co.
7. B.K. Tikadar. Threatened Animals of India, ZSI Publication, Calcutta.

**Paper 22: CELL PHYSIOLOGY AND TOXICOLOGY**

3

**Unit - I :**

1.0. Thermodynamic Principles and Steady state condition of living organisms.

- 1.1. Organization and Methods to study metabolism.
- 1.2. Degradation and synthesis of glucose, palmitic and phenylalanine.
- 1.3. Oxidative phosphorylation.

**Unit - II :**

2.0. Nature of Enzymes

- 2.1. Classification and Nomenclature of enzymes.
- 2.2. Enzyme inhibition and kinetics.
- 2.3. Immobilized enzymes and their application.

**Unit - III :**

3.0. General Principles of Toxicology.

- 3.1. Areas of toxicology.
- 3.2. Toxic dose tolerance.
- 3.3. Risk and safety.
- 3.4. Routes and sites.
- 3.5. Routes and sites of transportation.

**Unit - IV :**

4.0. Toxic effects of Pesticides.

- 4.1. Organochlorines.
- 4.2. Organophosphates.
- 4.3. Carbamates.

### **Practical :**

1. Protein estimation.
2. Glucose estimation.
3. Lipid estimation.
4. Effect of pesticides on oxygen consumption of fish.
5. Effect of pesticides on opercular rate of fish.
6. Evaluation of LC50 values by probit method.
7. Effect of pesticides on total proteins, carbohydrates and lipids.
8. In vitro effect of pesticides on ATPases and Acetyl choline esterase.

### **Suggested Reading Material :**

1. ✓ Voet, D. and J.G. Voet. Biochemistry. J. Wiley & Sons
2. Foster, R.L. Nature of Enzymology
3. Lodish et. al. Molecular Cell Biology
4. Annual Reviews of Biochemistry
5. Garrett and Grisham. Biochemistry
6. Marguis, J.K. A guide to General Toxicology
7. Casseret & Doull. Toxicology : The basic series of poisons
8. ✓ Robert G. Tardiff and Joseph V. Rodricks. Toxic substances and human risk.
9. Ernest Hodgson and Patricia Levi. Modern Toxicology.

7  
**DEVELOPMENTAL BIOLOGY**

**UNIT-I**

**Gametogenesis, Fertilization and Cleavage:**

- Introduction to animal development, pattern of embryonic development, Fertilization (species specific recognition of egg and sperm, acrosome reactions, fast and slow block to polyspermy); Cleavage (patterns, molecular mechanism of cleavage)

**UNIT-II**

**Early embryonic Development:**

Gastrulation, Neurulation (Establishment of neural tube, Tissue architecture of CNS, cerebral organization, differentiation of neural tube, neurons and neural crest cells); Specification of cell fate and cellular basis of morphogenesis, Autonomous development, Regulative development, Syncytial development.

**UNIT-III**

**Organogenesis:**

Mechanism of cellular differentiation – Ectoderm (CNS and Epidermis), Mesoderm (Chorda Mesoderm, paraxial, intermediate and lateral plate mesoderm) and Endoderm (digestive tube and its derivatives), Cell-cell communication, Development during organ formation: introduction and competence, paracrine and other factors (the inducer molecules), Signal transduction cascades.

**UNIT-IV**

**Gene expression during development: Role of Hormones**

Establishment of body axes. Anterior-posterior polarity-role of maternal effector, segmentation and homeotic selector genes, Dorso-Ventral polarity. Differential gene expression during animal development, Differential gene transcription, Selective nuclear RNA processing and mRNA translation. Differential protein modification. Regeneration of organs.

**Suggested Reading Material:**

1. Scott F. Gilbert (2006). Developmental Biology, 8<sup>th</sup> Edition, Sinauer Associates, Inc., Publishers Sunderland, Massachusetts, USA
2. L. Wolpert Rosa Beddington Thomas M. Jessell Peter Lawrence Elliot M. Meyerowitz and Jim Smith (2002) Principles of Development Second Edition Oxford University Press.
3. JMW Slack (2005) Essential Developmental Biology Second Edition Blackwell Publishing Australia.
4. Mac E. Hadley Endocrinology Sixth Edition Prentice hall International, Inc. Arizona (For Section 9).

## Z302. GENERAL AND COMPARATIVE ENDOCRINOLOGY

### UNIT-I

- 1.0 Aims and scope of endocrinology.
- 1.1 Discovery of hormones.
- 1.2 Classification of hormones.
- 1.3 Hormones as messengers.
- 1.4 Experimental methods of hormone research.
- 1.5 Phylogeny and ontogeny of endocrine glands.
- 1.6 Neuroendocrine system and neurosecretion.

### UNIT-II

- 2.0 General principles of hormone action;
- 2.1 Hormone structure and evolution,
- 2.2 Chemical nature and nature of hormone action,
- 2.3 Hormone receptors,
- 2.4 Signal transduction mechanisms,
- 2.5 Hormones and homeostasis.
- 2.6 Hormonal regulation of carbohydrate, nitrogen and lipid metabolism.

### UNIT-III

- 3.0 Biosynthesis and secretion of hormones;
- 3.1 Biosynthesis of steroid hormones-*de novo*,
- 3.2 Biosynthesis and amino acid derived small sized hormones (T<sub>4</sub>, Epinephrine),
- 3.3 Biosynthesis of simple peptide hormones – Pre and pro hormones,
- 3.4 Co-translational and post-translational modification of hormone structure,
- 3.5 Metabolism of hormones.

### UNIT-IV

- 4.0 Hormones growth and development;
- 4.1 Invertebrates (insects, crustacean),
- 4.2 Vertebrates (amphibian, reptiles, mammals),
- 4.3 Hormones and reproduction,
- 4.4 Seasonal breeders and continuous breeders.

### Suggested Reading Material:

1. Turner, Endocrinology
2. E.J.W. Barrington. General and Comparative Endocrinology, Oxford, Clarendon Press
3. P. J. Bently. Comparative Vertebrate Endocrinology. Cambridge University Press.
4. R. H. Williams. Text Books of Endocrinology, W. B. Saunders.
5. C. R. Martin. Endocrine Physiology. Oxford University Press.
6. A. Gorbman et al. Comparative Endocrinology, John Wiley & Sons.

## Z303. BIODIVERSITY AND ANIMAL CONSERVATION

## Z103. GENERAL AND COMPARATIVE PHYSIOLOGY

### UNIT-I

- 1.1. General Physiological functions and principles
- 1.2. Aims and scope of Comparative Physiology
- 1.3. Muscle structure and properties, Molecular basis of muscle contraction, sliding filament theory. Twitch Summation, Tetanus and Fatigue.
- 1.4. Nerve structure, nerve impulse, ionic basis of resting and action potentials
- 1.5. Synaptic transmission, Neurotransmitters
- 1.6. Blood coagulation - Factors affecting coagulation

### UNIT-II

- 2.1. Osmoregulation in aquatic and terrestrial environments mechanism of ionic regulation
- 2.2. Thermoregulation
- 2.3. Homoeothermic animals
- 2.4. Poikilotherms
- 2.5. Hibernation and Aestivation

### UNIT-III

- 3.1. Respiratory organs and respiratory pigments through different phylogenetic groups. Mechanisms of uptake of O<sub>2</sub> and CO<sub>2</sub>
- 3.2. Circulation of fluids and their regulation.
- 3.3. Comparative physiology of digestion and absorption of carbohydrates
- 3.4. Patterns of excretion among different animal groups
- 3.5. Receptor physiology – Comparative study
- 3.6. Mechanoreceptors
- 3.7. Chemoreceptor

