GOVT. MADHAV SCIENCE COLLEGE, UJJAIN M.P.

A GRADE ACCREDITED THROUGH NAAC
DST-FIST COLLEGE

Self-Declaration

This is certified that Govt. Madhav Science College Ujjain being affiliated Govt. College, has adopted syllabus approved from CBOS in case of conventional subjects and Syllabus approved from University BOS in case of Self-Finance Subjects in PG Classes

Principal
Govt. Madhav Science College Ujjain

Signature Not Verified
ARPAN BHARDWAJ
E=ARPANBHARDW
AJ11@GMAIL.COM,

Department of Higher Education, Govt. of M.P.
Semester wise syllabus for Postgraduates
As recommended by Central Board of Studies and
Approved by H.E. the Governor of M.P
Session 2008-09

M. Sc. Botany (Semester System)

First Semester
Course PG 102: Biology & Diversity of Algae, Bryophytes and Pteridophytes

UNIT I: Algae in diversified habitats; thallus organization; cell ultrastructure; reproduction; criteria for classification of algae, pigments, researve foods, flagella; classification.

UNIT II: Salient features of Protochlorophyta, charophyta, chlorophyta, xanthophyta, bacillariophyta, phaeophyta and rhodophyta; algal blooms; algal biofertilizers; algae as food, feed and industrial uses.

UNITIII: Morphology, structure, reproduction and life history of bryophyta; distribution, classification, general accounts of marchantiales, jungermeniales, anthocerotales, sphagnales, funariales and polytrichales; ecological and economic importance.

UNIT IV: Morphology, anatomy, reproduction and life history of pteridophyta; classification, evolution of stele, heterospory and origin of seed habits.

UNIT V: Introduction to psilopsida, sphenopsida and pteropsida.

Suggested Readings

Smith G. M.~ Cryptogamic Botany VoL I(2nd edition)~ TataMcGraw-Hill Publishing Company Ltd. Bombay -New Delhi.

Kumar H. D. 1988: Introductory Phycology. Affiliated East-West Press Ltd. New Delhi.

Paribar~ N.S. 1991: Bryophyta. Central Book Depot. Allahabad.

Brower~ 1926: Primitive Land Plants~ Cambridge At the University Press.

Kashyap~ 1972 LivelWorts of Western Himalayas and Punjab. Researchco Publication.

Smith, G. M.~ Cryptogamic Botany VoL n (2nd edition)~ TataMc Graw -Hill Publishing Company~ Bombay -New Delhi.

Puri P. 1980~ Bryophyta -Morphology, Growth & Differentiation. Atma Ram & Sons, Delhi.

Chopra & Kumar~ 1988: Biology of Bryophyta; Wiley Eastern Ltd.

Ram Udar; 1970: An Introduction to Bryophyta; Shashidhar Malviya Prakashan

Watson; 1968: Structure and life of Bryophyta; Hutchinson & Co. Ltd.

Campbell; 1939: The evolution of land plants; Stanford University.

Spome, K.R. 1991. The Morphology ot Ptenaopnyres.

Parihar N.S. 1996 Biology and Morphology of Pteridophytes, CentralBook Depot. Allahabad.

Smith G. M.; Cryptogamic Botany Vol. II; T ata Mc Graw –Hill Publishing Co. Bombay -New Delhi

Arnold C. A; An Introduction to Paleobotany; Tau Mc Graw --Hill Publishing Co. New Delhi.

Stewart, W. N. and RathwelL G. W. 1993. Paleobotany and the Evolution of Plants. Cambridge University Press.

Eames A J.; Morphology of Vascular Plants-Lower Groups.Tata Mc Graw -Hill Publishing Co. New Delhi

Rashid A. 1999; An Introduction to Pteridophytes; Vikas Publishing House Pvt. Ltd..

Parihar; 1965: Pteridophyta; Central Book Depot. Allahabad.

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M. Sc. Botany (Semester System)

First Semester

Course PG 101: Biology & Diversity of Viruses, Bacteria and Fungi

UNIT I: Viruses: characteristics and ultrastructurte of virions, isolation and purification of viruses; chemical nature, replication, transmission of viruses; economic importance.

UNIT II: Archaebacteria and Eubacteria: General account; ultrastructure, nutrition and reproduction; biology and economic importance; cyanobacteria – salient features and biological importance.

UNITIII: Classification of bacteria, Actinomycetes, *Mycoplasma, Rickettsiae, Chlamydiae* and their significance.

IIT IV: Mycology: classification and general characters of fungi; substrate relationship in fungi; cell ultrastructure; unicellular and multicellular organization; cell wall composition; nutrition(saprobic, biotrophic, symbiotic); reproduction (vegetative, asexual,sexual), heterothallic; parasexuality; recent trends in classification.

UNIT V: Phylogeny of Fungi: Phylogeny of fungi; general account of Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina; fungi in industry, medicine and as food; fungul diseases in plants and humans; Mycorriza; fungi as biocontrol agents.

Suggested Readings

Alexopoulus, C.J. Mims, C. W. and Blackwel, M; 1996: Introductory coO' Mycology, Jbon Wjley & Sons Inc.

Clifton, A; 1958: Introduction to Bacteria, Mcgraw- Hills Book Co.New Delhi.

Madigan, M T. Martinko, J. M and Parker Jack; I 997: Brock Biology Of Microorganisms, (8th)Jition) Prentice Hall, N,J. U.S.A

Mandahar, C. L.; 1978: Introduction to Plant Viruses. Chand & Co.Ltd. Delhi.

Mehrotra, RS. and Aneja, RS.; 1998: An Introduction to Mycology. New Age Intermediate ess.

ngaswamy, G. and Mahadevan, A; 1999: Diseases of Crop Plants in Indja (4th ition).PrentjceHaJl ofInilia Ltd. New Delbj.

Webster, J.; 1985: Introduction to Fungi Cambridge University Press. Dubey, R C. & Maheshwari, D. K.; 2005: A Text Book of Microbjology, S. Chand Publisher, New Delhi

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M. Sc. Botany (Semester System)

First Semester
Course PG 103: Biology & Diversity of Gymnosperms

UNIT I: Introduction: Gymnosperms, the vesseless and fruitless seed plants; evolution of gymnsperms; complexity of female gametophytes.

UNIT II: Classification of gymnosperms and their distribution in India. Economic importance of gymnosperms

UNITIII: Gerenal account of pteridospermales, cycadeoidales and cordaitales.

UNIT IV:Structure, reproduction and interrelationships of cycadales, ginkgoales and coniferales.

UNIT V: Structure, reproduction and interrelationships of ephedrales, welwitschiales and gnetales.

Suggested Readings

Bhatnagar, S.P. and Moitra, A; 1996: Gymnosperms. New Age International Pvt. Ltd., New Delhi.

Singh H.; 1978: Embryology of Gymnosperms, Encyclopedia of Plant Anatomy X. Gebruder Bortraeger, Berlin.

Spome K R; 1991: The Morphology of Gymnosperms; Hutchinson Univ. Library; London.

Foster A S. & Gifford E. M; Comparative morphology of vascular Plants; Vakils, Feffer, & Simons Private Ltd. Bombay. Chamberlain; Gymnosperms -Structure & Evolution; CBS Publishers & Distributors Delhi.

Shukla A C. & Mishra S. P.; Essentials of Paleobotany; Vikas Publishing House Pvt. Ltd. Delhi-Bombay-:6angalore-Calcutta-Kanpur .

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M. Sc. Botany (Semester System)

First Semester
Course PG 104: Plant Ecology

UNIT I: **Population Ecology**: Ecology & ecosystem: Definitions, Organization and components, Population & Environment; Population ecology, density & distribution, Natality, Mortality, Survivorship curves, Age structure & pyramids, Fecundity schedules, Life tables; Population growth – exponential and logistic curves; Intra specific competition and self regulation; r-and k-strategists.

UNIT II: **Community organization**: Concepts of community and continuum; Analysis of community analytical and synthetic characters, Community coefficients and indices of diversity, interspecific association negative and positive associations; Concept of ecological niche; Concepts of biodiversity; evolution and differentiation of species – allopatric & sypatric speciation; ecads and ecotypes.

UNITIII: **Ecosystem development and stability**: Temporal changes cyclic and non cyclic; Succession processes & types; Mechanism of succession facilitation, Tolerance and inhibition models; Concept of climax persistence resilience and resistance; Ecological perturbation natural and anthropogenic, Ecosystem restoration.

UNIT IV: **Fate of energy in ecosystems**: Trophic organization and structure, Food chains & webs; energy flow pathways, Ecological efficiencies consumption, assimilation and production trophic; Primary production methods of measurement, Global patterns, Limiting factors.

UNIT V: **Fate of matter in ecosystems**: Recycling pathways; Relationship between energy flow and recycling pathways; Nutrient exchange and cycling; Global biogeochemical cycles of C, N, P and S; Physical, chemical and Biological characteristics of soil.

Suggested Readings

Smith. R.L. 1996. Ecology and Field Biology. Harper Collins. New York.

Muller-Dombois. D. and Ellenberg. H.1974. Aims and Methods 01 Vegetation Ecology. Wiley, New York

Begon. M.. Harper, J.L. and Townsend, C.R. 1996. Ecology. Blackwell Science. Cambridge.

Ludwig. J. and Reynolds. J.F. 1988. Statistical Ecology. John Wiley & Sons.

Odum. E.P. 1971. Fundamentals of Ecology. Saunders, Philadelphia.

Odum, E.P. 1983. Basic Ecology. Saunders, Philadelphia.

;Barbour, M.G., Burk, J.H. and Pitts, W.O. 1987. Terrestrial Plant Ecology. Cummings Publication Company, California.

Kormondy, E.J. 1996. Concepts of Ecology. Prentice-Hall of India Pvt. Ltd., New Delhi.

Chapman, J.L. and Reiss, M.J. 1988. Ecology: Principles and Applications. t::ambridge University Press, Cambridge, U.K.

Moldan, B. and Billharz, S. 1997. Sustainability Indicators. John Wiley & Sons, New York.

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M. Sc. Botany (Semester System)

Second Semester
Course PG 201: Plant Development & Reproduction

Prof A. Dubey + Prof NS DAWAR

UNIT I: Unique features of plant development; differences between animal and plant development. Organization of shoot apical meristem (SAM); control of tissue differentiation, especially xylem and phloem; secretory ducts and laticifers. Wood development in relation to environmental factors.

UNIT II: Leaf growth and differentiation. Organization of root apical meristem (RAM); cell fates and lineages; vascular tissue differentiation; lateral roots; root hairs. Root – microbe interaction.

UNITIII: Vegetative options and sexual reproduction; flower development; genetics of floral organ differentiation; homeotic mutants in *Arabidiopsis* and *Antirrhinum*; sex determination. Structrue of anthers, microsporogenesis, role of tapetum, pollen development and gene expression.

UNIT IV: Male sterility; pollen germination, pollen tube greet and guidance. Pollen storage, pollen allergy and pollen embryos. Ovule development, megasporogenesis; organization of embryo sac; structure of embryo sac cells.

UNIT V: Flora characterisitics; pollination mechanisms and vectors; breeding systems; structure of pistil; pollen stigma interactions; sporophytic and gametophytic self-incompatibility. Double fertilization. Endosperm development during early, maturation and dessication stages; embryogenesis; storage proteins of endosperms and embryo. Polyembryoni, apomixis. Dynamics of fruit growth; biochemistry and molecular biology of fruit maturation.

Suggested Readings

Bhojwani,S.S.and Bhatnagar,S.P.2000. The Embryology of Angiosperms(4th revised and enlarged edition). Vikas Publishing House,New Delhi.

Burgess.J.1985.An introduction to Plant Cell Development.Cambridge University Press, Cambridge.

Fageri,K.and Van der Pijl,L1979. The Principles of Pollination Ecology .Pergamon Press, Oxford.

Fahn, A 1 982.Plant Anatomy.(3rd edition).Pergamon Press,Oxford.

F oskel, D .E.1994 .Plant Growth and Development. A Molecular Approach.Academic Press, San Diego.

Howell, S.H.1998. Molecular Genetics of Piant Development, Cambridge University Press, Cambridge.

Leins,P., Tucker,S.C.and Endress,P .K.1988.Aspects of Floral Development. J. Cramer, Germany.

Lyndon, R.F.1990.Plant Development. The Cellular Basis. Unin Hyman .London.

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M. Sc. Botany (Semester System)

Second Semester
Course PG 202: Morphology & Taxonomy of Angiosperms

Proof S. Soni

UNIT I: Morphology of stamens and carpels; carpel evolution. Morphology of inferior ovary; placentation types and their origin.

UNIT II: The species concept: taxonomic hierarchy; species, genus, family and other categories; principles used in assessing relationships, delimitation of taxa and attribution of rank. Salient features of Interantional code of Botanical Nomenclature.

UNIT III: Taxonomic evidence: morphology, anatomy, palynology, embryology, cytology, phytochemistry, genome analysis and nucleic acid hybridization. Relevance of taxonomy to conservation.

UNIT IV: Taxonomic tools: herbarium, floras, histological, cytological, phytochemical, serological, biochemical and molecular techniques; Computers and GIS. Local plant diversity and its socio-economic importance.

UNIT V: Systems of angiosperm classification: phenetic versus phylogenetic systems; cladistics in taxonomy; relative merits and demerits of major systems of classification. Endemism, hot spots, hottest hot spots; plant explorations; invasions and introductions.

Suggested Readings

Heywood & Moore, D.M; 1984: CWTent concept *in* Plant Taxonomy Academic Press.
Banson, L.B.; 1957: Plant Classification, Health& Co. Boston.
Davis, P.R & Heywood, V.H 1973: Principles of Angiosperms and Taxonomy, Robert E. Kreiger Pub. Co. New *York*, USA
Eames, Al.; 1961: Morphology of Angiosperms, Mc-Graw Hill, New York.
Jeffery, C.; 1968: An Introduction to Plant Taxonomy J. & H. Churchill Limited.
Lawrence, G .H.M.; 1951: Taxonomy of Vascular Plants Macmillan, New York.
Naik V. N.; 1984: Taxonomy of Angiosperms. Tata Mc-Graw Hill Pub. Co. Ltd. New Delhi.
Porter, L.L.; 1959: Taxonomy of Flowering Plants. San Francisco. Radfor~ *AE.* Dickinson, W.C. MasseyJ.R and. Ben. C.R: 1974: VQ~llar Plant SYstematics, Harper & Row, New York

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M. Sc. Botany (Semester System)

Second Semester
Course PG 203: Utilization & Conservation of Plant Resources

UNIT I: **Plant Biodiversity:** Major Biomes of the world, Tropical rain & Seasonal Forests, Temperate rain & Seasonal forests, Boreal forests, Grasslands, Deserts; Aquatic Ecosystems, wetlands, Lakes & Ponds Streams & Rivers, Marine & Estuarine habitats.

UNIT II: **Sustainable Development:** Resource utilization; Status & Utilization of Biodiversity; Sustainable development and utilization of resources from forest, Grassland and aquatic habitats; Food forage, Fodder, Timber & Non-wood forest products; Threats to quality & quantity of Resources due to overexploitation.

UNITIII: **Strategies for conservation of resources:** Classifications of resources; Principles of conservation; *In-situ* conservation, sanctuaries, National parks, Biosphere reserves for wildlife conservation; Habitat conservation practices of conservation for forests, ranges, soil and water; Ex-situ conservation, botanical gardens, field gene banks, seed banks, in vitro repositories, cryo-banks.