### UNIT-IV

- 4.1. Physiological adaptations of animals to different environments
- 4.2. Marine environment
- 4.3. Shores and Estuaries
- 4.4. Fresh water environment
- 4.5. Terrestrial environment
- 4.6. Yoga, meditation and their effects

### Suggested Reading Material:

1. ✓ Eckert. R. Animal Physiology: Mechanisms and adaptation. W.H. Freeman and Company. New York.
2. Hochachka. P.W. and Somero. G.N. Biochemical adaptation. Princeton. N.J.
3. ✓ Hoar. W.S. General and comparative Animal Physiology. Prentice Hall of India.
4. ✓ Schiemdt Neisen. Animal Physiology. Adaptation and Environment. Cambridge
5. Stamd. F.L. Physiology: A regulatory systems approach. Macmillan Publishing Co. New York.
6. Punmer. L. Practical Biochemistry. Tata McGraw-Hill
7. Prosser. C.L. and Brown. Comparative Animal Physiology
8. Wilson. K. and Walker. J. Practical Biochemistry
9. Willmer, PIG Sone and I. Johnson, Environmental Physiology, Blackwell Science, Oxford, U.K. 944p.
10. Newell, R.C. (ed.) 1976. Adaptation to environment, Essays on the physiology of marine animals. Butterworths. London. UK 539 pp.
11. Townsend, C.R. and P. Callow, Physiological Ecology An evolutionary approach to resource use. Blackwell Sci. Publication. Oxford, UK.

## Z104. MOLECULAR CELL BIOLOGY

## Paper 3: GENERAL AND COMPARATIVE PHYSIOLOGY

### Unit - I :

#### 1.0. Muscle : Historical background

- 1.1. Types of muscles and classification
- 1.2. Light and Electron microscopic structure of skeletal muscle
- 1.3. Molecular basis of muscle contraction, Sliding filament theory
- 1.4. Energetics and thermal aspects of muscle contractions
- 1.5. Twitch, Summation, Tetanus and Fatigue

#### 2.0. Nerve : Structure of the nerve, Excitability, conductivity, Refractory period, summation, Chronoxie and Rheobase, All or None principle

- 2.1. Nerve Impulse, Ionic basis of resting and action potentials
- 2.2. Synaptic transmission, Neurotransmitters

### Unit - II :

#### 3.0. Blood : Structure and properties of Blood

- 3.1. Blood cells and their origin, haemopoises, hemoglobin, functions of erythrocytes and leucocytes

#### 3.2. Blood coagulation - Factors affecting coagulation

#### 4.0. Defense mechanism :

- 4.1. Reticulo Endothelial system : Macro phages, Lymphocytes
- 4.2. Immunoglobulins, origin, properties and functions
- 4.3. Humoral Immunity and Cell- Mediated Immunity
- 4.4. Primary and secondary immune mechanisms
- 4.5. Blood groups and tissue antigens

### Unit - III :

#### 5.0. Physiological adaptation of animals to different environments

- 5.1. Marine environment
- 5.2. Shores and Estuaries
- 5.3. Freshwater environment



- 5.4. Extreme aquatic environment
- 5.5. Terrestrial life
- 5.6. Extreme terrestrial environment
- 5.7. Parasitic habitats

#### 6.0. Stress Physiology

- 6.1. Basic concept of environmental stress and strain, concepts of elastic and plastic strain; stress resistance, stress avoidance and stress tolerance
- 6.2. Adaptation, Acclimation and Acclimatization

### Unit - IV :

#### 7.0. Concept of homeostasis and homeostatic mechanisms of the body

- 7.1. Thermoregulation, Exothermic and Endothermic organisms
- 7.2. Endothermy and physiological mechanism of body temperature regulation

#### 8.0. Physiological adaptation to osmotic and ionic stress; mechanism of cell volume regulation

- 8.1. Osmoregulation in aqueous and terrestrial environments
- 8.2. Physiological response to oxygen deficient stress
- 8.3. Physiological response to body exercise
- 8.4. Meditation, Yoga and their effects

### Practical :

1. Oxygen consumption Vs. temperature
2. Estimation of Urea, Ammonia, etc.
3. Calculation of  $Q_{10}$  values
4. Determination of digestive enzymes
5. *Trichiurus* laterline sense organs
6. Demonstration of chromatophore
7. Osmotic regulation - Earthworm experiments

## II SEMESTER

## Z201. GENETICS AND EVOLUTION

## UNIT-I

Fine structure of the gene: cistron, recon, muton; Multiple Alleles; Lethality and interaction of genes; Linkage and crossing over; Genetic mapping of chromosomes; Sex linked and sex influenced traits, Sex determination, Sex differentiation, Dosage compensation; Genetic imprinting, Karyotyping; banding techniques.

## UNIT-II

Concepts of evolution and theories of organic evolution with emphasis on Darwinism. Neo-Darwinism, Hardy Weinberg law of genetic equilibrium, A detailed account of stabilizing and destabilizing forces (i) natural selection (ii) Mutation, (iii) Migration

## UNIT-III

Quantifying genetic variability, Genetic structure of natural population, phenotypic variation, Models explaining changes in genetic structure of population, Factors affecting human diseases frequency, Genetic of quantitative traits in population. Analysis of quantitative traits, Quantitative traits and natural selection, Estimation of heritability, Genotype-environmental interactions.

## UNIT-IV

Genetics of speciation, phylogenetics and biological concept of species. Models of speciation (Allopatric, Sympatric, Parapatric). Patterns and mechanisms of reproductive-isolation. Phylogenetic gradualism and punctuated equilibrium, Micro and macro evolution. Molecular Evolution, Gene and gene families, Molecular drive, Origin of higher categories.

## Suggested Reading Material:

1. ✓ Dobzhansky, Th. Genetics and origin of species, Surjeet Publication, Delhi
2. Dobzhansky, Th., F.J. Ayala, G.L., Stebbens and J.M. Valentine Evolution, Surjeet Publication, Delhi
3. Futuyama, D.J. Evolutionary Biology, Sinauer Associates, INC, Publishers, Dunderland
4. ✓ Hartl. D.L.A. Primer of population Genetics, Sinauer Associates, INC Massachusetts
5. Jha, A.P. Genes and Evolution, John Publication, New Delhi
6. King, M. Species Evolution - the role of chromosomal change. The Cambridge University Press, Cambridge.
7. Meerrer, D.J. Evolution and genetics. Oxford University Press, New York. Strikberger, M.W. Evolution, Jones and Bartett Publishers, Boston London

## Z202. DEVELOPMENTAL BIOLOGY

## Paper 8: GAMETE BIOLOGY

### Unit – I :

- 1.0. Heterogamy in eukaryotes
- 2.0. Comparative account of differentiation of gonads in a mammal and an invertebrate
- 3.0. Spermatogenesis
  - 3.1. Morphological basis in Rodents
  - 3.2. Morphological basis in any invertebrates
- 4.0. Biochemistry of semen
  - 4.1. Semen composition and formation
  - 4.2. Assessment of sperm functions

### Unit – II :

- 5.0. Ovarian follicular growth and differentiation
  - 5.1. Morphology
  - 5.2. Endocrinology
  - 5.3. Molecular Biology
  - 5.4. Oogenesis and Vitellogenesis
  - 5.5. Ovulation and ovum transport in mammals
- 6.0. Fertilization
  - 6.1. Pre-fertilization
  - 6.2. Biochemistry of fertilization
  - 6.3. Post-fertilization
- 7.0. Collection and cryopreservation of gametes and embryos

### Unit – III :

- 8.0. Multiple ovulation and embryo transfer technology (MOETT)
  - 8.1. *In vitro* oocyte maturation
  - 8.2. Superovulation
  - 8.3. *In vitro* fertilization

## 9.0. Transgenic animals and knock-outs

- 9.1. Production
- 9.2. Applications
- 9.3. Embryonic stem cells

## **Unit – IV :**

### 10.0. Assisted reproduction technologies

- 10.1. Embryo sexing and cloning
  - 10.2. Screening for genetic disorders
  - 10.3. ICSI, GIFT etc.
  - 10.4. Cloning of animals by nuclear transfer
- 11.0. Teratological effects of Xenobiotics

### 12.0. Immuno contraception

- 12.1. Gamete specific antigens
- 12.2. Surgical methods
- 12.3. Hormonal methods
- 12.4. Physical methods
- 12.5. IUCD

## **Practical :**

1. Types of eggs
2. Cleavage, Blastulation, Gastrulation, Frog/Amphioxus/Chick
3. Testis Section Human  
Ovary Section Human
4. Mounting spermatozoa – Grasshopper/Frog/Chick/Rat
5. Demonstration class : Pregnancy test using commercial kit

## **Suggested Reading Material :**

1. Austen, C.R. and Short, R.V. Reproduction in animals
2. Schatten and Schatten. Molecular biology of fertilization
3. F.T. Longo. Fertilization, Chapman & Hall
4. R.G. Edwards. Human Reproduction

## Paper 10: GENERAL AND COMPARATIVE ENDOCRINOLOGY

### Unit - I :

- 1.0 Aims and scope of endocrinology
  - 1.1. Hormones as messengers
  - 1.2. Hormones and eukaryotic metabolic regulation
  - 1.3. Classification of hormones
  - 1.4. Discovery of hormones
  - 1.5. Experimental methods of hormone research
- 2.0. Phylogeny of endocrine glands (Pituitary, pancreas, adrenals, thyroid)
- 3.0. Ontogeny of endocrine glands

### Unit - II :

- 4.0. Concept of Neurosecretion and Neuro-endocrine system in invertebrate groups
  - 4.1. Neuro-endocrine mechanisms of moulting and growth in crustaceans
  - 4.2. Hormonal control of reproduction and moulting in insects
  - 4.3. Hormonal control of reproduction in Mollusca and Echinodermata

### Unit - III :

- 5.0. General principles of hormone action
  - 5.1. Concept of hormone receptors
  - 5.2. Nature of hormone action, Steroid and protein hormones
  - 5.3. 1<sup>st</sup> messenger, 2<sup>nd</sup> messenger concept
  - 5.4. Hormonal control of homeostasis
  - 5.5. Hormonal regulation of carbohydrate metabolism
  - 5.6. Hormonal regulation of nitrogen and lipid metabolism

### Unit - IV :

- 6.0. Hormone structure and Biosynthesis of hormones

- 6.1. Chemical nature and gross features of hormones
- 6.2. Hormone levels in circulation and other body fluids
- 6.3. Biosynthesis of steroid hormones *de novo*
- 6.4. Biosynthesis and amino acid derives small size hormones (eg: T4 Epinephrine, etc.)
- 6.5. Biosynthesis and simple peptide hormones, Pre- and Pro-hormones
- 6.6. Co-translational and post-translational modifications of hormone structure

Hormones and behaviour

Hormonal control of growth and reproduction in vertebrates

Neuro-endocrine integration in vertebrate

### **Practical :**

1. Cockroach - *Carpora cardiaca* & *Carpora allata*
2. Prawn - Nervous system, Y-organ and androgenic organ, ovaries
3. Crab - Nervous system, Y-organ & androgenic organ, ovaries
4. Sepia - Optic glands
5. Fish - Endocrine glands: Pituitary, Pancreas, adrenals, testis and ovaries

### **Suggested Books :**

1. E.J.W. Barrington, General and Comparative Endocrinology, Oxford, Clarendon Press.
2. P.J. Bentley, Comparative Vertebrate Endocrinology, Cambridge University Press.
3. R.H. Williams, Textbook of Endocrinology, W.B. Saunders
4. C.R. Martin, Endocrine Physiology, Oxford University Press
5. A Gorbman et. al. Comparative endocrinology, John Wiley & Sons.

**M Sc. Zoology, III SEMESTER**

**Paper 13: COMPARATIVE ANATOMY AND FUNCTIONAL ORGANIZATION OF INVERTEBRATES AND VERTEBRATES**

**Unit – I :**

1.0. Origin of coelom

- 1.1. Acoelomates, Pseudocoelomates
- 1.2. Coelomates : Protostomia and Deuterostomia

2.0. Excretion

- a. Organs of excretion: Coelom, Coelomoducts, Nephridia and Malpighian tubules.
- b. Mechanism of excretion.

**Unit – II :**

3.0. Invertebrate larvae

- 3.1. Larval forms of free living invertebrates
- 3.2. Larval forms of parasites
- 3.3. Strategies and Evolutionary significance of larval forms

4.0. Minor Phyla.

- 4.1. Concept & significance
- 4.2. Organization and general characters

**Unit – III :**

5.0. Vertebrate integument and its derivatives

- 5.1. Development, general structure and function of skin and its derivatives

5.2. Glands, scales, horns, claws, nails, hoofs, feathers and hairs

6.0. General plan of circulation in various groups

- 6.1. Blood
- 6.2. Evolution of heart
- 6.3. Evolution of aortic arches and portal systems

#### **Unit - IV :**

- 7.0. Urino-genital and Nervous system.
  - 7.1. Evolution of urino-genital system in vertebrates.
- 8.0. Nervous system.
  - 8.1. Comparative anatomy of the brain in relation to its functions
  - 8.2. Nerves-cranial, peripheral and autonomous nervous systems
  - 8.3. Simple receptors
  - 8.4. Organs of Olfaction and taste
  - 8.5. Lateral line system and lateral line organs of fish.
  - 8.6. Electric organs & Electroreception

#### **Practical :**

1. Nervous system : Prawn, Crab, Sepia / Loligo
2. Mounting : Nephridium and Spermatheca in Earthworm.
3. Dissections : *Trichiurus/Scoliodon* - Digestion, Reproductive, Arterial, venous systems.
4. Respiratory system : Mounting of Gills, Trachea and Booklungs
5. Parasitic larval forms.
6. Museum specimens of minor phyla Phoronis, Dendrostoma  
Fossil specimens - Aurelia - Planula, Redia, Cerceria, Filiform of strongyloides, Trochophore,
7. Nauplius, Zöea, Mysis, Phyllosoma, Trilobite larvae of Limulus, Antion, Velliger, Bipinaria, Ophio and Echinopluteus, Auricularia, Tornaria.
8. Electric rays.
9. Types of vertebrae of Procoelus, Opisthocoelus, Amphicoelus,  
Amphiplatins, Heterocoelus, Axis and atlas vertebrae.  
*(Amphicoelus) - Bird - Typical*  
*Mammal*
9. Mounting of placoid scales.



# 9 IMMUNOLOGY

## UNIT-I

**Immunity**-innate and acquired, innate immune mechanisms, acute phase reactants, properties of acquired immunity

**Immunogens and antigens**- Properties, factors governing immunogenicity, haptens, epitopes size and identification. Adjuvants- properties and mechanism of action.