UNIT IV: **Pollution & Climate Change:** Air, Water and Soil pollution, Kinds, Sources, Quality parameters, Effects on structure & function of ecosystems; Management of pollution; Bioremediation; Climate changes sources, Trends & role of greenhouse gases, Effect of global warming on climate, Ecosystem processes & Biodiversity; Ozone layer & Ozone hole.

UNIT V: **Resource monitoring:** Remote sensing concepts & Tools, Satellite remote sensing basics sensors, Visual & digital interpretation, EMR bands and their applications; Indian remote sensing program; Thematic mapping of resources; Application of remote sensing in Ecology & Forestry.

Suggested Readings

Moldan, B. and Billharz, S. 1997. Sustainability Indicators. John Wiley & Sons, New York.

Treshow. M. 1985. Air Pollution and Plant Life. Wiley Interscience.

Heywood, V.H. and Watson. R.T. 1995. Global Biodiversity Assessment. Cambridge University Press.

Mason, C.F. 1991. Biology of Freshwater Pollution. Longman.

Hill. M.K. 1997. Understanding Environmental Pollution. Cambridge University Press.

Brady, N.C. 1990. The Nature and Properties of Soils. MacMillan.

Kothari, A 1997. Understanding Biodiversity: Life'Sustainability and Equity. Orient Longman.

Kohli, R., Arya, K.S., Singh, P.H. and Dhillon, H.S. 1994. Tree Directory of Chandigarh. Lovedale Educational, New Delhi.

Nair, M.N.B. et. al (Eds) 1998. Sustainable Management of Non-wood Forest Products. Faculty of Forestry, Universiti Putra Malaysia. 434004 PM Serdong, Selangor, Malaysia.

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M. Sc. Botany (Semester System)

Second Semester
Course PG 204: Cell Biology of Plants

UNIT I: Structural organization of the plant cell; specialized plant cell types. Structure and functions of cell wall; biogenesis; growth. Cytoskeleton: organization and role of microtubules and microfilaments; motor movements.

UNIT II: Plasma membrane: structure, models and functions; sites for ATPases; ion carriers, channels and pumps; receptors. Structure of plasmodesmata, role in movement of molecules; comparison with gap junctions.

UNITIII: Cholorplast: structure, genome organization, gene expression, nucleo-chloroplastic interactions; mitochondira: structure, genome organization, biogenesis. Plant vacuoles: tonoplast membrane, ATPases, trasporters, as storage organelle. Other cell organelles: golgi apparatus, lysosomes, endoplasmic reticulum.

JNIT IV:Nucleus: structure. Cell cycle: control mechanisms; role of cyclins and cyclin-dependent kinases; mechanisms of programmed cell death. Chromosome structure and packaging of DNA; euchromatin and heterochromatin; karyotype analysis and evolution; banding patterns; specialized types of chromosomes.

NIT V: Origin, meiosis and breeding behaviour of duplication, deficiency, inversion and translocation heterzygotes; origin, occurrence, production and meiosis of haploids, aneuploids and euploids; Origin and production of autopolyploids. Allopolyploids; types, genome constitution and analysis.

ggested Readings

vin, B. 2000, Genes VIL Oxford University Press, New York.

erts, B., Bray, D., Lewis, J., Ratf, M., Roberts, K., and Watson, J.D. Molecular Biology of Cell. Garland Publishing:Inc., New York.

fe, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA

T. et: al. 1998.Plant Biology, Wadsworth Publishing Co., California, U.S.A

murthy K V. 2000 Methods in Cell Wall Cytochemistry, CRC Press, Boca Raton, ja U.S.A

anari, B.B. Groissem, W. and Jones, RL. 2000. Biochemistry And Molecular Biology of s. American Society of Plant Physiologists, Maryland, USA

.N. 2000: Plant Cell Vacuoles: An Introduction. CSIRO Publication, ColliJ18W~ alia.

Department of Higher Education, Govt. of M.P.
Post Graduate Semester wise Syllabus
as recommended by Central Board of Studies and approved by the Governor of M.P.
उच्च शिक्षा विभाग, म.प्र. शासन
स्नातकोत्तर कक्षाओं के लिये सेमेस्टर अनुसार पाठ्यक्रम
केंद्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा म. प्र. के राज्यपाल द्वारा अनुमोदित

Session (सत्र) 2010–2011

Class / कक्षा	**: M. Sc.**
Semester / सेमेस्टर	**: III semester**
Subject / विषय	**: Botany**
Title of Subject Group	**: Plant Physiology**
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र कमांक	: PG 301
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: Compulsory
Max. Marks अधिकतम अंक	: 35 +CCE 15=50

Particulars / विवरण

Unit-1	Structure and functions of ATP, Plant water relations, mechanisms of water transport through xylem, root-microbe interactions in facilitating nutrient uptake. Membrane transport proteins.
Unit-2	Phloem transport; phloem loading and unloading, passive and active solute transport. Signal transduction; overview, receptors and proteins, phospholipids singaling, role of cyclic nucleotides, calcium-calmodulin cascade. Specific signaling mechanisms, for example, two-component sensor regulator system in bacteria and plants.
Unit-3	Plant growth regulators and elicitors: Physiological effects and mechanism of action of auxins, gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, polyamines, jasmonic acid, and salicylic acid. Hormone receptors.
Unit-4	Flowering process: photoperiodism and its significance, endogenous clock and its regulation. Floral induction and development. Phytochromes and cryptochromes, their photochemical and biochemical properties, Role of vernalization.
Unit-5	Stress physiology: Plant responses to biotic and abiotic stress. Water deficit and drought resistance. Salinity stress and resistance. Concepts of freezing, heat and oxidative stresses.

Suggested Laboratory Exercise based on P.G 301 :

1. Radioisotope methodology, autoradiography, instrumentation (GM counter & scintillation counter) and principles involved.
2. Principles of colorimetry, Spectrophotometry and florimetry.
3. Determine rate of transpiration by Ganong's potometer.
4. Determine rate of respiration in germinating/young buds by Ganong's respirometer.

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Session (सत्र) 2010–2011

Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	: III semester
Subject / विषय	: Botany
Title of Subject Group	: **Plant Biochemistry & Metabolism**
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र कमांक	: PG 302
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: Compulsory
Max. Marks अधिकतम अंक	: 35 +CCE 15=50

Particulars / विवरण

Unit-1	Fundamentals of enzymology: allosteric mechanism, regulatory and active sites, isozymes, kinetics of enzymatic catalysis, Michaelis- Menten equation and its significance, Mechanism of enzyme action.
Unit-2	Photochemistry and photosynthesis: General concepts, evolution of photosynthetic apparatus, photosynthetic pigments and light –harvesting complexes. Photooxidation of water, mechanism of electron and proton transport, Carbon assimilation; Calvin cycle, photorespiration and its significance, C4-cycle, CAM pathway, physiological and ecological considerations.
Unit-3	Respiration and lipid metabolism: Overview of plant respiration, glycolysis, TCA cycle, electron transport and ATP synthesis. Oxidative pentose phosphate pathway, glyoxylate cycle, alternative oxidase system.
Unit-4	Structure and functions of lipids, fatty acid biosynthesis, structural lipids and storage lipids and their catabolism. Sulphate uptake, transport and assimilation.
Unit-5	Nitrogen fixation, nitrogen and sulphur metabolism: Overview, biological nitrogen fixation, nodule formation. Mechanism of uptake and reduction, ammonium assimilation.

Suggested Laboratory Exercise based on P.G 302 :

1. Effect of time and enzyme concentration on the rate of reaction of enzyme C e.g. acid Phosphatase, nitrate reductase.
2. Effect of substrate concentration on activity of any enzyme C (catalase, Amylase)
3. Demonstration of the substrate inducibility of the enzyme nitrate reductase.
4. Determination of succinate dehydrogenase activity, Its kinetics and sensitivity to inhibitors.

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Session (सत्र) 2010–2011

Class / कक्षा : M.Sc.
Semester / सेमेस्टर : III semester
Subject / विषय : Botany
Title of Subject Group : **Genetics & Cytogenetics**
विषय समूह का शीर्षक :
Paper No. / प्रश्नपत्र कमांक : PG 303
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य :Compulsory
Max. Marks अधिकतम अंक :35 +CCE 15=50

Particulars / विवरण

Unit-1	Genetics of prokaryotes and eukaryotic; genetic recombination in prokaryotes, genetic transformation, conjugation and transduction in bacteria. Genetics of mitochondria and chloroplasts; cytoplasmic male sterility.
Unit-2	Genetic recombination and genetic mapping in eukaryotes; Recombination, independent assortment and crossing-over, molecular mechanism of recombination. Chromosome mapping, linkage groups, genetic markers, construction of molecular maps, somatic cell genetics- an alternative approach to gene mapping.
Unit-3	Mutations: spontaneous and induced mutations, physical and chemical mutagens, molecular basis of gene mutations. Transposable elements in prokaryotes and eukaryotes. Mutations induced by transposons, DNA damage and repair mechanisms.
Unit-4	Cytogenetics of numerical and structural changes of chromosomes. Euploidy, aneuploidy: origin, meiosis and effect. Cytogenetics of deficiencies., duplication, inversions and translocation.
Unit-5	Molecular Cytogenetics; Nuclear DNA content, c-value paradox, *cot* curve and its significance, restriction mapping – concept and techniques, multigene families and their evolution. Transfer of whole genome, examples from wheat and *Brassica, Arachis.*

Suggested Laboratory Exercise based on P.G 303 :

1. Isolation of DNA & preparation of 'Cot' curve
2. Demonstration of SEM & TEM.
3. Isolation of Mitochondria and its marker enzyme, succinate dehydrogenase (SDH)
4. Demonstration of Mitosis/ Meiosis (Normal & abnormal)

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Session (सत्र) 2010–2011

Class / कक्षा : M.Sc.
Semester / सेमेस्टर : III semester
Subject / विषय : Botany
Title of Subject Group : **Molecular Biology**
विषय समूह का शीर्षक :
Paper No. / प्रश्नपत्र कमांक : PG 304
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य : Compulsory
Max. Marks अधिकतम अंक : 35 +CCE 15=50

Particulars / विवरण

Unit-1	DNA structure; A, B and Z forms; transcription; plant promoters and transcription factors; splicing; messenger RNA transport; ribosomal RNA biosynthesis.
Unit-2	Gene structure and expression; genetic fine structure; cis-trans test; fine structure analysis of eukaryotes; introns and their significance; RNA splicing; regulation of gene expression in prokaryotes and eukaryotes.
Unit-3	Ribsosomes: structure and site of protein synthesis; mechanism of translation, initiation, elongation and termination; structure and role of transfer RNA; protein sorting; targeting of proteins to organelles.
Unit-4	Cell cycle and apoptosis, control mechanisms; role of cyclins and cyclin dependent kinases; cytokinesis and cell plate formation; mechanism of programmed cell death. DNA replication in prokaryotes and eukaryotes.
Unit-5	Immunotechniques, In situ hybridization – concepts and techniques, physical mapping of genes on chromosomes. In situ hybridization to locate transcript in cell types; FISH; Flow cytometry.

uggested Laboratory based on PG 304:

1. Isolation of genomic DNA from plant tissue using CTAB (cetyetri methyl ammonium bromide) or any animal tissue.
2. Isolation of DNA & its quantitation by a spectrophometric method.
3. Restriction digestion of plant DNA, its seperation by Agrose gel electrophoresis and visualization by ethidium bromide staining.
4. Isolation of RNA and quantitation by a spectrophotometric method. (Complete write)
5. Separation of RNA by Agrose gel electrophoresis and visualization by Et. Br. staining.
6. Immunological techniques : Ouchterlony method, ELISA & western blotting.
7. Isolation of ~~chloroplats and~~ SDS-PAGE. ~~profile of proteins to demarcate the two subunits of Rubisco.~~ Protein

Other experiments based on theory paper.

Department of Higher Education, Govt. of M.P.
Post Graduate Semester wise Syllabus
as recommended by Central Board of Studies and approved by the Governor of M.P.
उच्च शिक्षा विभाग, म.प्र. शासन
स्नातकोत्तर कक्षाओं के लिये सेमेस्टर अनुसार पाठ्यक्रम
केंद्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा म. प्र. के राज्यपाल द्वारा अनुमोदित

Session (सत्र) 2010–2011

Total 50

Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	: IV semester
Subject / विषय	: Botany
Title of Subject Group विषय समूह का शीर्षक	: **Plant Cell, Tissue & Organ Culture**
Paper No. / प्रश्नपत्र कमांक	: PG 401
Compulsory / अनिवार्य या Optional / वैकल्पिक	: Compulsory
Max. Marks अधिकतम अंक	: 35 + CCE 15 =50

Particulars / विवरण

Unit-1	Plant cell and tissue culture: general introduction, history, scope, concept of cellular differentiation and totipotency.
Unit-2	Techniques of tissue culture. Organ culture – meristem, anther and embryo. In vitro fertilization.
Unit-3	Organogenesis and adventive embryogenesis; fundamental aspects of morphogenesis, somatic embryogenesis and androgenesis. Mechanisms, techniques and utility.
Unit-4	Somatic hybridization, protoplast isolation, fusion and culture, hybrid selection and regeneration; possibilities and achievements and limitations of protoplast research.
Unit-5	Application of plant tissue culture; clonal propagation; artificial seeds; production of hybrids, somaclones and somaclonal variation; production of secondary metabolites/ natural products; cryopreservation and germplasm storage.

Suggested Laboratory Exercise based on P.G 401 :

1. Sterilization techniques.
2. Preparation of culture medium.
3. Sterilization of medium.
4. To prepare tissue culture lab.
5. Sterilization of glassware.
6. Preparation of tissue culture medium.
7. Stertization of Explants.
8. Study effect of plant growth hormones (PGR) on tissue culture.
9. To perform the techniques of micro propagation/ somatic embryogenesis /androgenesis.
10. To perform the techniques of organogenesis.
11. Study of applications of tissue culture.

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Session (सत्र) 2010--2011

Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	: IV semester
Subject / विषय	: Botany
Title of Subject Group विषय समूह का शीर्षक	: Biotechnology & Genetic Engineering
Paper No. / प्रश्नपत्र कमांक	: PG 402
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: Compulsory
Max. Marks अधिकतम अंक	: 35 + CCE 15 =50

Particulars / विवरण

Unit-1	Biotechnology; basic concepts, principles and scope. Intellectual Property Rights possible ecological risks and ethical concerns.
Unit-2	Basic concepts of Recombinant DNA technology; gene cloning – principles and techniques; construction of genomic/ cDNA libraries; choice of vectors; DNA synthesis and sequencing, polymerase chain reaction. DNA fingerprinting
Unit-3	Genetic engineering of plants, aims, strategies for development of transgenics (with suitable examples); *Agrobacterium* – the natural genetic engineer; T-DNA and transposon mediated gene tagging; chloroplast transformation and its utility.
Unit-4	Microbial genetic manipulation; bacterial transformation; selection of recombinants and transformants; genetic improvements of industrial microbes and nitrogen fixers; fermentation technology.
Unit-5	Genomics and Proteomics; genetic and physical mapping of genes; molecular markers for introgression of useful traits; artificial chromosomes; high throughput sequencing; genome projects; bioinformatics; functional genomics; microarrays; protein profiling and its significance.