**Immunoglobulins**- structure, isotypes, allotypes and idiotypes. Functions of antibody in relation to structure

## UNIT-II

**Antigen-antibody interactions**- affinity of antibody, avidity, bonus effect, classical precipitin reaction, antigen-binding site of antibody, forces involved in antigen - antibody complex formation.

**Lymphoid tissue**- primary and secondary lymphoid organs, structure and cellular organization. Lymphocyte traffic.

**Cells involved in the immune response**- T cells, B cells, CD antigens, neutrophils, eosinophils and natural killer cells.

**Antigen presentation** - pathways of antigen processing and presentation of intracellular and extracellular antigens.

## UNIT-III

**Antibody response** - Primary and secondary antibody response, antibody response to haptens, enumeration of antibody-forming cells, T- dependent and T- independent antigens.

**Macrophage**- role in immune response and activation.

**Cell mediated immunity**- helper, cytotoxic, suppressor T cells. In vivo and in vitro assays for assessment of cell mediated immunity

**Complement**- classical and alternative pathways of activation. Regulation of complement activation and functions.

**Antigen receptors** -On T and B cells. Generation of receptor diversity.

## UNIT-IV

*Smolika university transplantation human immunology page no*

**Development of immune system**- T cell ontogeny in thymus, thymic hormones, cell development. **Immunological tolerance**- pathways of tolerance and mechanisms of tolerance in T and B cells. **Immunological tests**- Immunodiffusion, immunoelectrophoresis, immunofluorescence, radioimmunoassay and enzyme-linked immunosorbent assay.

### Suggested Reading Material:

1. Immunology and Immunopathology by Stewart.
2. Cellular and Molecular Immunology by Abul K. Abbas *et. al.*
3. Textbook of Immunology by Barret.
4. Essential Immunology by Roitt, Brostoff, Male, Harcourt Brace & Company (5<sup>th</sup> Ed), Mosby (6<sup>th</sup> Ed).
5. Immunology by Kuby, Richard A. Goldsby, Thomas, J. Kindl, Barbara A. Osborne, Freeman & Company, Mosby publishers.
6. Immunobiology – The immune system in Health disease by Janeway and Travers.
7. Immunology – An introduction by Tizard.
8. Text book of Immunology by Unani and Benacerraf.
9. Fundamentals of Immunology by Paul.
10. Immunology – A short course by Benjaini, Sunshine and Lesrowitz.

## Paper 15: Immunology and Immuno-Technology

### Unit I

- 1.0 Immunology
  - 1.1 Historical Perspective
  - 1.2 Scope and Over view of the Immune System
- 2.0 Innate and Adaptive Immunity
- 3.0 Cells and Organs of the Immune System
  - 3.1 Primary and Secondary Lymphoid organs
  - 3.2 Cells of the Immune system

### Unit II

- 4.0 Nature of antigens and Super-antigens
  - 4.1 Immunogenicity and Antigenicity
  - 4.2 Factors influencing immunogenicity
  - 4.3 Epitopes and Haptens
- 5.0 Antibodies - Structure and Function
  - 5.1 Gross and Fine structure of Immunoglobulin molecule
  - 5.2 Antibody Classes and their effector functions
  - 5.3 Monoclonal antibodies - Hybridoma Technology } P.K. Gupta
- 6.0 Antigen - Antibody reactions and Diagnostic Procedures
  - 6.1 Ag. - Ab. binding mechanism
  - 6.2 Ag. - Ab. reactions - Precipitation, Agglutination, Immuno-diffusion, ELISA, RIA, Immuno-flourescence.

### Unit III

- 7.0 Major Histocompatibility Complex
  - 7.1 MHC Haplotypes
  - 7.2 Class I and Class II MHC molecules
  - 7.3 MHC - Immune responsiveness and disease susceptibility
- 8.0 T- Cells - Maturation, activation and differentiation
  - 8.1 T-Cell maturation and Thymus
  - 8.2  $T_H$  - Cell activation and differentiation
  - 8.3 Effector Cells and Mechanism of Action:  $T_{DTH}$ , CTLs and NK cells
- 9.0 B- Cells: Development, Activation and Differentiation
  - 9.1 B-Cell activation and Proliferation

- 9.2  $T_H$  - B - Cell interaction
- 9.3 Humoral Immune response - Kinetics

#### **Unit - IV**

- 10.0 Hypersensitivity Reactions
  - 11.1 Gell and Coombs Classification
  - 11.2 IgE Mediated (Type I) and Ab - mediated (Type II) Hypersensitivity Reactions
  - 11.3 Immune - complex mediated (Type III) and  $T_{DTH}$  mediated (Type IV) Hypersensitivity Reactions
- 11.0 Immunology and Health
  - 12.1 Immunodeficiency Diseases
  - 12.2 Autoimmunity

#### **Practical :**

Organs :

1. Lymphoid organs in Rat - Dissection.
2. Lymphoid organs - Histology slides
3. Cells - Differential count of blood cells - Staining with Giemsa
4. Lymphocyte separation - Gradient methods
5. Antigen - Antibody reactions - Kits
  - a) Determination of blood groups ✓
  - b) Diagnostic test for typhoid ✓
  - c) Quantitative precipitin assay teaching kit. ✓
  - d) Test for HBS Ag. ✓
  - e) Estimation of serum proteins ✓

#### **Suggested Reading Materials :**

1. Kuby, W.H., Freeman, Immunology, USA
2. W. Paul, Fundamentals of immunology
3. I.M. Roitt, Essential immunology, ELBS ion.

**Paper 20: MEDICAL PARASITOLOGY** (2)

**Unit - I :**

1. Introduction to parasites of man, scope and definition of parasites/parasitology
2. Protozoa :
  - 2.1. General characters of parasitic protozoa
  - 2.2. Morphology, life cycle and pathogenicity of *Entamoeba histolytica*, *Giardia*, *Trichomonas Naeglaria* - 12/12
  - 2.3. Haemoflagellates : *Trypanosoma*, *Leishmania*
  - 2.4. Apicomplexa : *Plasmodium*, Differential diagnosis : *Toxoplasma Pneumocystis*

**Unit - II :**

3. Trematodes :
  - 3.1. General characters and classification of digenetic trematodes
  - 3.2. Identification characters, life cycle, pathogenicity and control of human parasitic, digenetic trematodes : *Chlonorchis sinensis*, *Paragonimus westermani* and *Schistomes*

**Unit - III :**

4. Cestodes :
  - 4.1. General characters and classification of cestodes
  - 4.2. Larval cestodes pathogenic to man

- 4,3, Identification characters, life cycle, pathogenecity and control of *Diphyllobothrium latum*, *Taenia solium*, *T. saginata*, *Hymenolepis nana*

**Unit -IV :**

5. Nematodes :

5.1. General characters of Nematodes

5.2. Identification, life cycle, pathogenecity and control of *Ascaris lumbricoides*, *Enterobius vermicularis*, *Ancylostoma duodenale*

5.3. Filarid worms : *Wuchereria bancrofti* and *Brugia malayi*

5.4. *Trichinella spiralis* and *Trichiuris trichiura*. (25)

**Practical :**

1. Smear preparation for protozoa
2. Preparation of whole mounts for helminths
3. Spotters based on theory

**Suggested Reading Material :**

1. Manson's Tropical disease by Cook
2. Concepts and Principles of Epidemiological studies
3. Parasitology in Focus

Submitted by LUTWEN Feb.