Suggested Laboratory Exercise based on P.G 402 :

1. To prepare biotechnology lab.
2. To demonstrate growth characteristics of E.coli using plating method.
3. To demonstrate growth characteristics of E.coli by turbidiometric method.
4. Demonstration of DNA sequencing by Sanger's dideoxy method.
5. Isolation of DNA and preparation of 'Cot' curve.
6. Isolation of DNA & its quantitation by a spectrophometric methods.

Vikram University, Ujjain

M. Sc. Botany IV Semester (403)

Syllabus

Elective Paper : Environmental Science

UNIT-1 ECOLOGY and ENVIRONMENT : History and scope of ecology, autecoloty, synecology, population, community, biome. Distinguishing characters of forests, grasslands, arid lands and wetlands; community organisation – concept of habitat, key stone species, dominant species. Species diversity and measurement of diversity. Biological communities and ecosystem. Bioelement cycling.

UNIT-2 NATURAL ENVIRONMENTAL RESOURCES AND CONSERVATION : Forest Resources- Forest Types of India, deforestation and its effects; Water Resources- Indian water resources, hydrological cycle, surface water, ground water, World water resources, distribution: Food Resources; Conservation of natural resources and environmental management.

UNIT-3 CURRENT ENVIRONMENTAL ISSUES : Climate change- Global Warming, Greenhouse Effect and Global Ozone Problems, Acid Rain, Atmosphere Turbidity and Nuclear Winter, Global Carbon Dioxide-rise and impact on Biosphere; Air, water and noise Pollution; Radiation hazards and environmental degradation.

UNIT-4 ENERGY PRODUCTION AND MANAGEMENT : Introduction, Energy Production and Consumption, sources of energy, Non-Conventional and Biological Energy; use of wastes and energy use pattern in India; Future energy scenario of the World. Nuclear energy and the risks

UNIT-5 ENVIRONMENTAL BIOTECHNOLOGY : Basic techniques in genetic engineering: Nucleic acid hybridisation and polymerase chain reaction as sensitive detection methods. Use of micro-organisms like thermophiles, alkalophiles; acidophiles, halophiles and psychrophiles in waste treatment and methane production; production of enzymes like cellulase, proteases, amylases; alcohol and acetic acid production.

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Session (सत्र) 2010–2011

Class / कक्षा : M.Sc.
Semester / सेमेस्टर : IV semester
Subject / विषय : Botany
Title of Subject Group : **Ethnobotany**
विषय समूह का शीर्षक :
Paper No. / प्रश्नपत्र कमांक : 404
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य : Elective Paper
Max. Marks अधिकतम अंक : 35 + CCE 15 = 50

Particulars / विवरण

Unit-1	Definition and scope of Ethnobotany Historical review and outline idea of archaeoethnobotany. Ethboecology, Ethromedicines, Ethnonarcotics. Ethnopharmacology, Ethnotaxonomy, Ethnocosmetics, Ethnolinguistics, Ethnoorthopaedics, Ethnopaediatrics.
Unit-2	Preservation of Genetic diversity, plants used in various systems of medicines, Ayurvedic, Unani and Homoeopathic system . Allopathic systems. Plants used by villagers and tribal people, Role of ethnobotany in the development of Society.
Unit-3	**Ethnobotanical importance of :** Aconitum napellus, Allium cepa,Mentha arvensis, Allium sativum, Nux-vomica, Aloe vera, Ocimum sanctum, Atropa belladona, Azadirchta indica, Piper nigrum, Butea manospora, Pterocarpus marsupium, Eugenra aromatica, Terminalia arjuna, Euginea jambolana, Terminalia bellerica, Hollarhena antidysenica, Terminalia chebula, Withania somnifera, Lawsonia inermis,
Unit-4	Plants in mythology, Taboos and Totems in relation to plants, folkore and folk tales, Wild life protection in tribal, plants domestication by the tribal. plants in similes and metaphors. Ethnobotanical importance of : Cassia fistula, Cannabis sativa, Ricinus communis, Emblica oficinalis, Santalum album
Unit-5	**Detailed study of the common plants and their parts used in the treatment of following diseases:** Expulsion of worms, Skin diseases, Bronchial inflammation & Asthma Tuberculosis, Urino - genital problems, Amoebic dysentery Malaria, Rheumatism, Leprosy, Jaundice, Heart diseases, Piles, Leukoderma

PRACTICALS: Laboratory exercises corresponding to theory courses covering all Units.

Session 2011-12

Scheme of Marks

M.Sc. Chemistry

SEMESTER-I

Paper	Paper Title	Code	Max.Marks
I	Inorganic Chemistry I	MCH-401	40+10 (CCE)=50
II	Organic Chemistry I	MCH-402	40+10 (CCE)=50
III	Physical Chemistry I	MCH-403	40+10 (CCE)=50
IV	Group Theory & Spectroscopy I	MCH-404	40+10 (CCE)=50
V	Mathematics for Chemists OR Biology for Chemists	MCH-405 (a) MCH-405 (b)	40+10 (CCE)=50 40+10 (CCE)=50
Practical	Inorganic MCHPI-1 Organic MCHPO-1 Physical MCHPP-1	33 33 34	100
		Grand Total	350

6.8.11

SEMESTER I

Paper-I
MCH-401: INORGANIC CHEMISTRY I

Unit-I

Stereochemistry and Bonding in Main Group Compounds :
VSEPR. Walsh diagram (triatomic and penta-atomic molecules), $d\pi$-$p\pi$ bond. Bent rule and energetics of hybridization, some simple reactions of covalently bonded molecules.

Unit-II

Metal-Ligand Equilibrium in Solution
Stepwise and overall formation constants and their interaction, trends in stepwise constant, factors affecting the stability of metal complexes with reference to the nature of metal ion and ligand. Chelate effect and its thermodynamic origin, determination of binary formation constants by potentiometry and spectrophotometry.

Unit-III

Reaction Mechanism of Transition Metal Complexes
Energy profile of a reaction, reactivity of metal complex, inert and labile complexes, kinetic application of valence bond and crystal field theories, kinetics of octahedral substitution, acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism, direct and indirect evidences in favour of conjugate mechanism, anion reactions, reactions without metal ligand bond cleavage, Substitution reactions in square planar complexes, the trans effect, mechanism of the substitution reaction. Redox reaction, electron transfer reactions, mechanism of one electron transfer reactions, outer sphere type reactions, cross reactions and Marcus-Hush theory, inner sphere type reactions.

Unit-IV

Metal-Ligand bonding
Limitation of crystal field theory, molecular orbital theory for bonding in octahedral, tetrahedral and square planar complexes, π-bonding and molecular orbital theory.

Unit-V

HSAB Theory : Classification of acids and bases as hard and soft: HSAB principle, theoretical basis of hardness and softness; Lewis-acid base reactivity approximation; donor and acceptor numbers, E and C equation; applications of HSAB concept.

Books Suggested :

1. Advanced Inorganic Chemistry, F.A. Cotton and Wilkinson, John Wiley.
2. Inorganic Chemistry, J.E. Huhey, Harpes & Row.
3. Chemistry of the Elements, N.N. Greenwood and A. Earnshow, Pergamon.
4. Inorganic Electronic Spectroscopy, A.B.P. Lever, Elsevier.
5. Magnetiochemistry, R.L. Carlin, Springer Verlag.
6. Comprehensive Coordiamion Chemistry eds., G. Wilkinson, R.D. Gillars and J.A. Mc Cleverty, Pergamon.

Paper-II
MCH-402: ORGANIC CHEMISTRY I

Unit-I

Nature of Bonding in Organic Molecules

Delocalized chemical bonding-conjugation, cross conjugation, resonance hyperconjugation. bonding in fullerences, tautomerism. Aromaticity in benzenoid and non-benzoid compounds, alternate and non-alternate hydrocarbons. Huckel's rule, energy. Level of π-molecular orbitals, annulenes, anti-aromaticity. homo-aromaticity, PMO approach. Bonds weaker than covalent-addition compounds. crown ether complexs and cryptands, inclusion compounds. catenanes and rotaxanes.

Unit-II

Stereochemistry

Strain due to unavoidable crowding Elements of symmetry, chirality, molecules with more than one chiral center, threo and ertythro isomers, methods of resolution. optical purity, enantiotopic and diastereotopic atoms, groups and faces. stereospecific and stereoselective synthesis, Asymmetric synthesis. Optical activity in the absence of chiral carbon (biphenyls, allenes and spirane chirallity due to helical shape. Stereochemistry of the compounds containing nitrogen, sulphur and phosphorus.

Unit III

Conformational analysis and linear free energy relationship

Conformational analysis of cycloalkanes, decalines, effect of conformation on reactivity. conformation of sugars.

Generation, structure, stability and reactivity of carbocations, carbanions, free radicals. carbenes and nitrenes. The Hammett equation and linear free energy relationship, substituents and reaction constants, Taft equation.

Unit-IV

Reaction Mechanism : Structure and Reactivity

Type of mechanisms, types of reactions, thermodynamic and kinetic requirements. kinetic and thermodynamic control. Hammond's postulate. Curtir-Hammett principle. Potential energy diagrams, transition states and intermediates, methods of determining mechanisms, isotopes effects

Unit-V

Aliphatic Nucleophilic Substitution

The SN2. SN1 mixed SN1 and SN2 and SET mechanism. The neighboring group mechanism, neighboring group participation by p and s bonds, anchimeric assistance.

Classical and nonclassical carbocations, phenomium ions, norborynl systems, common carbocation rearrangements. Application of NMR spectroscopy in the detection of carbocations. The SN1 mechanism. Nucleophilic substitution at an allylic, aliphatic trigonal and a vinylic carbon. Reactivity effects of substrate structure, attacking nucleophile, leaving group and reaction medium, phase transfer catalysis and ultrasound, ambident nucleophile, regioselectivity.

Book Suggested

1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley.
2. Advanced Organic Chemistry, F.A. Carey and R.J. Sunderg, Plenum.
3. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
4. Structure and Mechanism in Organic Chemistry, C.K. Ingold, Comell University Press.
5. Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice-Hall.
6. Modern Organic Reactions, H.O. House, Benjamin.
7. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, Blackie Academic & Professionsl.
8. Reaction Mechanism in Organic Chemistry, S.M. Mukherji and S.P. Singh, Macmilian.
9. Pericyclic Reactions, S.M. Mukherji, Macmillan, India
10. Stereochemistry of Organic Compounds, D.Nasipuri, New Age International.
11. Stereochemisty of Organic Compounds, P.S. Kalsi, New Age International.

Paper-III
MCH-403: PHYSICAL CHEMISTRY I

Unit-I

Introduction to Exact Quantum Mechanical Results

Schrödinger equation and the postulates of quantum mechanics. Discussion of solutions of the Schrödinger equation to some model systems viz., particle in a box, the harmonic oscillator, the rigid rotor, the hydrogen atom and helium atom.

Unit-II

Approximate Methods

The variation theorem, linear variation principle. Perturbation theory (First order and nondegenerate). Applications of variation method and perturbation theory to the Helium atom.

Molecular Orbital Theory

Huckel theory of conjugated systems bond and charge density calculations. Applications to ethylene, butadiene, cyclopropenyl radical cyclobutadiene etc. Introduction to extended Huckel theory.

UNIT III

Angular Momentum

Ordinary angular momentum, generalized angular momentum. eigenfucntions for angular momentum. eigenvalues of angular momentum operator using ladder operators addition of angular momenta. spin, antisymmetry and Pauli exclusion principle.

Unit-IV

Classical Thermodynamics

Brief resume of concepts of laws of thermodynamics. free energy. chemical potential and entropies. Partial molar free energy, partial molar volume and partial molar heat content and their significance. Determinations of these quantities. Concept of fugacity and determination of fugacity. Non-ideal systems : Excess function s for non-ideal solutions. Activity. activity coefficient, Debye Huckel theory for activity coefficient fo electrolytic solutions; determination of activity and activity coefficients; ionic strength. Application of phase rule to three component systems; second order phase transitions.

Unit-V

Statistical Thermodynamics

Concept of distribution, thermodynamic probability and most probable distribution. Ensemble averaging, postulates of ensemble averaging. Canonical. grand canonical and micro-canonical ensembles. corresponding distribution laws (using Lagrange's method of undetermined multipliers). Partition functions-translation. rotational. vibrational and electronic partition functions. Calculation of thermodynamic properties in terms of partition. Application of partition functions. Fermi-Dirac Statistics. distribution law and applications to metal. Bose-Einstein statistics distribution Law and application to helium.

Books Suggested

1. Physical Chemistry, P.W. Atkins, ELBS.
2. Introduction to Quantum Chemistyry, A.K. Chandra, Tata Mc Graw Hill.
3. Quantum Chemistry, Ira N. Levine, Prentice Hall.
4. Coulson's Valence. R.Mc Ween y. ELBS.
5. Chemical Kinetics. K.J. Laidler, McGraw-Hill.
6. Kinetics and Mechanism of Chemical Transformation J.Rajaraman and J. Kuriacose, Mc Millan.
7. Micelles, Theoretical and Applied Aspects. V. MOraoi. Plenum.
8. Modern Electrochemistry Vol. I and Vol II J.O.M. Bockris and A.K.N. Reddy, Planum.
9. Introduction to Polymer Science. V.R. Gowarikar, N.V. Vishwanathan and J. Sridhar, Wiley Eastern.
10. Introduction to Quantum Chemistry-R.K. Prasad, New Age Publication.

Paper-IV
MCH-404: Group Theory & Spectroscopy I

Unit-I
Symmetry and Group theory in Chemistry

Symmetry elements and symmetry operation, definition of group, subgroup, Conjugacy relation and classes. Point symmetry group. Schonfilies symbols, representations of groups by matrices (representation for the C_n, C_{nv}, C_{nh}, D_{nh} group to be worked out explicity). Character of a representation. The great orthogonality theorem (without proof) and its importance. Character tables and their use: spectroscopy. Derivation of character table for C_{2v} and C_{3v} point group Symmetry aspects of molecular vibrations of H_2O molecule.

Unit-II
Microwave Spectroscopy

Classification of molecules, rigid rotor model, effect of isotopic substitution on the transition frequencies, intensities, non-rigid rotor. Stark effect, nuclear and electron spin interaction and effect of external field, applications.

Unit-III
Infrared-Spectroscopy

Review of linear harmonic oscillator, vibrational energies of diatomic molecules, zero point energy, force constant and bond strengths; anharmonicity, Morse potential energy diagram, vibration-rotation spectroscopy, P,Q,R, branches, Breakdown of Oppenheimer approximation; vibrations of polyatomic molecules, Selection rules, normal modes of vibration, group frequencies, overtones, hot bands, factors affecting the band positions and intensities, far IR region, metal ligand vibrations, normal co-ordinate analysis.

Unit-IV
Raman Spectroscopy

Classical and quantum theories of Raman effect, Pure rotational, vibrational and vibrational-rotational Raman spectra, selection rules, mutual exclusion principle, Resonance Raman spectroscopy, coherent anti stokes Raman spectroscopy (CARS).

Unit-V
Electronic Spectroscopy

Molecular Spectroscopy

Energy levels, molecular orbitals, vibronic transitions, vibrational progressions and geometry of the excited states, Franck-Condon principle, electronic spectra of polyatomic molecules. Emission spectra; radio-active and non-radioactive decay, internal conversion, spectra of transition metal complexes, charge-transfer spectra

Photoelectron Spectroscopy

Basic principles; photo-electric effect, ionization process, Koopman's theorem.

Photoelectron spectra of simple molecules, ESCA, chemical information from ESCA. Auger electron spectroscopy-basic idea.

Books suggested

1. Modern Spectroscopy, J.M. Hollas, John Viley.
2. Applied Electron Spectroscopy for chemical analysis d. H. Windawi and F.L. Ho, Wiley Interscience.
3. NMR, NQR, EPr and Mossbauer Spectroscopy in Inorganic Chemistry, R.V. Parish, Ellis Harwood.
4. Physical Methods in Chemistry, R.S. Drago, Saunders College.
5. Chemical Applications of Group Theory, F.A. Cotton.
6. Introduction to Molecular Spectroscopy, G.M. Barrow. Mc Graw Hill.
7. Basic Principles of Spectroscopy, R. Chang. Mc Graw Hill.
8. Theory and Application of UV Spectroscopy, H.H Jaffe and M. Orchin, IBH-Oxford.
9. Introduction to Photoelectron Spectroscopy, P.K. Ghosh, John Wiley.
10. Introduction to Magnetic Resonance. A Carrington and A.D. Maclachalan, Harper & Row.

Paper-V
MCH-405 (a) : MATHEMATICS FOR CHEMISTS
(For students without Mathematics in B.Sc.)

Unit-I

Vectors

Vectors. dot, cross and triple products etc. gradient, divergence and curl. Vector Calculus.

Matrix Algebra

Addition and multiplication, inverse, adjoint and transpose of matrices.

Unit-II

Differential Calculus

Functions. continuity and differentiability. rules for differentiation. applications of differential calculus including maxima and minima (examples related to maximally populated rotational energy levels. Bohr's radius and most probable velocity from Maxwell's distribution etc.).

Unit-III

Integral calculus

Basic rules for integration, integration by parts, partial fractions and substitution.
Reduction formulae, applications of integral calculus.
Functions of several variables. partial differentiation. co-ordinate transformations (e.g. Cartesian to spherical polar)

Unit-IV

Elementary Differential equations

First-order and first degree differential equations, homogenous, exact and linear equations. Applications to chemical kinetics, secular equilibria, quantum chemistry etc. second order differential equation and their solutions.

Unit-V

Permutation and Probability

Permutations and combinations, probability and probability theorems average, variance root means square deviation examples from the kinetic theory of gases etc.. fitting (including least squares fit etc with a general polynomial fit.

Book Suggested

1. The chemistry Mathematics Book, E.Steiner, Oxford University Press.
2. Mathematics for chemistry, Doggett and Suiclific, Logman.
3. Mathematical for Physical chemistry : F. Daniels. Mc. Graw Hill.
4. Chemical Mathematics D.M. Hirst, Longman.
5. Applied Mathematics for Physical Chemistry, J.R. Barante, Prentice Hall.
6. Basic Mathematics for Chemists, Tebbutt, Wiley.

Paper-V
CH-405 (b) BIOLOGY FOR CHEMISTS
(For students without Biology in B.Sc.)

Unit-I

Cell Structure and Functions

Structure prokaryotic and eukaryotic cells. intracellular organelles and their functions. comparison of plant and animal cells. Ove4rview and their functions. comparison of plant and animal cells. Overview of metabolic processes-catabolism and anabolism. ATP - the biological energy currency. Origin of life-unique properties of carbon chemical evolution and rise of living systems. Introduction to bio-molecules. building blocks of bio-macromolecules.

Unit-II

Carbohydrates

Conformation of monosaccharides, structure and functions of important derivatives of mono-saccharides like glycosides. deoxy sugars, myoinositol, amino sugars. N-acetylmuramic acid, sialic acid disaccharides and polysaccharides. Structural polysaccharides cellulose and chitin. Storage polysaccharides-starch and glycogen. Structure and biological function of glucosaminoglycans of mucopolysaccharides. Carbohydrates of glycoporteins and glycolipids. Role of sugars in biological recognition. Blood group substances. Ascorbic acid.

Unit-III

Lipid

Fatty acids, essential fatty acids, structure and function of triacylglycerols, glycerophospholipids, sphingolipids, cholesterol, bile acids, prostaglandins. Liproproteins-compositiion and function, role in atherosclerosis. Properties of lipid aggregates-micelles, bilayers, liposomes and their possible biological functions. Biological membranes. Fluid mosaic model of membrane structure. Lipid metabolism-b-oxidation of fatty acids.

Unit-IV

Amino-acids, Peptides and Proteins

Chemical and enzymatic hydrolysis of proteins to peptides, amino acid sequencing. Secondary structure of proteins, force responsible for holding of secondary structures, a-helix, -b-sheets, super secondary structure, triple helix structure of collagen. Tertiary structure of protein-folding and domina structure. Quaternary structure. Amino acid metabolism-degradation and biosynthesis of amino acids, sequence determination : chemical/enzymatic/mass spectral, racemization/detection. Chemistry of oxytocin and tryptophan releasing hormone (TRH).

Unit-V

Nucleic Acids

Purine and pyrimidine bases of nucleic acids, base pairing via Hbounding. Structure of ribonucleic acids (RNA) and deoxyribonucleic acid (DNA), double helix model of DNA and forces responsible for holding it. Chemical and enzymatic hydrolysis of nucleic acids. The chemical basis for heredity, an overview of replication of DNA, transcription, translation and genetic code. Chemical synthesis of mono and trinucleoside.

Book Suggested

1. Principles of Biochemistry, A.L. Lehninger, Worth Publishers.
2. Biochemistry, L. Stryer, W.H. Freeman.
3. Biochemistry, J. David Rawan, Neil Patterson.
4. Biochemistry, Voet and Voet, John Wiley.
5. Outlines of Biochemistry E.E. Conn and P.K. Stumpf, John Wiley.

PRACTICAL

(Duration: 6-8 hrs in each branch)

Practical examination shall be conducted separately for each branch.

Inorganic Chemistry	
Quantitative and quantitative Analysis	8
Chromatography	8
Preparation	8
Record	4
Viva Voce	5

Not Applicable

P. T. O.

M. Sc. Practicals

PRACTICAL

(Duration: 6-8 hrs in each branch)

Practical examination shall be conducted separately for each branch.

Inorganic Chemistry

SEMESTER I

Quantitative and quantitative Analysis	12
Preparation	12
[illegible]	4
Viva Voce	5

Qualitative and Quantitative Analysis

a. Quantitative determinations of a three component mixture

b. Insoluble- Oxides, sulphates and halides

c. Less common metal ions Ti, Mo, W, Ti, Zr, Th, V, U (two metal ions in cationic/anionic forms).

d. Quantitative separation and determination of the following pairs of metal ions using gravimetric and volumetric methods:

1. Cu^{2+} (gravimetrically) and Zn^{2+} (volumetrically),
2. Fe^{3+} (gravimetrically) and Ca^{2+} (volumetrically)
3. [illegible] (gravimetrically) and Ni^{2+} (volumetrically)
4. Ni^{2+} (gravimetrically) and Zn^{2+} (volumetrically)
5. Cu^{2+} (gravimetrically) and Fe^{3+} (volumetrically)

Preparations

Preparation of selected inorganic compounds and their studies by I R electronic spectra, Mossbauer, E S R and magnetic susceptibility measurements Handling of air and moisture sensitive compounds

1. trans-potassium diaquabis(oxalato)chromate(III), trans-$K[Cr(ox)_2(H_2O)_2]$
2. cis-potassium diaquabis(oxalato)chromate(III), cis-$K[Cr(ox)_2(H_2O)_2]$
3. $Na[Cr(NH_3)_2(SCN)_4]$
4. $Ni(acac)_2$
5. $K_3[Fe(C_2O_4)_3]$
6. Prussian Blue, Turnbull's Blue.
7. Potassium tri-oxalato aluminate

ORGANIC CHEMISTRY

SEMESTER I

Organic Chemistry

Qualitative Analysis 16

Organic Synthesis 08

Record 4

Viva Voce 5

22/07

22.07.13

22/7/13

Signature Not Verified
ARPANA BHARDWAJ
E=ARPANA.BHARDWAJ11@GMAIL.COM,

Qualitative Analysis

Separation, purification and identification of compounds of ternary mixture (two solid and one liquid)

Organic Preparation

Acetylation Acetylation of salicylic acid and acetanilide

Oxidation Adipic acid by chromic acid oxidation of cyclothexaneol

Grignard reaction. Synthesis of triphenylmethanol from benzoic acid

The Products may be Characterized by Spectral Techniques.

SEMESTER I

Physical Chemistry

Error Analysis and Statistical Data Analysis	8
Chemical Kinetics	9
Solution	8
Record	4
Viva Voce	5

Error Analysis and Statistical Data Analysis

1. Errors, types of errors, minimization of errors distribution curves precision, accuracy and combination; statistical treatment for error analysis, t test, null hypothesis, rejection criteria. F & Q test; linear regression analysis, curve fitting.

2. Use of volumetric apparatus burette pipette and standard flask

3 Preparation of standard solutions (solid and liquid compounds) and their standardization

4. Equalization of strength of two acids by titrimetrically

Chemical Kinetics

Determination of the effect of (a) Change of temperature (activation parameters) (b) Change of concentration of reactant and catalyst and (c) Ionic strength of the media on the velocity constant of

1. Acid catalyzed hydrolysis of an ester
2. Sodium-formate-I_2 reaction

Solution

1. Determination of congruent composition and temperature of a binary system (e.g. diphenylamine-benzophenone system).
2. Determination of molecular weight of camphor by Rast method

Books Suggested

1. Vogel's Textbook of Quantitative Analysis, revised. J. Bassett, R.C. Denney, G H. Jeffery and J Mendham, ELBS.
2 Synthesis and Characterization of Inorganic Compounds. W L. Jolly Prentice Hall

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3. Experiments and Techniques in Organic Chemistry, D.P. Pasto, C. Johnson and M. Miller, Prentice Hall.
4 Macroscale and Microscale Organic Experiments, K.L Williamson, D.C. Health.
5 Systematic Qualitative Organic Analysis, H Middleton, Adward Arnold.
6. Handbook of Organic Analysis-qualitative and Quantitative. H. Clark, Adward Arnold.
7. Vogel's Textbook of Practical Organic Chemistry, A.R. Tatchell, John Wiley.
8. Practical Physical Chemistry, A.M. James and F.E. Prichard, Longman.
9 Findley's Practical Physical chemistry, B.P Levitt, Longman.
10. Experimental Physical Chemistry, R.C. Das and B. Behera, Tata McGraw Hill.
11. Inorganic Experimens, J. Derek Woolings, VCH.
12. Microscale Inorganic Chemistry, Z. Szafran, R.M, Pike and M.M. Singh, Wiley.
13. Practical Inorganic Chemistry, G. Marr and B. W. Rockett, Van Nostrad.
14 The systematic Identification of Organic Compounds, R.L Shriner and D.Y. curlin.

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Session 2011-12

Scheme of Marks

M.Sc. Chemistry

SEMESTER-II

Paper	Paper Title	Code	Max.Marks
I	Inorganic Chemistry II	MCH-406	40+10 (CCE)=50
II	Organic Chemistry II	MCH-407	40+10 (CCE)=50
III	Physical Chemistry II	MCH-408	40+10 (CCE)=50
IV	Spectroscopy II	MCH-409	40+10 (CCE)=50
V	Computers for Chemists	MCH-410	40+10 (CCE)=50
Practical	Inorganic Organic Physical	~~34~~ 33 ~~33~~ 33 ~~33~~ 34	100
		Grand Total	350

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Signature Not Verified

ARPANA PANDEY
E=ARPANA.PANDEY
AJ1@GMAIL.COM,

SEMESTER II

Paper-VI
MCH-406: INORGANIC CHEMISTRY II

Unit-I

Electronic Spectral Studies of Transition Metal Complexes :

Spectroscopic ground states, correlation. Orgel and Tanabe-Sugano diagrams for transition metal complexes (d^1-d^9 states), Selection rule for electronic spectroscopy. Intensity of various type electronic transitions. Calculations of 10Dq, B and β parameters, charge transfer spectra.

Unit-II

Magnetic Properties of Transition Metal Complexes

Anomalous magnetic moments, Quenching of Orbital contribution. Orbital contribution to magnetic moment, magnetic exchange coupling and spin crossover.

Unit-III

Metal π-Complexes

Metal carbonyl, structure and bonding, vibrational spectra of metal carbonyls for bonding and structural elucidation, important reactions of metal carbonyls; preparation, bonding structure and important reaction of transition metal nitrosyl, dinitrogen and dioxgen complexes; tertiary phosphine as ligand.

Unit-IV

Metal Clusters

Higher boranes, carboranes, metalloboranes and metallo-carboranes compounds with metal metal multiple bonds.

Unit-V

Optical Rotatory Dispersion and Circular Dichroism

Linearly and circularly polarized lights; optical rotatory power and circular birefringence, elipticity and circular dichroism: ORD and Cotton effect, Faraday and Kerr effects: Assignment of electronic transitions: applications of ORD and CD for the determination of (i) absolute configuration of complexes and (ii) isomerism due to non-planarity of chelate rings.

Books Suggested :

7. Advanced Inorganic Chemistry, F.A. Cotton and Wilkinson, John Wiley.
8. Inorganic Chemistry, J.E. Huhey, Harpes & Row.
9. Chemistry of the Elements, N.N. Greenwood and A. Earnshow, Pergamon.
10. Inorganic Electronic Spectroscopy, A.B.P. Lever, Elsevier.
11. Magnetiochemistry, R.1. Carlin, Springer Verlag.
12. Comprehensive Coordiantion Chemistry eds., G. Wilkinson, R.D. Gillars and J.A. Mc Cleverty,Pergamon.

Paper-VII
MCH-407: ORGANIC CHEMISTRY II

Unit-I

Aromatic Electrophilic Substitution

The arenium ion mechanism, orientation and reactivity, energy profile diagrams. The ortho/para ratio, ipso attack, orientation in other ring systems. Quantitative treatment of reactivity in substrates and electrophiles. Diazonium coupling, Vilsmeir reactiion, Gatterman-Koch reaction

Aromatic Nucleophilci Substitution

The SNAr SN1, benzyne and SN1 mechanism, Reactivity effect of substrate structure, leaving group and attacking nucleophile. The Von Richte. Sommelet-Hauser, and Smiles rearrangements.

Unit-II

Free Radical Reactions

types of free radical reactions. free radical substitution mechanism, mechanism at an aromatic substrate. neighbouring group assistance. Reactivity for aliphatic and aromatic substrates at a bridgehead. Reactivity in the attacking radicals. The effect of solvents on reactivity. Allylic halogenation (NBS), oxidation of aldehydes to carboyxlic acids, auto-oxidation. coupling of alkynes and arylation of aromatic compounds by diazonium salts. Sandmeyer reaction. Free radical rearrangement. Hunsdiecker reaction.

Unit III

Addition Reactions

Mechanistic and stereochemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, regio-and chemoselectivity, orientation and reactivity. Addition to cyclopropane ring. Hydrogenation of double and triple bounds, hydrogenation of aromatic rings. Hydroboration. Michael reaction, sharpless asymmetric epoxidation.