## METABOLIC CELL FUNCTION & CELL REGULATION

### UNIT-I

- 1.0. Thermodynamic principles and steady-state conditions of living organisms
  - 1.1. Organization and methods to study metabolism
- 2.0. Degradation of glucose, palmitic acid, phenylalanine *Biochemistry Bot. Schen*  
*658-659*

### UNIT-II

- 3.0. Energy metabolism and high energy compounds
  - 3.1. Redox potentials
  - 3.2. Mitochondrial electron transport chain
  - 3.3. Oxidative phosphorylation
- 4.0. Storage and utilization of biological energy
  - 4.1. Biosynthesis of Urea, Glucose, Glycogen, Oleic acid and prostaglandins

### UNIT-III

- 5.0. Nature of Enzymes
  - 5.1. Classification and nomenclature of enzymes
  - 5.2. Kinetic analysis of enzyme catalysed reactions
- 6.0. Metabolic profile of adipose, neural, hepatic, and muscle tissues

### UNIT-IV

- 7.0. Metabolic Engineering
- 8.0. Immobilized enzymes and their applications

### Suggested Reading Material:

1. Voet, D. and J.G. Voet. Biochemistry. J. Wiley & Sons
2. Foster, R.L. Nature of Enzymology
3. Lodish et. al. Molecular Cell Biology
4. Annual Reviews of Biochemistry
5. Garrett and Grisham. Biochemistry.

## **Paper 16: MOLECULAR BIOLOGY AND CYTOGENETICS**

### **Unit - I :**

#### **1. Biology of chromosomes**

- 1.1. Molecular anatomy of eukaryotic chromosomes
- 1.2. Metaphase chromosome: centromere, kinetochore, telomeres and its maintenance
- 1.3. Heterochromatin and euchromatin
- 1.4. Giant chromosomes: polytene and lampbrush chromosome

#### **2. Nucleic acids structure and replication**

- 2.1 Prokaryotic and eukaryotic DNA replication
- 2.2 Mechanism of DNA replication
- 2.3 Enzymes and accessory proteins involved in DNA replication
- 2.4 Types of RNA and molecular structure of RNA

### **Unit - II :**

#### **3.0. Transcription**

- 3.1. Prokaryotic Transcription
- 3.2. Eukaryotic Transcription
- 3.3. RNA Polymerases
- 3.4. Post-transcriptional modifications

#### **4.0. Translation**

- 4.1. Genetic Code
- 4.2. Prokaryotic and eukaryotic Translation
- 4.3. Mechanisms of initiation, elongation and termination
- 4.4. Regulation of translation
- 4.5. Antisense and Ribozyme technology

### **Unit - III :**

#### **5.0. Recombination and repair**

- 5.1 Holliday junction, gene targeting and gene disruption

5.2 RecA and other recombinases

5.3 DAN repair mechanisms

## 6. Molecular mapping

6.1 Genetic and physical maps

6.2 FISH

6.3. DNA finger printing

## Unit - IV :

## 7. Microbial genetics

7.1 Bacterial transformation, transduction. Conjugation, bacterial chromosomes

7.2 Bacteriophages: types, structure and morphology and life cycles

## 8. Human cytogenetics

8.1 Techniques in human chromosome analysis, molecular cytogenetic approach

8.2 Human karyotype-banding-nomenclature

8.3 Numerical and structural abnormalities of human chromosomes- syndromes- cytogenetic implications

## Practical :

1. Fielgen reaction method for DNA localization
2. Localization of RNA by methylgreen pyronin - 'Y'
3. Staining of metaphase chromosomes - chromosomal banding - stain with giemsa - fluorescent dye - demonstration
4. Polytene chromosome - banding - *Chironomus* / *Drosophila* larva
5. Microbial genetics - diagrams and models
6. Human chromosomes - karyotyping



# MOLECULAR BIOLOGY

## UNIT-I

- 1.0 History and scope of Molecular Biology
- 2.0 DNA Structure and Replication
  - 2.1. Prokaryotic and Eukaryotic DNA Replication
  - 2.2. Mechanics of DNA Replication
  - 2.3. Enzymes and accessory proteins involved in DNA Replication

## UNIT-II

- 3.0. Transcription
  - 3.1. Prokaryotic Transcription
  - 3.2. Eukaryotic Transcription
  - 3.3. RNA Polymerases
- 4.0. Post-transcriptional modifications in RNA
  - 4.1. Cap formation
  - 4.2. Transcription
  - 4.3. Nuclear Export of m-RNA

## UNIT-III

- 5.0. Translation
  - 5.1. Genetic Code
  - 5.2. Prokaryotic and eukaryotic Translation
  - 5.3. Mechanisms of initiation, elongation and termination
  - 5.4. Regulation of translation
- 6.0. Antisense and Ribozyme technology
  - 6.1. Molecular mechanisms of antisense molecules
  - 6.2. Inhibition of splicing, polyadenylation and translation

## UNIT-IV

- 7.0. Recombination and Repair
  - 7.1. Holiday junction, gene targeting and gene disruption
  - 7.2. RecA and other Recombinases
  - 7.3. DNA repair mechanisms
- 8.0. Molecular mapping of genome
  - 8.1. Genetic and physical maps
  - 8.2. Physical mapping and map-based cloning
  - 8.3. Southern fluorescence insitu hybridization (FISH) for genome analysis

### Suggested Reading Material:

- 1. J.D. Watson, N.H. Hopkins, J.W. Roberts, J.A. Steitz and A.M. Weiner. Molecular biology of Gene. The Benjamin/Cummings Pub. Co. Inc., California.
- 2. Alberts, B., D. Bray, J. Lewis, M. Raff, K. Roberts and J.D. Watson. Molecular Biology of the Cell. Garland Publishing Inc., New York.
- 3. Benjamin Lewin, Gene IV, Oxford University Press, U.K.
- 4. Meyers, R.A. (Eds.) Molecular Biology and Biotechnology : A comprehensive desk reference. VCH Publishers Inc., New York.
- 5. Sambrook, J., E.F. Fritch and T. Maniatis. Molecular cloning : A Laboratory Manual. Cold Spring Harbor Laboratory Press, New York.
- 6. Daber, P.D. Introduction to practical Molecular Biology. John Wiley & Sons Ltd., New York.
- 7. Brown, T.a. (Eds.). Molecular Biology LabFax. Bios Scientific Publishers Ltd., Oxford.

### III SEMESTER PRACTICALS

## Paper 4: MOLECULAR CELL BIOLOGY

### Unit - I :

- 1.0. Introduction : Experimental system in Cell Biology
- 2.0. Biomembranes
  - 2.1. Molecular composition and arrangement, functional consequences
  - 2.2. Transport across cell membrane: diffusion, active transport and pumps, uniports, symports and antiports
  - 2.3. Membrane potential
  - 2.4. Co-transport by symporters or antiports
  - 2.5. Transport across epithelia: Transport of macromolecules

### Unit - II :

- 3.0. Cytoskeleton
  - 3.1. Microfilaments and microtubules - structure and dynamics
  - 3.2. Microtubules and mitosis
  - 3.3. Cilia and flagella
  - 3.4. Cell movements - intracellular transport, role and kinesin and dynein, signal transduction mechanisms

### Unit - III :

- 5.0. Cell-Cell Signaling
  - 5.1. Cell surface receptors
  - 5.2. Second messenger system
  - 5.3. MAP kinase pathways
  - 5.4. Apoptosis: Definition, mechanism and significance
- 6.0. Cell-Cell adhesion and communication
  - 6.1.  $Ca^{++}$  dependent homophillic cell-cell adhesion
  - 6.2.  $Ca^{++}$  independent homophillic adhesion
  - 6.3. Gap junctions and connections
  - 6.4. Integrins
  - 6.5. Collagen