Unit-IV

Addition to Carbon-Hetero Multiple bonds

Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, acid esters and nitriles. Addition of Grignard reagents, organozinc and organolithium reagents to carbonyl and usaturated carbonyl compounds. Witting reaction. Mechanism of condensation reactions involving enolates-Aldol. Knoevenagel, Claisen. Mannich, Benzoin. Perkin and Stobbe reactions. Hydrolysis of esters and amides, ammonolysis of esters.

Elimination Reactions

The E2. E1 and E1 cB mechanisms and their spectrum. Orientation of the double bond. Reactitivty-effects of substrate structures. attacking base, the leavign group and the medium. Mechanism and orientation in pyrolytic elimination.

Unit-V

Pericyclic Reactions

Molecular orbital symmetry, Frontier orbitals of ethylene. 1.3-butadiene. 1.3.5-hexatriene and allyl system. Classification of periycyclic reactions. Woodward-Hoffmann correlatino diagrams. FMO and PMO approach. Electrocyclic reactions-conrotatory and disrotatory motions. 4n 4n+2 and allyl systems. Cycloadditions-antarafacial and suprafacial additions, 4n and 4n+2 systems. 2+2 addition of ketenes, 1.3 dipolar cycloadditions and cheleotrpic reactions. Sigmatropic rearrangements-suprafacial and antarafacial shifts of H, sigmatropic involving carbon moieties. 3,3- and 5.5 sigmatropic rearrangements. Claise n, Cope and aza-Cope rearrangements. Fluxional tautomerism. Ene reaction.

Book Suggested

12. Advanced Organic Chemistry-Reactions, Mechanism and Structure. Jerry March, John Wiley.
13. Advanced Organic Chemistry, F.A. Carey and R.J. Sunderg. Plenum.
14. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes. Longman.
15. Structure and Mechanism in Organic Chemistry. C.K. Ingold. Comell University Press.
16. Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice-Hall.
17. Modern Organic Reactions, H.O. House. Benjamin.
18. Principles of Organic Synthesis. R.O.C. Norman and J.M. Coxon, Blackie Academic &* Professionsl
19. Reaction Mechanism in Organic Chemistry. S.M. Mukherji and S.P. Singh. Macmillan
20. Pericyclic Reactions. S.M. Mukherji. Macmillan. India
21. Stereochemistry of Organic Compounds. D.Nasipuri. New Age International
22. Stereochemisty of Organic Compounds. P.S. Kalsi. New Age International.

Paper-VIII
MCH-408: PHYSICAL CHEMISTRY II

Unit-I

Chemical Dynamics

Methods of determining rate laws, collision theory of reaction rates. steric factor. activated complex theory, Arrhenius equation and the activated complex theory; ionic reactions, kinetic salt effects, steady state kinetics. kinetic and thermodynamic control of reactions. treatment of unimolecular reactions. Dyamic chain (hydrogen-bromine reaction. pyrolysis of acetaldehyde, decomposition of ethane). photochemical (hydrogen-bromine and hydrogen-chlorine reactions) and homogenous catalysis. kinetics of enzyme reactions. general features fo fast reactions, study of fast reactions by flow method. relaxation method, flash photolysis ad the nuclear magnetic resonance method. dynamics

of unimolecular reactiosn (Lindemann Hinshelwood and Rice-Ramsperger-Kassel-Marcus (RRKM) theories for unimolecular reactions).

Unit-II

Surface Chemistry

Adsorption

Surface tension, capillary action, pressure difference across curved surface (Laplace equation), vapour pressure of droplets (Kelvin equation), Gibbs adsorption isotherm, estimation of surface area (BET equation), Surface films on liquids (Electro-kinetic phenomenon).

Micelles

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, solublization, micro emulsion, reverse micelles.

Unit-III

Macromolecules

Polymer-definition, types of polymers, electrically conducting, fire resistant, liquid crystal polymers, kinetics of polymerization, mechanism of polymerization. Molecular mass, number and mass average molecular mass, molecular mass determination (Osmometry, viscometry, diffusion and light scattering methods), sedimentation, chain configuration of macromolecules, calculation of average dimension of various chain structures.

Unit-IV

Non Equilibrium Theromodynamics

Thermodynamic criteria for non-equilibrium states, entropy production and entropy flow, entropy balance equations for different irreversible processes (e.g., heat flow, chemical reaction etc.) transformations of the generalized fluxes and forces, non equilibrium stationary states, phenomenological equations, microscopic reversibility and Onsager's reciprocity relations, electrokinetic phenomena, diffusion, electric conduction.

Unit-V

Electrochemistry

Electrochemistry of solutions, Debye-Huckel-Onsager treatment and its extension, ion solvent interactions, Debye-Huckel-Jerum mode. Thermodynamics of electrified interface equations. Derivation of electro capillarity, Lippmann equations (surface excess), methods of determination, Structure of electrified interfaces.

Overpotentials, exchange current density, derivation of Butler Volmer equation, Tafel plot. Quantum aspects of charge transfer at electrodes-solution interfaces, quantization of charge transfer, tunneling. Semiconductor interfaces-theory of double layer at

semiconductor, electrolyte solution interfaces, structure of double layer interfaces. Effect of light at semiconductor solution interface. Polarography theory. Ilkovic equation: half wave potential and its significance.

Books Suggested

11. Physical Chemistry, P.W. Atkins. ELBS.
12. Introduction to Quantum Chemistry, A.K. Chandra, Tata Mc Graw Hill.
13. Quantum Chemistry, Ira N. Levine, Prentice Hall.
14. Coulson's Valence, R.Mc Ween y, ELBS.
15. Chemical Kinetics. K.J. Laidler. McGraw-Hill.
16. Kineties and Mechanism of Chemical Transformation J.Rajaraman and J. Kuriacose, Mc Millan.
17. Micelles, Theoretical and Applied Aspects, V. MOraoi, Plenum.
18. Modern Electrochemistry Vol. I and Vol II J.O.M. Bockris and A.K.N. Reddy, Planum.
19. Introduction to Polymer Science, V.R. Gowarikar, N.V. Vishwanathan and J. Sridhar, Wiley Eastern.

Paper-IX
MCH-409: Spectroscopy II and Diffraction Methods

Unit-I

Nuclear Magnetic Resonance Spectroscopy

Nuclear spin, nuclear resonance, saturation, shielding of magnetic nuclei, chemical shift and its measurements, factors, influencing chemical shift, deshielding, spin-spin interactions, factors influencing coupling constant "j" Classification (AXB, AMX, ABC, A2B2 etc.), spin decoupling; basic ideas about instrument, NMR studies of nuclei other than protin-13C, 19F and 31P. FT NMR, advantages of FT NMR.

Unit II

Nuclear Quadrupole Resonance Spectroscopy

Quadrupole nuclei, quadrupole moments, electric field gradient, coupling constant, splitting. Applications.

Unit-III

Electron Spin Resonance Spectroscopy

Basic principles, zero field splitting and Kramer's degeneracy, factors affecting the 'g' value. Isotropic and anisotropic hyperfine coupling constants, spin Hamiltonian, spin densities and Mc Connell relationship, measurement techniques, applications.

Unit-IV

X-ray Diffraction
Bragg condition, Miller indices, Laue Method, Bragg method, Debye Scherrer method of X-ray structural analysis of crystals, index reflections, identification of unit cells from systematic absences in diffraction pattern, Structure of simple lattices and X-ray intensities, structure factor and its relation to intensity and electron density, phase problem. Description of the procedure for an X-ray structure analysis, absolute configuration of molecules.

Unit-V

Electron Diffraction
Scattering intensity vs. scattering angle, Wierl equation, measurement technique, elucidation of structure of simple gas phase molecules. Low energy electron diffraction and structure of surfaces.
Neutron Diffraction Scattering of neutrons by solids measurement techniques, Elucidation of structure of magnetically ordered unit cells.

Books suggested

11. Modern Spectroscopy, J.M. Hollas, John Viley.
12. Applied Electron Spectroscopy for chemical analysis d. H. Windawi and F.L. Ho, Wiley Interscience.
13. NMR, NQR, EPr and Mossbauer Spectroscopy in Inorganic Chemistry, R.V. Parish, Ellis Harwood.
14. Physical Methods in Chemistry, R.S. Drago. Saunders College.
15. Chemical Applications of Group Theory, F.A. Cotton.
16. Introduction to Molecular Spectroscopy. G.M. Barrow. Mc Graw Hill.
17. Basic Principles of Spectroscopy. R. Chang. Mc Graw Hill.
18. Theory and Application of UV Spectroscopy. H.H. Jaffe and M. Orchin. IBH-Oxford.
19. Introduction to Photoelectron Spectroscopy. P.K. Ghosh. John Wiley.
20. Introduction to Magnetic Resonance. A Carrington and A.D. Maclachalan, harper & Row.

Paper-X
Ch-410 : COMPUTERS FOR CHEMISTS

This is a theory cum-laboratory co use with more emphasis on laboratory work.

Unit-I

Introduction to computers and Computing
Basic structure and functioning of computer with a PC as illustrative example. Memory I/O devices. Secondary storage Computer languages. Operating systems with DOS as an example Introduction to UNIX and WINDOWS. Principles of programming Alogrithms and flow-charts.

Unit-II

Computer Programming in FORTRAN/C/BASIC

(the language features are listed here with reference to FORTRAN. The instructor may choose another language such as BASIC or C the features may be replaced appropriately). Elements of the compute language. Constants and variables. Operations and symbols Expressions. Arithmetic assignment statement. Input and output Format statement. Termination statements. Branching statements as IF or GO TO statement. LOGICAL variables. Double precession variables. Subscripted variables and DIMENSION. DO statement FUNCTION AND SUBROUTINE. COMMON and DATA statement (Student learn the programming logic and these language feature by hands on experience on a personal computer from the beginning of this topic.)

Unit-III

Programming in Chemistry

Developing of small computer codes using any one of the languages FORTRAN/C/BASIC involving simple formulae in Chemistry, such as Van der Waals equation. Chemical kinetics (determination of Rate constant) Radioactive decay (Half Life and Average Life). Determination Normality, Molarity nd Molality of solutions. Evaluation Electronegativity of atom and Lattice Energy from experimental determination of molecular weight and percentage of element organic compounds using data from experimental metal representation of molecules in terms of elementary structural features such as bond lengths, bond angles.

Unit-IV

Use of Computer programmes

Operation of PC. Data Processing. Running of standard Programs and Packages such as MS WORD, MS EXCEL -special emphasis on calculations and chart formations. X-Y plot. Simpson's Numerical Integration method. Programmes with data preferably from physical chemistry laboratory.

Unit V

Internet

Application of Internet for Chemistry with search engines, various types of files like PDF, JPG, RTF and Bitmap. Scanning, OMR. Web camera

Book Suggested :

Fundamentals of Computer : V. Rajaraman (Prentice Hall)
Computers in Chemistry : K.V. Raman (Tata Mc Graw Hill)
Computer Programming in FORTRAN IV-V Rajaraman (Prentice Hall)

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SEMESTER II

Inorganic Chemistry

Chromatography	12
Preparation	12
Chromatography	8
Record	4
Viva Voce	5

Chromatography Separation of cations and anions by Column Chromatography : Ion exchange.

a. To determine the ion exchange capacity of cation exchangers

b. To determine the ion exchange capacity of anion exchangers

c. Ion – exchange chromatography, Separation & estimation of (Zn^{+2}/ Cd^{+2}) &(Zn^{+2} / Mg^{+2}) in mixtures using Amberlite IRA 400 anion exchanger

d. To determine the total cation concentration of given sample of water by ion exchange in ppm.

Preparations

Preparation of selected inorganic compounds and their studies by I.R. electronic spectra, Mossbauer, E.S.R. and magnetic susceptibility measurements. Handling of air and moisture sensitive compounds.

1. $[Co(NH_3)_6]\ [Co(NO_2)_6]$
2. $Hg[Co(SCN)_4]$
3. $[Co(Py)_2Cl_2]$
4. $[Ni(NH_3)_6]Cl_2$
5. $Ni(dmg)_2$
6. $[Cu(NH_3)_4]SO_4H2O$
7. $[Cr(NH_3)_6]Cl_3$
8. Reinecke s salt

SEMESTER II

Organic Chemistry

Organic Synthesis	12
Quantitative Analysis	12
Record	4
Viva Voce	5

Organic Synthesis

Aldol condensation Dibenzal acetone from benzaldehyde.

Sandmeyer reaction p- Chlorotoluene from p-toluidine

Acetoacetic ester Condensation : Synthesis of ethyl-nbutylacetoacetate by A.E.E. condensation.

Cannizzaro reaction : 4-Chlorobenzaldehyde as substrate.

Friedel Crafts reaction b-Benzoyl propionic acid from succinic anhydride and benzene.

Aromatic electrophilic sustitutions : Synthesis of p-nitroaniline and pbromoaniline

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Signature Not Verified
ARPANA BHARDWAJ
E=ARPANABHARDWAJ
AU1@GMAIL.COM,

The Products may be Characterized by Spectral Techniques.

Quantitative Analysis

Determination of iodine and Saponification values of an oil sample.

Determination of DO, COD and BOD of water sample.

[illegible]

Physical Chemistry

Conductometry	12
Potentiometry/pH metry/ Polarimetry	13
Record	4
Viva Voce	5

Conductometry

1. To find out the strength of HCl solution by titrating against standard NaOH solution conductometrically
2. To find out the strength of HAc solution by titrating against standard NaOH solution conductometrically
3. To find out the strength of HCl and HAc in a mixture of both by titrating against standard NaOH solution conductometrically

Potentiometry/pH metry

1. Estimation of halides (Cl^-, Br^- and I^-) single ionsand in a mixture potentiometrically.
2. Determination of the strength of strong and weak acids in a given mixture using pH meter
3. Acid-base titration in a non-aqueous media using a pH meter.
4. Determination of activity and activity coefficient of electrolytes.
5. Determination of the dissociation constant of monobasic/polybasic acid by titrating against standard NaOH solution

Polarimetry

1. Determination of rate constant for hydrolysis/inversion of sugar using a polarimeter.
2. Enzyme kinetics-inversion of sucrose.

Books Suggested

1. Vogel's Textbook of Quantitative Analysis, revised, J. Bassett, R.C. Denney, G.H. Jeffery and J. Mendham, ELBS.
2. Synthesis and Characterization of Inorganic Compounds, W.L. Jolly. Prentice Hall
3. Experiments and Techniques in Organic Chemistry, D.P. Pasto, C. Johnson and M. Miller, Prentice Hall.

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4 Macroscale and Microscale Organic Experiments, K.L. Williamson, D.C. Health.
5. Systematic Qualitative Organic Analysis, H. Middleton, Adward Arnold.
6. Handbook of Organic Analysis-qualitative and Quantitative. H. Clark, Adward Arnold.
7. Vogel's Textbook of Practical Organic Chemistry, A.R. Tatchell, John Wiley.
8 Practical Physical Chemistry. A.M. James and F.E. Prichard, Longman.
9. Findley's Practical Physical chemistry, B.P. Levitt, Longman.
10. Experimental Physical Chemistry, R.C. Das and B. Behera, Tata McGraw Hill.
11. Inorganic Experimens, J. Derek Woolings, VCH.
12. Microscale Inorganic Chemistry. Z. Szafran, R.M, Pike and M.M. Singh, Wiley.
13 Practical Inorganic Chemistry, G. Marr and B. W. Rockett, Van Nostrad.
14. The systematic Identification of Organic Compounds, R.L. Shriner and D.Y. curlin.

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Signature Not Verified

ARPAN BHARDWAJ
E=ARPANBHARDWAJ1@GMAIL.COM,

Department of Higher Education, Govt. of M.P.
Post Graduate Semester wise Syllabus
as recommended by Central Board of Studies and approved by the Governor of M.P.
उच्च शिक्षा विभाग, म.प्र. शासन
स्नातकोत्तर कक्षाओं के लिये सेमेस्टर अनुसार पाठ्यक्रम
केंद्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा म. प्र. के राज्यपाल द्वारा अनुमोदित
Session (सत्र) ~~2010–2011~~ 2013-14

Scheme of Marks

M. Sc. Chemistry
SEMESTER – III

Paper	Comp/Opt	Paper Title	Code (MCH)	Max. Marks
I	Compulsory	APPLICATION OF SPECTROSCOPY-I	501	40+ 10 (CCE) = 50
II	Compulsory	PHOTOCHEMISTRY	502	40+ 10 (CCE) = 50
III	Compulsory	ENVIRONMENTAL CHEMISTRY	503	40+ 10 (CCE) = 50
IV	Optional -I	ANY TWO	504-508	40+ 10 (CCE) = 50
V	Optional -II			40+ 10 (CCE) = 50
		PRACTICAL -1. Inorganic		33
		2. Organic		33
		3. Physical		34 100 =~~100~~
		~~Internship~~		~~100~~
		Total		350 ~~450~~

M. Sc. Chemistry
SEMESTER – IV

Paper	Comp/Opt	Paper Title	Code (MCH)	Max. Marks
I	Compulsory	APPLICATION OF SPECTROSCOPY-II	511	40+ 10 (CCE) = 50
II	Compulsory	SOLID STATE CHEMISTRY	512	40+ 10 (CCE) = 50
III	Compulsory	BIOCHEMISTRY	513	40+ 10 (CCE) = 50
IV	Optional	ANY TWO From MCH 514-518	514-518	40+ 10 (CCE) = 50
V	Optional			40+ 10 (CCE) = 50
		PRACTICAL -1. Inorganic		33
		2. Organic		33
		3. Physical		34 =100
		Project Work		50
		Total		400

22/7/13

Department of Higher Education, Govt. of M.P.
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Session (सत्र) ~~2010–2011~~ 2013–14

Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	: III
Subject / विषय	: Chemistry
Title of Subject Group	: **APPLICATION OF SPECTROSCOPY-I**
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र कमांक	: **I (Code- MCH-501)**
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: Compulsory
Max. Marks अधिकतम अंक	: 50

Particulars/विवरण

	Semester III
Unit - 1	**Electronic Spectroscopy:** Electronic Spectral Studies for d^1 – d^9 systems in octahedral, tetrahedral and square planer complexes
Unit - 2	Vibrational Spectroscopy Symmetry and shapes of AB_2, AB_3, AB_4, AB_5 and AB_6, mode of bonding of ambidentate ligands, nitrosyl, ethylenediamine and diketonato complexes, application of resonance Raman spectroscopy and its applications.
Unit - 3	**Nuclear Magnetic Resonance Spectroscopy-I** General introduction and definition, chemical shift, spin-spin interaction, shielding and deshielding mechanism, mechanism of measurement of chemical shift values and correlation for protons bonded to carbon (aliphatic, olefinic, aldehydic and aromatic) and other nuclei (alcohols, phenols, enols, carboxylic acids, amines, amides & mercapto),
Unit - 4	**Nuclear Magnetic Resonance Spectroscopy-II** Chemical exchange, effect of deuteration, Complex spin spin interaction between two, three, four and five nuclei (I order spectra) Stereochemistry, hindered rotation, Karplus curve-variation of coupling constant with disordered angle. NMR shift reagents, solvent effects. nuclear overhauser effect (NOE).
Unit - 5	**Mössbauer Spectroscopy** Basic principles, spectral parameters and spectrum display. Application of the technique to the studies of (1) bonding and structures of Fe^{+2} and Fe^{+3} compounds including those of intermediate spin, (2) Sn^{+2} and Sn^{+4} compounds nature of M-L bond, coordination number, structure and (3) detection of oxidation state and inequivalent MB atoms.

Department of Higher Education, Govt. of M.P.
Post Graduate Semester wise Syllabus
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Session (सत्र) ~~2010–2011~~ 2013–14

Class / कक्षा	: **M.Sc.**
Semester / सेमेस्टर	: **III**
Subject / विषय	: **Chemistry**
Title of Subject Group	: **PHOTOCHEMISTRY**
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र कमांक	: **II (Code- MCH-502)**
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: **Compulsory**
Max. Marks अधिकतम अंक	: 50

Particulars / विवरण

Unit-1	**Photochemical Reactions** Interaction of electromagnetic radiation with matter, types of excitations, fate of excited molecule, quantum yield, transfer of excitation energy, actinometry.
Unit-2	**Determination of Reaction Mechanism** Classification, rate constants and life times of reactive energy state, determination of rate constants of reactions. Effect of light intensity on the rate of photochemical reactions. Types of photochemical reactions-photo dissociation, gas-phase photolysis.
Unit-3	**Photochemistry of Alkenes** Intramolecular reactions of the olefinic bond-geometrical isomerism, cyclisation reactions, rearrangement of 1,4- and 1,5-dienes. **Photochemistry of Aromatic Compounds** Isomerisations, additions and substitutions.
Unit-4	**Photochemistry of Carbonyl Compounds** Intramolecular reactions of carbonyl compounds-saturated, cyclic and acyclic, β, Υ unsaturated and α. β unsaturated compounds, cyclohexadienones. Intermolecular cyloaddition reactions-dimerisations and oxetane formation.
Unit-5	**Miscellaneous Photochemical Reactions** Photo-Fries reactions of annilides, Photo-Fries rearrangement. Barton reaction. Singlet molecular oxygen and its reactions. Photochemical formation of smog. Photodegradation of polymers. Photochemistry of vision.

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Signature Not Verified
ARPANA PRAKASH VAJPAYEE
E=ARPANA.VAJPAYEE@GMAIL.COM,

Department of Higher Education, Govt. of M.P.
Post Graduate Semester wise Syllabus
as recommended by Central Board of Studies and approved by the Governor of M.P.
उच्च शिक्षा विभाग, म.प्र. शासन
स्नातकोत्तर कक्षाओं के लिये सेमेस्टर अनुसार पाठ्यक्रम
केंद्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा म. प्र. के राज्यपाल द्वारा अनुमोदित
Session (सत्र) ~~2010-2011~~ 2013-14

Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	: III
Subject / विषय	: Chemistry
Title of Subject Group	: ENVIRONMENTAL CHEMISTRY
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र कमांक	: III (Code- MCH-503)
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: Compulsory
Max. Marks अधिकतम अंक	: 50

Particulars / विवरण

Unit-I	**Atmosphere** Atmospheric layers, Vertical temperature profile, heat/radiation budget of the earth atmosphere systems. Properties of troposphere, thermodynamic derivation of lapse rate. Temperature inversion. Calculation of Global mean temperature of the atmosphere. Pressure variation in atmosphere and scale height. Biogeochemical cycles of carbon, nitrogen, sulphur, phosphorus, oxygen. Residence times. **Atmospheric Chemistry** Sources of trace atmospheric constituents : nitrogen oxides, sulphurdioxide and other sulphur compounds, carbon oxides, chlorofluorocarbons and other halogen compounds, methane and other hydrocarbons. **Tropospheric Photochemistry** Mechanism of Photochemical decomposition of NO_2 and formation of ozone. Formation of oxygen atoms, hydroxyl, hydroperoxy and organic radicals and hydrogen peroxide. Reactions of hydroxyl radicals with methane and other organic compounds. Reaction of OH radicals with SO_2 and NO_2. Formation of Nitrate radical and its reactions. Photochemical smog meteorological conditions and chemistry of its formation.
Unit-2	**Air Pollution** Air pollutants and their classifications. Aerosols-sources, size distribution and effect on visibility, climate and health. **Acid Rain** Definition. Acid rain precursors and their aqueous and gas phase atmospheric oxidation reactions. Damaging effects on aquatic life, plants, buildings and health. Monitoring of SO_2 and NO_2. Acid rain control strategies. **Stratospheric Ozone Depletion** Mechanism of Ozone formation, Mechanism of catalytic ozone depletion, Discovery of Antarctic Ozone hole and Role of chemistry and meteorology. Control Strategies. **Green House Effect** Terrestrial and solar radiation Spectra, Major green house gases and their sources and Global warming potentials. Climate change and consequences. **Urban Air Pollution** Exhaust emissions, damaging effects of carbon monoxide. Monitoring of CO. Control strategies.
Unit-3	**Aquatic Chemistry and Water Pollution** Redox chemistry in natural waters. Dissolved oxygen, biological oxygen demand, chemical oxygen demand, determination of DO, BOD and COD. Aerobic and anaerobic reactions of organic sulphur and nitrogen compounds in water, acid-base chemistry.

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	water and sea water. Aluminum, nitrate and fluoride in water. Petrification. Sources of water pollution. Treatment of waste and sewage. Purification of drinking water, techniques of purification and disinfection.
Unit-4	**Environmental Toxicology** **Toxic heavy metals :** Mercury, lead, arsenic and cadmium. Causes of toxicity. Bioaccumulation, sources of heavy metals. Chemical speciation of Hg, Pb, As, and Cd. Biochemical and damaging effects. **Toxic Organic Compound :** Pesticides, classification, properties and uses of organochlorine and ionospheres pesticides detection and damaging effects. **Polychlorinated biphenyls :** Properties, use and environmental continuation and effects. **Polynuclear Aromatic Hydrocarbons :** Source, structures and as pollutants.
Unit-5	**Soil and Environmental Disasters** Soil composition, micro and macronutrients, soil pollution by fertilizers, plastic an metals. Methods of re-mediation of soil. Bhopal gas tragedy, Chernobyl, three mile island, Minimtata Disease, Sevoso (Italy), London smog.

Books Suggested

1. Environmental Chemistry, Colin Baird, W.H. Freeman Co. New York, 1998.
2. Chemistry of Atmospheres, R.P. Wayne, Oxford.
3. Environment Chemistry, A.K. De, Wiley Eastern, 2004.
4. Environmental Chemistry, S.E. Manahan, Lewis Publishers.
5. Introduction to atmospheric Chemistry, P.V. Hobbs, Cambridge.

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OPTIONAL PAPERS

Out of the following select any two papers each of marks 50:

OPT-1 MCH-504 Organotransition Metal Chemistry

OPT-2 MCH-505 Polymers

OPT-3 MCH-506 Heterocyclic Chemistry

OPT-4 MCH-507 Physical Organic Chemistry

OPT-5 MCH-508 Chemistry of Materials

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Sharma

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Class / कक्षा : M.Sc.
Semester / सेमेस्टर : III
Subject / विषय : Chemistry
Title of Subject Group : Organotransition Metal Chemistry
विषय समूह का शीर्षक :
Paper No. / प्रश्नपत्र कमांक : OPT-1 Code- MCH-504
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य : Optional
Max. Marks अधिकतम अंक : 50

Particulars / विवरण

Unit-1	**Alkyls and Aryls of Transition Metals** Types, routes of synthesis, stability and decomposition pathways, organocopper in organic synthesis. **Compounds of Transition Metal-Carbon Multiple Bonds** Alkylidenes, alkylidynes, low valent carbenes and carbynes-synthesis, nature of bond, structural characteristics, nucleophilic and electrophilic reactions on the ligands, role in organic synthesis.
Unit-2	**Transition Metal π-Complexes** Transition metal π-Complexes with unsaturated organic molecules, alkenes, alkynes, allyl, diene, dienyl, arene and trienyl complexes, preparation, properties, nature of bonding and structural features. Important reactions relating to nucleophilic and electrophilic attack on ligands and to organic synthesis.
Unit-3	**Transition organometalic compounds:** Transition metal compounds with bonds to hydrogen, boron, silicon
Unit-4	**Homogeneous Catalysis** Stoichiometric reactions for catalysis, homogeneous catalytic hydrogenation, Zeigler-Natta polymerization of olefins, catalytic reactions involving carbon monoxide such as hydrocarbonylation of olefins (oxoreaction), explanation reactions, activation of C-H bond.
Unit-5	**Fluxional Organometallic Compounds** Flexionality and dynamic equilibrium in compounds such as η^2 olefine, η^3-allyl and dienyl complexes.

Book Suggested

1. Principles and Application of Organotransition Metal Chemistry, J.P. Collman, L.S. Hegsdus, J.R. Norton and R.G. Finke, University Science Books.
2. The Organometallic Chemistry of the Transition Metals, R.H. Crabtree. John Wiley.
3. Metallo-organic Chemistry, A.J. Pearson, Wiley.
4. Organometallic Chemistry, R.C. Mehrotra and A. Singh New Age International.

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Signature Not Verified
ARPAN BHARDWAJ
E=ARPANBHARDW
AJ1@GMAIL.COM,

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Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	: **III**
Subject / विषय	: **Chemistry**
Title of Subject Group	: **Polymers**
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र कमांक	: OPT-2 **(Code- MCH-505)**
Compulsory / अनिवार्य या **Optional / वैकल्पिक अनिवार्य**	: **Optional**
Max. Marks अधिकतम अंक	: 50

Particulars / विवरण

Unit-1	**Basics** Importance of polymers. Basic concepts: Monomers, repeat units, degree of polymerization Linear, branched and network polymers. Classification of polymers. Polymerization: condensation, addition/radical chain-ionic and co-ordination and copolymerization. Polymerization conditions and polymer reactions. Polymerization in homogeneous and heterogeneous systems.
Unit-2	Polymer Characterization Polydispersion-average molecular weight concept. Number, weight and viscosity average molecular weights. Polydispersity an molecular weight distribution. The practical significance of molecular weight. Measurement of molecular-weights. End-group, viscosity, light scattering, osmotic and ultracentrifugation methods.
Unit-3	**Analysis and testing of polymers** Chemical analysis of polymers, spectroscopic methods, X-ray diffraction study. Microscopy. Thermal analysis and physical testing-tensile strength. fatigue, impact, tear resistance, Hardness and abrasion resistance.
Unit-4	**Inorganic Polymers** A general survey and scope of Inorganic Polymers special characteristics, classification, homo and hetero atomic polymers. Structure, Properties and Applications of a. Polymers based on boron-borazines, boranes and carboranes. b. Polymers based on Silicon, silicone's polymetalloxanes and polymetallosiloxanes, silazanes.
Unit-5	**Structure, Properties and Application of Polymers** a. Polymers based on Phosphorous-Phosphazenes, Polyphosphates b. Polymers based on Sulphur-Tetrasulphur tetranitride and related compounds. c. Co-ordination and metal chelate polymers.

Book Suggested

1. Inorganic Chemistry, J.E. Huheey, Harper Row.
2. Developments in Inorganic polymer Chemistry, M.F. Lappert and G.J. Leigh.
3. Inorganic polymers- N.H. Ray.
4. Inorganic polymers, Graham and Stone.
5. Inorganic Rings and Cages : D.A. Armitage.
6. Textbook of Polymers Science, F.W. Billmeyer Jr. Wiley.
7. Contemporary Polymer Chemistry, H.R. Al cock and F.W. Lambe, Prentice Hall.