## **Unit – IV :**

### 7.0. Cell cycle

- 7.1. Cyclins and cyclin dependent kinases
- 7.2. Regulation of CDK-cyclin activity

### 8.0. Genome organization

- 8.1. Hierarchy in organization
- 8.2. Chromosomal organization of genes and non-coding DNA
- 8.3. Mobile DNA
- 8.4. Morphological and functional elements of eukaryotic chromosomes

### 9.0. Intracellular protein traffic

- 9.1. Protein synthesis on free and bound polysomes
- 9.2. Uptake into ER
- 9.3. Membrane proteins, Golgi sorting, post-translational modifications
- 9.4. Biogenesis of mitochondria and nuclei
- 9.5. Trafficking mechanisms

### **Practical :**

1. Light microscopic examination of tissues
2. Preparation of different cell – types Hepatic parenchymal cells, adipocytes, macrophages, neuronal cells, epithelial cells
3. Stages of Mitosis and Meiosis
4. Squash preparation
5. Sub-cellular fractionation – separation of macromolecules

### **Suggested Reading Material :**

1. Molecular Cell Biology, J. Darnell, H. Lodish and D. Baltimore, Scientific American Book INC, USA.
2. Molecular Biology of the Cell, B. Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts and J.D. Watson Garland Publishing INC, New York.

# MOLECULAR BIOLOGY<sup>4</sup>

## UNIT-I

- 1.0. Introduction: Experimental system in Cell Biology
- 2.0. Biomembranes
  - 2.1. Molecular composition and arrangement, functional consequences
  - 2.2. Transport across cell membrane: diffusion, active transport and pumps, uniports, symports and antiports
  - 2.3. Membrane potential
  - 2.4. Co-transport by symporters or antiports
  - 2.5. Transport across epithelia: Transport of macromolecules

## UNIT-II

- 3.0. Cytoskeleton
  - 3.1. Microfilaments and microtubules – structure and dynamics
  - 3.2. Microtubules and mitosis
  - 3.3. Cilia and flagella
  - 3.4. Cell movements – intracellular transport, role and kinesin and dynein, signal transduction mechanisms

## UNIT-III

- 5.0. Cell-Cell Signaling
  - 5.1. Cell surface receptors
  - 5.2. Second messenger system
  - 5.3. MAP kinase pathways
  - 5.4. Apoptosis: Definition, mechanism and significance
- 6.0. Cell-Cell adhesion and communication
  - 6.1. Ca<sup>2+</sup> dependent homophilic cell-cell adhesion
  - 6.2. Ca<sup>2+</sup> independent homophilic adhesion
  - 6.3. Gap junctions and connections
  - 6.4. Integrins
  - 6.5. Collagen

## UNIT-IV

- 7.0. Cell cycle
  - 7.1. Cyclins and cyclin dependent kinases
  - 7.2. Regulation of CDK-cyclin activity
- 8.0. Genome organization
  - 8.1. Hierarchy in organization
  - 8.2. Chromosomal organization of genes and non-coding DNA
  - 8.3. Mobile DNA
  - 8.4. Morphological and functional elements of eukaryotic chromosomes
- 9.0. Intracellular protein traffic
  - 9.1. Protein synthesis on free and bound polysomes
  - 9.2. Uptake into ER
  - 9.3. Membrane proteins, Golgi sorting, post-translational modifications
  - 9.4. Biogenesis of mitochondria and nuclei
  - 9.5. Trafficking mechanisms

### Suggested Reading Material:

1. Molecular Cell Biology, J. Darnell, H. Lodish and D. Baltimore, Scientific American Book INC, USA.
2. Molecular Biology of the Cell, B. Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts and J.D. Watson Garland Publishing INC, New York.

### I SEMESTER PRACTICALS

# NEUROBIOLOGY & ANIMAL BEHAVIOR<sup>20</sup>

**Introduction to Neurobiology:** Neuron: Passive and membrane properties, information flow in neurons, compartments, spike initiation zone.  
Neurons, astrocytes, oligodendroglia, Schwann cells, microglia, ependymal cells, neuroglial cell interaction.  
Animal electricity, electrochemical potential, The Nernst equation and Goldman equation.

## UNIT-II

**Channels and Membrane Potential:** Neuron – Excitability, conductivity, Resting Membrane potential, Nerve Impulse, Refractory period, Action potential and its propagation. Signaling and Channels, Ion Channels and Voltage-gated Channels. ✓ Sodium Channel, Potassium Channel, Calcium channel – morphological and physiological characters.

✓ **Neural Communication:** ✓ Synapses- Electrical and ✓ Chemical synapses, Nerve-muscle synapse and signaling, ✓ Synaptic Integration; Synaptic Plasticity.  
✓ Neurotransmitters-synthesis, storage, release and uptake, inactivation, post-synaptic action of neurotransmitters, neuro-transmitter gated ionic channels; Dale's principle drugs affecting their activities, ionotropic and metabotropic receptors.

## UNIT-III

**Organization of the Brain:** Functional Anatomy of the brain. Systems neurobiology – Visual systems, hearing systems.

## UNIT-IV

**Cognitive Neuroscience;** Nerve cells and their network, Cognitive skills, Learning and memory-Conditioning, habituation, insight learning, associative learning, Reasoning, Genetic aspects of cognition. Neurogenetics and behaviour in insects. Imprinting-case studies of animal models.

### Suggested Reading Material:

- ✓ 1. **Fundamental Neuroscience** by Haines, Duane E., Churchill Livingston, New York.
- ✓ 2. **Principles of Neural Science** by Kandel Eric, James H. Schwartz, and Thomas Jessel; 4<sup>th</sup> ed. Mc Graw-Hill.
- ✓ 3. **Basic Neurochemistry: Molecular, Cellular and Medical Aspects**, by George M.D. Siegel, R. Wayne Albers, Scott Brady, Donald M. D. Price; Seventh Edition; Elsevier Academic Press.
- ✓ 4. **Foundations of Neurobiology** by Fred Delcomyn, N.Y. Freeman
5. **The Neuron: Cell and Molecular Biology** 3ed by Irwin B. Levitan, Leonard K. Kaczmarek, (2002), Oxford University Press
6. **Neuroscience (Book with CD-ROM)** 3ed by Dale Purves, George J. Augustine, David Fitzpatrick, William C. Hall, Lawrence C. Katz, Anthony-Samuel LaMantia, James O. McNamara, S. Mark Williams (2004) Sinauer Assoc.,
- ✓ 7. **Fundamental Neuroscience**, 2ed by Larry R. Squire, Floyd E. Bloom, Susan K. McConnell, James L. Roberts (Editor), Nicholas C. Spitzer, Michael J. Zigmond (2002) Academic Press.

## IV SEMESTER PRACTICALS

Z405-Metabolic cell function and regulations lab:

## Aquaculture

### PRINCIPLES OF AQUACULTURE

Periods : 60

Max. Marks : 100

#### UNIT - I

##### 1.1 Introduction / Basics of Aquaculture :

- 1.1.1 Definition, significance and history of aquaculture.
- 1.1.2 Present status of aquaculture - Global and national scenario.
- 1.1.3 Major cultivable species for aquaculture, freshwater, brackish water and marine.
- \* 1.1.4 Criteria for the selection of species for culture.

#### UNIT - II

##### 2.1 Types of Aquaculture :

- 2.1.1 Fresh water, brackish water, marine.
- 2.1.2 Concept of monoculture, polyculture, composite culture, monosex culture and integrated fish farming.

##### 2.2 Culture Systems :

- 2.2.1 Pond, raceways, cages, pens, rafts and water recirculating aquaculture systems.

##### 2.3 Culture Practices :

- 2.3.1 Traditional extensive, modified extensive, semi intensive and intensive cultures of fish and shrimp.

#### UNIT - III

##### 3.1 Design and construction of aquafarms :

- 3.1.1 Criteria for the selection of site for fresh water and brackish water pond farms.
- 3.1.2 Design and construction of fish and shrimp farms.

##### 3.2 Seed resources :

- 3.2.1 Natural seed resources and Procurement of seed for stocking ; Carp and shrimp culture.

##### 3.3 Nutrition and feeds :

- 3.3.1 Nutritional requirements of a cultivable fish and shell fish.
- 3.3.2 Natural food and Artificial feeds and their importance in fish and shrimp culture.

## **Limmunology**

### **UNIT-1**

Course introduction -Properties of water

Lake Ontogeny -Lake Morphometry

Lake Morphometry -Assignment: lake trophic status as affected by morphometry

### **UNIT-2**

Light and the lake ecosystem calculations -Temperature, Heat, and Stratification

-Lake types: monomictic, polymictic etc. -Meromictic lakes and paleolimnology -Water movement, surface waves, seiches and circulation patterns

### **UNIT-3**

Dissolved inorganic carbon -Lake whittings and biota -Oxygen in lakes, profiles, seasonal effects, primary production, effect of DOC, BOD

Nutrients in lakes: P -P management in lakes: successful and unsuccessful attempts -Nutrients in lakes: N

### **UNIT-4**

Algae, Algal succession and productivity -Microbial loop -Benthic Invertebrates

-Zooplankton communities -Zooplankton migration -Size efficiency hypothesis -Food webs: benthic-pelagic coupling

### **UNIT-5**

Size efficiency hypothesis -Food webs: benthic-pelagic coupling -Resources vs. predation control of food webs: Top-down bottom-up control, trophic cascade hypothesis

## **Ichthyology**

### **UNIT-1**

Introduction, Course Goals & Requirements

The Science of Ichthyology Form and Movement

Saltwater Sampling Field Trip aboard the Ridley

### **UNIT-2**

Blood and Circulation Buoyancy and Thermal Regulation

Hydromineral Balance Feeding, Nutrition,

Digestion and Excretion

### **UNIT-3**

Reproduction

Sensory Perception

Behaviour and Communication

### **UNIT-4**

Systematics and Evolution

Hagfishes and Lampreys Sharks, Rays and Chimeras / Relict Bony Fishes

Bonytongues, Eels and Herrings / Minnows, Characins and Catfishes

### **UNIT-5**

Smelt-Pike & Anglerfish-Dragonfish

Percomorpha Flounders, Puffers and Molas

Zoogeography of Freshwater Fishes

Zoogeography of Marine Fishes



## Capture fisheries

**UNIT –I:** FISHERY BIOLOGY Classification of fishes – Morphometric and Meristic Characters – Length weight Relationship- Food and Feeding Habits – Reproductive Biology- Fish Physiology – Developmental Biology of Fin Fish, Shell fishes – Aquatic Ecology.

**UNIT –II:** INLAND & MARINE FISHERIES Capture fishery resource of India – Major Riverine fisheries of India – Lake Fisheries Reservoir Fisheries – Cold Water Fisheries – Pollution in Inland Waters. Principal Marine Fisheries of Indian Coasts–Crustaceanfishery resources-shrimps, lobsters- Molluscan resources-Gastropods, Bivalves- Sea weed Resources — Von Betalanffy's Growth equation –growth parameters – mortality parameters-Maximum Sustainable Yield-Distribution of living organisms in the Sea

**UNIT –III:** NAUTICAL TECHNOLOGY Compass – Navigational Charts – Mercator Projections – Buoyage System – International Codeflag signals –Navigational lights-Firefighting –Strom Signals – Distress Signals – Life Saving Appliances-Life buoy-Life jackets-Life raft

**UNIT – IV:** FISH PROCESSING TECHNOLOGY Proximate composition of fish –principle of fish spoilage– Rigor Mortis – Drying, Salt drying, Icing, Freezing, Canning, Fishery by products, Fish packaging technology.

**UNIT –V:** AQUACULTURE Site selection for fish culture –composite fish culture– Plankton – Fertilization – Aqua feeds – Pond disinfection with lime -Water quality management – Disease control-common fresh water ornamental Fishes.

**UNIT – VI:** OCEANOGRAPHY AND METEOROLOGY Waves- Tides- Currents- El – Nino – Salinity – Tsunamis – Weather – Climate – humidity- Tropical Cyclones – Atmospheric pressure.

### III SEMESTER

#### Z301. POPULATION ECOLOGY

##### UNIT-I

Ecology: Nature and scope of ecology; ecosystem structure and function.

Composition: Abiotic and biotic components; classification of ecosystem with examples; feedback loop.

Tropic dynamics of ecosystem: Energy flow; food chain; food web; tropic levels; ecological pyramids.

Major terrestrial biomes.

Concept of productivity.

##### UNIT-II

Population growth – Natality and Mortality, Biotic Potential and Environmental resistance – Form of population growth – Logistic Curve – Stochastic and time log models of population growth – Optimal yield.

Population Regulation – Effects of increased numbers – Harmful Effects – Beneficial Effects – Protection – Influence on reproduction – Division of labour

Population – Inter-specific relationships – Positive interactions – Commensalism – Mutualism – Negative interactions – Predation – Parasitism – Antibiosis

##### UNIT-III

Community concept – Community dominance – Ecotone – Community composition – Stratification of community

Habitat and Ecological Niche – Ecological Equivalents – Sympatry and Allopatry – Spatial relations of populations – Space requirements – Home range and Territory – Homing and return migration – Emigration

##### UNIT-IV

Demography – Life Tables – Net Reproductive rate – Longevity and theories of ageing – Reproductive strategies

Fish population – Population density – Population structure : Year classes – Estimation of population – Population dynamics – Abundance in population and fishery – Population dynamics and fishery catches.

##### Suggested Reading Material:

1. Begon, M., J.L. Harper and C.R. Townsend. Ecology, Individuals, Populations and Communities. Blackwell Science, Oxford, UK.
2. Koromondy, E.J. Concepts of ecology. Prentice Hall, New Delhi.
3. Clarke, G.L. Elements of Ecology, John Wiley & Sons, New York.
4. Odum, E.P. Fundamentals of Ecology. W.B. Saunders, Philadelphia.
5. Krebs, C.J. Ecology. Harper & Row, New York.
6. Jorgensen, S.E. Fundamentals of Ecological modeling. Elsevier, New York.
7. Chapman J.L and Reiss M.J. 1995. *Ecology Principles and Application*. Cambridge University Press.
8. Trivedy RK, Goel and Trisa. 1997. *Practical methods in Ecology & Environmental Science*.