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Session (सत्र) ~~2010-2011~~ 2013-14

Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	: III
Subject / विषय	: Chemistry
Title of Subject Group	: Heterocyclic Chemistry
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र कमांक	: OPT-3 (Code- MCH-506)
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: Optional
Max. Marks अधिकतम अंक	: 50

Particulars / विवरण

Unit-1	**Nomenclature of Heterocycles** Replacement and systematic nomenclature (HantzsMCH-Widman system) for monocyclic fused and bridged heterocycles. **Aromatic Heterocycles** General chemical behaviour of aromatic heterocycles, classification (structural type), criteria of aromaticity (bond lengths, ring current and chemical shifts in 1H NMR-spectra. Empirical resonance energy, delocalization energy and Dewar resonance energy, diamagnetic susceptibility exaltations). Heteroaromatic reactivity and tautomerism in aromatic heterocycles.
Unit-2	**Non-aromatic Heterocycles** Strain-bond angle and torsional strains and their consequences in small ring heterocycles. Conformation of six-membered heterocycles with reference to molecular geometry, barrier to ring inversion, pyramidal inversion and 1,3-diaxial interaction. Aterco-electronic effects anomeric and related effects. Attractive interactions-hydrogen bonding and intermolecular nucleophilic electrophilic interactions. Heterocyclic synthesis-princples of heterocyclic synthesis involing cyclization reactions and cycloaddition reactions.
Unit-3	**Small Ring Heterocycles** Three-membered and four-membered heterocycles-synthesis and reactions of azirodines, oxiranes, thiranes, azetidines, oxetanes and thietanes. **Benzo-Fused Five-Membered Heterocycles** Synthesis and reactions including medicinal applications of benzopyrroles, bezofurans and benzothiophenes.
Unit-4	**Meso-ionic Heterocycles** General classification, chemistry of some important meso-ionic heterocycles of type-A and B and their applications. **Six-Membered Heterocycles with one Heteroatom** Synthesis and reactions of pyrylium salts and pyrones and their comparison with pyridinium & thiopyrylium salts and phridones. Synthesis and reactions of quionlizinium and benzopyrylium salts, coumarins and chromones.
Unit-5	Six Membered Heterocycles with Two or More Heteroatoms: Synthesis and reactions of diazones, triazines, tetrazines and thiazines. Seven-and Large-Membered Heterocycles: Synthesis and reactions of azepines, oxepines, thiepines, diazepines, thiazepines, azocines, diazocines, dioxocines and dithiocines. **Heterocyclic Systems Containing P, As, Sb and B** Heterocyclic rings containing phosphorus : Introduction, nomenclature,

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	characteristics of 5- and 6-membered ring systemsphosphorinaes, phosphorines, phospholanes and phospholes. Heterocyclic rings containing As and Sb : Introduction, synthesis and characteristics of 5- and 6-membered ring system. Heterocyclic rings containing B : Introduction, synthesis reactivity and spectral characteristics of 3- 5- and 6-membered ring system.

Book Suggested

1. Heterocyclic Chemistry Vol. 1-3, R.R. Gupta, M. Kumar and V.Gupta, Springer Verlag.
2. The Chemistry of Heterocycles, T. Eicher and S. Hauptmann, Thieme.
3. Heterocyclic chemistry J.A. Joule, K. Mills and g.F. Smith, Chapman and Hall.
4. Heterocyclic Chemistry, T.L. Gilchrist, Longman Scietific Techinal.
5. Contemporary Hetrocyclic Chemistry, G,.R. Newkome and W.W. Paudler, Wiley-Inter Science.
6. An Introductiion to the Heterocyclic Compounds, R.M. Acheson, Johnwiely.
7. Comprehensive Heterocyclic Chemistry, A.R. Katrizky and C.W. Rees, eds. Pergamon Press.

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Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	: III
Subject / विषय	: Chemistry
Title of Subject Group	: Physical Organic Chemistry
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र कमांक	: OPT-4 (Code- MCH-507)
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: Optional
Max. Marks अधिकतम अंक	: 50

Particulars / विवरण

Unit-1	**Concepts in Molecular Orbital (MO) and Valence Bond (VB) Theory** Introduction to Huckel molecular orbital (MO) method as a mean to explain modern theoretical methods. Advanced techniques in PMO and FMO theory. Molecular mechanics, semi empirical methods and ab initio and density functional methods. Scope and limitations of several computational programmes.
Unit-2	Quantitative MO theory : Huckel molecular orbital (HMO - method as applied to ethene, allyl and butadiene. Qualitative MO theory ionisation potential. Electron affinities. MO energy levels. Orbital symmetry. Orbital interaction diagrams. MO of simple organic systems such as ethene, allyl, butadiene, methane and methyl group. Conjugation and hyper-conjugation. Aromaticity. Valence bond (B) configuration mixing diagrams. Relationship between VB configuration mixing and resonance theory. Reaction profiles. Potential energy diagrams. Curve-crossing model-nature of activation barrier in chemical reactions.
Unit-3	**Principles of Reactivity** Mechanistic significance of entropy, enthalpy and Gibb's free energy. Arrrhenius equation. Transition state theory. Uses of activation parameters, Hammond's postulate, Bell-Evans-Polanyi Principle. Potential energy surface model. Marcus theory of electron transfer. Reactivity and selectivity principles. **Kinetic Isotope Effect** Theory of isotope effects. Primary and secondary kinetic isotope effects. Heavy atom isotope effects. Tunneling effect. Solvent effects. **Structural Effects on Reactivity** Linear free energy relationships (LFER). The Hammett equation, substituent constants, theories of substituent effects. Interpretation of δ-values. Reaction constants. Deviations from Hammett equation. Dualparameter correlatins, inductive substituent constant. The Taft model, s1 and sR scales.
Unit-4	**Acids, Bases, Electrophiles, Nucleophiles and Catalysis** Acid-base dissociation, Electronic and structural effects, acidity and basicity. Acidity functions and their applicatins. hard and soft acids and bases. Nucleophilicity scales. Nucleofugacity. The α-effect. Ambivalent nucleophiles. Acid-base catalysis-specific and general catalysis. Bronsted catalysis, Nucleophilic and electrophilic catalysis. Catalysis by noncovalent binding-micellar catalysis. **Steric and Conformation Properties** Various type of steric strain and their influence on reactivity. Steric a[illegible] Molecular measurements of steric effects upon rates. Steric LFET, C[illegible] to bond rotation-spectroscopic detection of individual conformers. A[illegible]

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	monocyclic systems. Rotation around partial double bonds. Winstein-Holness and Curtin-Hammett principle.
Unit-5	**Nucleophilic and Electrophilic Reactivity** Structural and electronic effects on SN^1 and SN^2 reactivity. Solvent effect, Kinetic isotope effects. Intramolecular assistance. Electron transfer nature of SN^2 reaction. Nucleophilicity and SN^2 reactivity based on curved crossing mode. Relationship between polar and electron transfer reactions, SR_N^1 mechanism. Electrophilic reactivity, general mechanism. Kinetic of S_E^2 Ar reaction. Structural effects on rates and selectivity. Curve-crossing approach to electrophilic reactivity. **Supramolecular Chemistry** Properties of covalent bonds-bond length, inter-bond angles, force constant, bond and molecular dipole moments. Molecular and bond polarizability, bond dissociation enthalpy, entropy. intermolecular forces, hydrophobic effects. Electrostatic, induction, dispersion and resonance energy, magnetic interactions, magnitude of interaction energy, forces between macroscopic bodies, medium effects. Hydrogen bond.

Book Suggested :

1. Molecular Mechanics, U. Burket and N.L. Allinger, ACS Monograph 177, 1982.
2. Orgaic Chemists. Book of Orbitals : L. Salem and W.L. Jorgensen, Academic Press.
3. Mechanism and Theory in Organic chemistry, T.H. Lowry and K.C. Richadson, Harper and Row.
4. Introduction to Theoretical Organic Chemistry and Molecular Modeling.
5. Physical Organic Chemistry : N.S. Isaacs, ELBS/Longman.
6. Supramolecular Chemistry : Concepts and Perspective, J.M. Lehn, VCH.
7. The Physical Basis of Organic Chemistry : H. Maskill, Oxford University Press.

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Class / कक्षा : M.Sc.
Semester / सेमेस्टर : III
Subject / विषय : Chemistry
Title of Subject Group : Chemistry of Materials
विषय समूह का शीर्षक :
Paper No. / प्रश्नपत्र कमांक : OPT-5 (Code- MCH-508)
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य : Optional
Max. Marks अधिकतम अंक : 50

Particulars / विवरण

Unit-1	**A. Multiphase materials** Ferrous alloys; Fe-C phase transformations in ferrous alloys; stainless steels, non ferrous alloys, properties of ferrous and non-ferrous alloys and their applications. **B. Glasses, Ceramics, Composites and Nanomaterials** Glassy state, glass formers and glass modifiers, applications. Ceramic structures, mechanical properties, clay products. Refractories, characterizations, properties and applications. Microscopic composites; dispersion-strengthened and particle-reinforced, firbre-reinforced composites, macroscopic composites. Nanocrystalline phase, preparation procedures, special properties, applications.
Unit-2	**A. Thin Films and Langmuir-Blodgett Films** Preparation techniques; evaporation/sputtering, chemical processes, MOCVD, sol-gel etc. Languir-Blodgett (LB) film, growth techniques, photolithography, properties and applications of thin and LB films. **B Liquid Crystals** Mesmorphic behaviour, thermotropic liquid crystals, positional order, bond orientational order. nematic and smectic mesophases; smectic-nematic transition and clearing temperature-homeotropic. planer and schlieren textures. twisted nematics, chiral nematics, molecular arrangement in smectic A and smectic C phases, optical properties of liquid crystals. Dielectric susceptibility and dielectric constants. Lyotropic phases and their description of ordering in liquid crystals.
Unit-3	**A. Polymeric Materials** Molecuar shape. structure and configuration, crystallinity, stress-strain behaviour, thermal behaviour, polymer types and their applications, conducting and ferro-electric polymers. **B. Ionic Conductors** Types of ionic conductgors, mechanism of ionic conduction, interstitial jumps (Frenkil); vacancy mechanism, diffusion superionic conductors; phase transitions and mechanism of conduction in superionic conductors, examples and applications of ionic conductors.
Unit-4	**High T_c Materials** Defect perovskites, high T_c superconductivity in cuprates, preparation and characterization of 1-2-3 and 2-1-4 materials, normal state properties; anisotropy; temperature dependence of electrical resistance; optical phonon modes, superconducting state; heat capacity; coherence length, elastic constants, position lifetimes, microwave absorption-pairing and multigap structure in high T_c materials, applications of high T_c materials.
Unit-5	**A. Materials of Solid State Devices** Rectifiers. transistors, capacitors-IV-V compounds, low-dimentional quantum structures.

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	optical properties. **B. Organic Solids, Fullerenes, Muleuclar Devices** Conducting organics, organic superconductors, magnetism in organic materials. Fullerenes-doped, fullerenes as superconductors. Moleuclar rectifiers and transistors, artificial phytosynthetic devices, optical storage memory and switches-sensors. Nonlinear optical materials; nonlinear optical effects, second and third order-molecular hyperpolarisability an second order electric susceptibility – materials for second and third harmonic generation.

Book Suggested

1. Solid State Physics, N.W.Ashcroft and N.D.Mermin, Saunders College.
2. Materials Science and Engineering, An Introduction, W.D.Callister, Wiley.
3. Principles of the Solid State, H.V. Keer, Wiley Eastern.
4. Materials Sciences, J.C.Anderson, K.D.Leaver, J.M.Alexander and R.D. Rawlings, ELBS
5. Thermotropic liquid Crystals, Edl, G.W. Gray, John Wiley.
6. Handbook of Liquid Crystals, Kelker and Hatz, Chemie Verlag.

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Practicals

SEMESTER III 2013-14

(Duration: 6-8 hrs in each branch)

Practical examination shall be conducted separately for each branch.

Inorganic Chemistry

Quantitative determinations of a three component mixture	12
Chromatographic Separations	12
Record	04
Viva Voice	05

Quantitative determinations of a three component mixture :

Quantitative analysis of tri-component mixture of metal ions using gravimetric and volumetric techniques.

(i) Mixed solution of Cu^{2+}, Ni^{2+} and Zn^{2+}

(ii) Mixed solution of Cu^{2+}, Ni^{2+} and Mg^{2+}

(iii) Mixed solution of Cu^{2+}, Ag^{+} and Fe^{2+}

(iv) Mixed solution of Ni^{2+}, Zn^{2+} and Fe^{2+}

Chromatographic Separations

Thin-layer chromatography-separation of nickel, manganese, cobalt and zinc. Determination of Rf values.

Separation of cations and anions by Paper Chromatography.

Cadmium and zinc

Zinc and magnesium.

SEMESTER III

Organic Chemistry

Multi-step Synthesis of Organic Compounds	16
Paper Chromatography	08
Record	04
Viva Voice	05

Multi-step Synthesis of Organic Compounds

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

Beckmann rearrangement : Benzanilide from benzene Benzene -> Benzophenone -> Benzophenone oxime -> Benzanilide

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Benzilic acid rearrangement : Benzilic acid from benzoin Benzoin -> Benzil -> Benzilic acid
Synthesis of heterocyclic compounds Skraup synthesis : Preparation of quinoline from aniline
Fisher Indole synthesis : Preparation of 2-phenylindole from phenylhydrazine.
Enzymatic synthesis Enzymatic reduction : reduction of ethyl acetoacetate using Baker's yeast to yield enantiomeric excess of S (+) ehtyl-3-hydroxybutanoate and determine its optical purity.

Thin layer Chromatography

Separation and identification of the sugars / amino acids present in the given mixture by TLC chromatography and determination of RF values

SEMESTER III

Practical

(Duration: 6-8 hrs in each branch)

Physical Chemistry

Spectroscopy	13
Conductometry / Equilibrium and Dissociation Constants	12
Record	04
Viva Voice	05

Conductometry

1. Determination of solubility and solubility product of sparingly soluble salts (e.g. PbSO4, BaSO4) conductometrically.
2. Determination of the dissociation constant of acetic acid.
3. A commercial sample of vinegar is suspected of having H_2SO_4. Show conductometricly, if it is so and estimate the impurity of mineral acid if present.

Spectroscopy

1. Determination of PKa of an indicator (e.g. methyl red) in (a) aqueous and (b) micellar media.
2. To verify Beers law for solution of $K_2Cr_2O_7$ and $KMnO_4$ using spectrophotometer and determine the concentrations in their solutions of unknown concentration.
3. To determine the composition of a binary mixture containing say $K_2Cr_2O_7$ or $KMnO_4$ spectrophotometrically.
4. Determination of stoichiometry and stability constant of Ferricisothicoyanation complex ion in solution.

Equilibrium and Dissociation Constants

1. To determine the equilibrium constant of the esterification reaction between acetic acid and ethanol.
2. To determine the equilibrium constant of the keto-enol tautomerism of ethyl acetoacetate.