## II SEMESTER

### Paper 7: POPULATION GENETICS AND EVOLUTION

#### Unit - I :

1. Introduction to Evolutionary Theory, Darwin and the Theory of Evolution, Natural Selection, The Modern Synthesis, Evolution of populations
2. Hardy -Weinberg law of genetic equilibrium and estimating allele frequencies, Assumptions and Testing Hardy-Weinberg principle, An introduction to Bayesian inference, Factors affecting human diseases frequency

#### Unit - II :

- 3.0. Quantifying genetic variability
  - 3.1. Genetic structure of natural populations
  - 3.2. Phenotypic variation
- 4.0. Genetics of quantitative traits in populations
  - 4.1. Analysis of quantitative traits
  - 4.2. Quantitative traits and natural selection
  - 4.3. Estimation of heritability
  - 4.4. Genotype - environment interactions
  - 4.5. Inbreeding, depression and Heterosis

#### Unit - III :

- 5.0. Genetics of speciation
  - 5.1. Phylogenetic and biological concept of species
  - 5.2. Patterns and mechanisms of reproductive isolation
  - 5.3. Models of speciation (Allopatric, Sympatric, Parapatric)
- 6.0. Molecular evolution
  - 6.1. Gene evolution
  - 6.2. Evolution of gene families, Molecular drive

## **Unit – IV :**

### 7.0. Origin of higher categories

- 7.1. Phylogenetic gradualism and punctuated equilibrium
- 7.2. Micro- and macro-evolution

### 8.0. Molecular Phylogenetics

- 8.1. How to construct Phylogenetic trees?
- 8.2. Immunological techniques, Restriction Enzyme sites
- 8.3. Amino acid phylogeny-DNA-DNA hybridizations, Nucleotide sequence comparisons and homologies

### **Practical :**

1. Population genetics : Calculating gene frequencies and genotype frequencies for Autosomal dominant traits, Autosomal recessive traits. Using Binomial distribution
2. Quantitative Genetics : Mean, Standard Deviation, Chi-Square & Variance
3. Problems on related topics
4. Multifactor inheritance

### **Suggested Reading Material :**

1. Dobzhansky, Th. Genetics and origin of Species. Colombia University Press
2. Dobzhansky, Th., F.J. Ayala. G.L. Stebbens and J.M. Valentine. Evolution , Surjeet Publication, Delhi.
3. Futuyama, D.J. Evolutionary Biology. Suinuaer Associates, INS Publishers, Dunderland
4. Hartl, D.L. A Primer of population genetics. Sinauer Associates, INC, Massachusetts
5. Jha, A.P. Genes and Evolution, John Publication, New Delhi
6. King, M. Species Evolution – the role of chromosomal change. The Cambridge University Press, Cambridge.
7. Merrel, D.J. Evolution and genetics. Oxford University Press, New York
8. Strikberger, M.W. Evolution. Jones and Bartett Publishers, Boston, London.

## **Paper 14: POPULATION ECOLOGY & ANIMAL BEHAVIOUR**

### **Unit - I :**

1.0 Population group properties- population dispersion- population density - estimation of fish population density - natality- mortality- age structure- age pyramids- survival ship curves- Biotic potential- environmental resistance - carrying capacity

1.1 Population regulation- density dependent factors- density independent factors- effects of increased numbers- harmful effects- beneficial effects

1.2 Population - Inter-specific relationships - Positive interactions - Commensalism- Mutualism - Negative interactions - Predation - Parasitism - Antibiosis.

### **Unit II**

2.0 Population growth - Assumptions of Logistic and exponential growth models - population fluctuations -population cycle- -Lotka-Volterra equations

2.1 Demography - Life Tables. - Net Reproductive rate- Reproductive strategies.

2.2 Habitat and Ecological Niche - Ecological Equivalents - Sympatry and Allopatry- Community concept - Community dominance - Ecotone - Community composition

### **Unit - III :**

3.0 Animal psychology - classification of behavioural patterns, analysis of behaviour (ethogram)

3.1. Innate behaviour.

4.0. Ecological & Social aspects of behaviour

- 4.1. Habitat selection, food selection, Optimal foraging, theory, antipredator defenses
- 4.2. Aggression, homing, territoriality, dispersal, Schooling in fishes, flocking in birds, herding in mammals
- 4.3. Group selection, kin selection, altruism, reciprocal altruism, inclusive fitness
- 4.4 Social organization in insects and primates

**Unit - IV :**

5. 0. Biological rhythms

- 5.1. Circadian and circannual rhythms
- 5.2. Orientation and navigation
- 5.3. Migrations of fish, turtle and birds

6.0. Perception of the environment & communication

- 6.1. Mechanical
- 6.2. Chemical
- 6.3. Auditory
- 6.4. Visual.

**Practical :**

1. Enumeration and identification of phytoplankton
2. Enumeration and identification of Zooplankton
3. Enumeration of phytal fauna
4. Enumeration of Rocky shore fauna
5. Creation of Life Table
6. Calculation of net reproductive rate ( $R_0$ ), Generation time (T), Rate of intrinsic growth and optimal age for sexual maturity
7. Calculation of logistic and exponential growth of a given population
8. An introduction to animal behaviour - Animal Psychology - Classification of behavioural patterns
9. Perception of the environment - Examples
10. communication - Examples from invertebrates and vertebrates (Terrestrial, Aerial, Aquatic habitats)

## Paper 21: PRINCIPLES OF BIOTECHNOLOGY

①

### Unit - I :

1. Concepts of Biotechnology: Scope and importance. Biotechnology in India
2. Recombinant DNA and gene cloning : Cloning and expression vectors Chimeric DNA. Gene Libraries

### Unit - II :

3. Polymerase chain reaction (PCR)
4. Gene amplification : Basic PCR and its modifications, Applications of PCR in Biotechnology and genetic engineering

### Unit - III :

5. Animal cell and tissue culture : Laboratory facilities, culture media and procedures, primary culture, cell lines, cloning tissue and organ culture
6. Biotechnology in Medicine : animal and human health care, genetic counseling, forensic medicine

### Unit - IV :

7. Biotechnology and Environment : Pollution control environment and energy, biodiversity and conservation
8. Biotechnology and intellectual property :
  - 8.1. Intellectual Property Rights (IPR)
  - 8.2. Intellectual Property Protection (IPP)

### Practical :

1. Determination of DNA, RNA, Glucose, Proteins and Lipids. Polyacrylamide gel electrophoresis (PAGE), Southern Blotting and Northern Blotting. PCR demonstration.

### Suggested Reading Material :

1. Gupta, P.K. Elements of Biotechnology
2. Singh, B.D. Biotechnology
3. Balasubramanian. Concepts in Biotechnology

# PRINCIPLES OF BIOTECHNOLOGY

## UNIT-I

1. Concepts of Biotechnology: Scope and importance. Biotechnology in India
2. Recombinant DNA and gene cloning: Cloning and expression vectors Chimeric DNA. Gene Libraries

## UNIT-II

1. Polymerase chain reaction (PCR)
2. Gene amplification: Basic PCR and its modifications, Applications of PCR in Biotechnology and genetic engineering

## UNIT-III

1. Animal cell and tissue culture: Laboratory facilities, culture media and procedures, primary culture, cell lines, cloning tissue and organ culture 626-632
2. Biotechnology in Medicine: animal and human health care, genetic counseling, forensic medicine

## UNIT-IV

1. Biotechnology and Environment: Pollution control environment and energy, biodiversity and conservation
2. Biotechnology and intellectual property: Intellectual Property Rights (IPR) Intellectual Property Protection (IPP)

### Suggested Reading Material:

1. Gupta, P.K. Elements of Biotechnology
2. Singh, B.D. Biotechnology
3. Balasubramanian. Concepts in Biotechnology

Z403. AQUACULTURE

UNIT-I