3. To determine the dissociation constant of picric acid by studying its distribution between benzene and water.

Books Suggested

1. Vogel's Textbook of Quantitative Analysis, revised, J. Bassett, R.C. Denney, G.H. Jeffery and J. Mendham, ELBS.
2. Synthesis and Characterization of Inorganic Compounds, W.L. Jolly. Prentice Hall.
3 Experiments and Techniques in Organic Chemistry, D.P. Pasto, C. Johnson and M. Miller, Prentice Hall.
4. Macroscale and Microscale Organic Experiments, K.L. Williamson, D.C. Health.
5. Systematic Qualitative Organic Analysis, H. Middleton, Adward Arnold.
6. Handbook of Organic Analysis-qualitative and Quantitative. H. Clark, Adward Arnold.
7. Vogel's Textbook of Practical Organic Chemistry, A.R Tatchell, John Wiley.
8. Practical Physical Chemistry, A.M. James and F.E. Prichard, Longman.
9. Findley's Practical Physical chemistry, B.P. Levitt, Longman.
10. Experimental Physical Chemistry, R.C. Das and B. Behera, Tata McGraw Hill.
11. Inorganic Experimens, J. Derek Woolings, VCH.
12. Microscale Inorganic Chemistry, Z. Szafran, R.M, Pike and M.M. Singh, Wiley.
13. Practical Inorganic Chemistry, G. Marr and B. W. Rockett, Van Nostrad.
14. The systematic Identification of Organic Compounds, R.L. Shriner and D.Y curlin.

22/7/13

Sharma

Department of Higher Education, Govt. of M.P.
Post Graduate Semester wise Syllabus
as recommended by Central Board of Studies and approved by the Governor of M.P.
उच्च शिक्षा विभाग, म.प्र. शासन
स्नातकोत्तर कक्षाओं के लिये सेमेस्टर अनुसार पाठ्यक्रम
केंद्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा म. प्र. के राज्यपाल द्वारा अनुमोदित

Session (सत्र) 2010 – 2011

Class / कक्षा	M.Sc.
Semester / सेमेस्टर	IV
Subject / विषय	Chemistry
Title of Subject Group विषय समूह का शीर्षक	APPLICATION OF SPECTROSCOPY-II
Paper No. / प्रश्नपत्र कमांक	I (Code- MCH-511)
Compulsory / अनिवार्य या **Optional** / वैकल्पिक अनिवार्य	Compulsory
Max. Marks अधिकतम अंक	50

Particulars/विवरण

Unit-1	**Ultraviolet and Visible spectroscopy** Various electronic transitions (185-800 nm) Beer-Lambert law, Effect of solvent on electronic transitions, ultraviolet bands for carbonyl compounds, unsaturated carbonyl compounds, dienes, conjugated polyenes, Fieser Woodward rules for conjugated dienes and carbonyl compounds, ultraviolet spectra of aromatic compounds. Steric effect in biphenyls.
Unit-2	**Infrared Spectroscopy** Characteristic vibrational frequencies of alkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers, phenols and amines. Detailed study of vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters, amides, acids, anhydrides, lactones, lactams and conjugated carbonyl compounds). Effect of hydrogen bonding and solvent effect on vibrational frequencies, overtones, combination bands and fermi resonance.
Unit - 3	**Nuclear Magnetic Resonance of Paramagnetic Substances in Solution** The contact and Pseudo contact shifts, factors affecting nuclear relaxation, some applications including biochemical systems, an overview of NMR of metal nuclide with emphasis on ^{195}Pt and ^{119}Sn NMR.
Unit-4	**Carbon-13 NMR Spectroscopy** General considerations, chemical shift (aliphatic olefinic, alkyne, aromatic, heteroaromatic and carboyml carbon), coupling constants. Two dimension NMR spectroscopy-COSY, NOESY, DEPT, HMBC and HMQC techniques.
Unit-5	**Mass Spectrometry** Introduction ion production EI, CI FD, ESI and FAB, factors affecting fragmentation, ion analysis, ion abundance Mass spectral fragmentation of organic compounds, common functional groups, molecular ion peak, metastable peak. Mc Lafferty rearrangement. Nitrogen rule. High resolution mass spectrometry. Structure elucidation of simple molecules using UV – Visible, IR, NMR and mass spectral techniques.

21-2-12

Suggested Readings:

1. Physical Methods for Chemistry, R.S. Drago, Saunders Compnay.
2. Structural Methods in Inorganic Chemistry, E.A.V. Ebsworth, D.W.H. Rankin and S. Cradock, ELBS.
3. Infrared and Raman Spectral ; Inorganic and Coordination Compounds K. Nakamoto, Wiley.
4. Progress in Inorganic Chemistry vol., 8, ed., F.A. Cotton, vol., 15 ed. S.J. Lippard, Wiley.
5. Transition Metal Chemistry ed. R.L. Carlin vol. 3 dekker.
6. Inorganic Electronic Spectroscopy, A.P.B. Lever, Elsevier.
7. NMR, NQR, EPR and Mossbauer Spectroscopy in Inorganic Chemistry, .V. Parish, Ellis Haywood.
8. Practical NMR Spectroscopy, M.L. Martin. J.J. Deepish and G.J. Martin, Heyden.
9. Spectrometric Identification of Organic Compounds, R.M. Silverstein, G.C. Bassler adn T C. Morrill, John Wiley.
10. Introduction to NMR spectroscopy, R.J. Abraham, J. Fisher and P. Loftus, Wiley
11. Application of Spectroscopy of Organic Compounds, J.R. Dyer Prentice Hall.
12. Spectroscopic Methods in Organic Chemistry D.H. Williams, I. Fleming, Tata McGraw-Hill.
13. Structural Methods in Inorganic Chemistry, E.A.V. Ebsworth, D.W.H. Rankin and S. Cradock, ELBS.
14. Introduction to NMR spectroscopy, R.J. Abraham, J. Fisher and P. Loftus, Wiley.

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Session (सत्र) 2010 – 2011

Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	IV
Subject / विषय	: Chemistry
Title of Subject Group	**SOLID STATE CHEMISTRY**
विषय समूह का शीर्षक	:
Paper No. / प्रश्नपत्र कमांक	: **II (Code- MCH-512)**
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: Compulsory
Max. Marks अधिकतम अंक	50

Particulars / विवरण

Unit-1	**Solid State Reactions** General principles, experimental procedure, co-precipitation as a precursory to solid state reactions, kinetics of solid state reactions.
Unit-2	**Crystal Defects and Non-Stoichiometry** Perfect and imperfect crystals, intrinsic and extrinsic defects-point defects, line and plane defects, vacancies-Schottky detects and Frenkel defects. Thermodynamics of Schottky and Frenkel defect formation, colour centres, non-stoichiometry and defects.
Unit-3	**Electronic Properties and Band Theory** Metals insulators and semiconductors, electronic structure of solidsband theory band structure of metals, insulators and semiconductors, Intrinsic and extrinsic semiconductors, doping semiconductors, p-n junctions, super conductors. Optical properties-Application of optical and electron microscopy. Magnetic Properties-Classification of materials : Effect of temperature calculation of magnetic moment, mechanism of ferro and anti ferromagnetic ordering super exchange.
Unit-4	**Organic Solids** Electrically conducting solids, organic charge transfer complex, organic metals, new superconductors.
Unit-5	**Liquid Crystals:** Types of liquid crystals: Nematic, Smectic, Ferroelectric, Antiferroelectric, Various theories of LC, Liquid crystal display, New materials.

Books Suggested.

1. Solid state chemistry and its applications, A.R. West. Peenum.
2. Principles of the Solid State, H.V. Keer, Wiley Eastern.
3. Solid State Chemistry, N.B. Hannay.
4. Solid State Chemistry, D.K. Chakrabarty, New Wiley Eastern.

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Session (सत्र) 2010 – 2011

Class / कक्षा	: M.Sc.
Semester / सेमेस्टर	: IV
Subject / विषय	: Chemistry
Title of Subject Group विषय समूह का शीर्षक	: **BIOCHEMISTRY**
Paper No. / प्रश्नपत्र कमांक	: **III (Code- MCH-513)**
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: Compulsory
Max. Marks अधिकतम अंक	: 50

Particulars / विवरण

Unit-1	**Metal Ions in Biological Systems** Bulk and trace metals with special reference to Na, K, Mg, Ca, Fe, Cu, Zn, Co, and K+/Na+ pump. **Bioenergetics and ATP Cycle.** DNA polymerisation, glucose storage, metal complexes in transmission of energy; chlorophyll's, photosystem I and photosystem II in cleavage of water. **Transport and Storage of Dioxygen** Heam proteins and oxygen uptake structure and function of haemoglobin's, mygolobin, haemocyanms and hemerythrin, model synthetic complexes of iron, cobalt and copper.
Unit-2	**Electron Transfer in Biology** Structure and function of metal of proteins in electron transport processes cytochrome's and iron-sulphure proteins. synthetic models. **Nitrogen fixation** Biological nitrogen fixation, and its mechanism, nitrogenase, Chemical nitrogen fixation.
Unit-3	**Enzymes** Introduction and historical perspective, chemical and biological catalysis, remarkable properties of enzymes like catalytic power, specificity and regulation. Nomenclature and classification, extraction and purification. Fischer's lock and key and Koshalnd's induced fit hypothesis, concept and identification of active site by the use of inhibitors, affinity labeling and enzyme modification by site-directed mutagenesis. Enzyme kinetics, Michael's-Menten and Lineweaver Burk plots, reversible and irreversible inhibition. **Mechanism of Enzyme Action** Transition-state theory, orientation and Steric effect, acid-base catalysis, covalent catalysis, strain or distortion. Examples of some typical enzyme mechanisms for chemotrypsin, ribonuclease, lysozyme and carboxypeptidase. **Kinds of Reactions Catalysed by Enzymes** Nucleophilic displacement on a phosphorus atom, multiple displacement reactions and the coupling of ATP cleavage to endergonic processes. Transfer of sulphate, addition and elimination reactions, enolic intermediates in Isomerisations reactions, b-Cleavage and condensation, some isomerization and rearrangement reactions. Enzyme catalyzed carboxylation and decarboxylation.
Unit-4	**Co-Enzyme Chemistry** Cofactors as derived from vitamines, coenzymes, prosthetic groups, apoenzymes. Structure and biological functions of coenzyme A, thiamine pyrophosphate, pyridoxal phosphate, NAD+, NADP+, FMN, FAD, lipoic acid, vitamin B12. Mechanisms of reactions catalyzed by the above cofactors. **Enzyme Models**

	Host-guest chemistry, chiral recognition and catalysis, molecular recognition, molecular asymmetry and prochirality Biometric chemistry, crown ether, cryptates. Cyclodextrins, cyclodextrion-based enzyme models, clixarenes, ionospheres, micelles synthetic enzymes or synzymes **Biotechnological Applications of Enzymes** large-scale prodcution and purification of enzymes, techniques and methods of immobilization of enzymes, effect of immobilization on enzyme activity, application of immobilized enzymes, use of enzymes in food and drink industry-brewing and cheese-making, syrups from cron starch, enzymes as targets for drug design. Clinical uses of enzymes, enzyme therapy, enzymes and recombinant DNA Technology.
Unit-5	**Biological Cell and its Constituents** Biological cell, structure and functions of proteins, enzymes, DNA and RNA in living systems Helix coils transition. **Bioenergetics** Standard free energy change in biochemical reactions, exergonic, endergonic. Hydrolysis of ATP, synthesis of ATP from ADP **Biopolymer Interactions** Forces involved in biopolymer interactions. Electrostatic charges and molecular expansion, hydrophobic forces, dispersion force interactions. Multiple equilibrium and various types of bidning processes in biological systems. Hydrogen ion titration curves. **Cell Membrane and Transport of Ions** Structure and functions of cell membrane, ion transport through cell membrane, irreversible thermodynamic treatment of membrane transport. Nerve conduction.

Book Suggested

1. Principles of Bioinorganic Chemistry, S.J Lippard and J.M. Berg, University Science Books.
2. Bioinorganic Chemistry, I Bertini, H.B. Gray, S J Lippard and J S Valentine, University Science Books.
3. Inorganic biochemistry vol. I and II ed G.L. Eichhorn, Elsever.
4. Progress in Inorganic Chemistry, Vol 18 and 38 ed J J. Lippard, Wiley.
5. Bioorganic Chemistry : A chemical Approach to Enzyme Action, Hermann Dugas and C. Penny, Springer Verlag
6. Understanding Enzymes, Trevor Palmer, Prentice Hall
7. Enzyme Chemistry : Impact and applications, Ed. Collin J suckling, chemistry.
8. Enzyme Mechanisms Ed. M.I. Page and A Williams, Royal Society of Chemistry.
9. Fundamentals of Enzymology, N.C. Price and L. Stevens. Oxford University Press.
10. Immobilized Enzymes : An Introduction and Applications in Biotechnology, Michael ID. Trevan, Hohn Wiley.
11. Enzymatic Reaction Mechanisms C. Walsh. W H. Freeman.
12. Enzyme Structure and Mechanism, A Fersht, W H. Freeman
13. Biochemistry : The Chemical Reactions of Living Cells, D.E Metzler, Academic Press.

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Session (सत्र) 2010 – 2011

Class / कक्षा	M.Sc.
Semester / सेमेस्टर	IV
Subject / विषय	Chemistry
Title of Subject Group विषय समूह का शीर्षक	**Organic Synthesis**
Paper No. / प्रश्नपत्र क्रमाक	**OPT-1 (Code- MCH-514)**
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	Optional
Max. Marks अधिकतम अंक	50

Particulars / विवरण

Unit-1	**Disconnection Approach** An introduction to synthons and synthetic equivalents. Disconnection approach, functional group inter-conversions, the importance of the order of events in organic synthesis, one group C-X and two group C-X disconnections, chemoselectivity, reversal of polarity, cyclisation reaction, amine synthesis. Protection of groups, chemo, region and stereo selectivity.
Unit-2	**One Group C-C Disconnections** Alcohols and carbonyl compounds, regioselectivity, alkene synthesis, use of acetylenes and aliphatic Nitro compounds in organic synthesis. **Two Group C-C Disconnections** Diels-Alder Reaction, 1,3-difunctionalised compounds, a-b- unsaturated carbonyl compounds, control in carbonyl condensations, 1,5-difunctionalised compounds. Micheal addition and Robinson annelation.
Unit-3	**Oxidation** Introduction, Different oxidative processes. Hydrocarbons-alkenes, aromatic rings, saturated C-H groups (activated and unactivated) Alcohols, diols, aldehyde's, ketones, ketals and carboxylic acids. Amines, hydrazines, and sulphides Oxidations with ruthenium tetraoxide, iodobenzene diacetate and thallium. (III) Nitrate **Reduction** Introduction, Different reductive processes Alkanes, alkenes, alkynes, and aromatic rings. Carbonyl compounds-aldehydes, ketones, acids and their derivatives. Epoxides Nitro, nitroso, azo and oxime groups Expoxide, Nitro, Nitroso, azo and oxime groups Hydrogenolysis.
Unit-4	**Organometallic Reagents** Principle, preparations, properties and applications of the following in organic synthesis with mechanistic details. Group I and II metal organic compounds Li, Mg, Hg, Cd, Zn and Ce Compounds.
Unit-5	**Synthesis of some complex molecules:** Application of the above in the synthesis of following compounds: Camphor, longifoline, cartisone, reserpine, vitamin D, juvabion, aphidicolin and fredericamycin. A

Suggested Readings:

1. Designing Organic Synthesis, S Warren Wiley.
2. Organic Synthesis-Concept, Methods and Starting Materials, J Fuhrhop
3. Some Modern Methods of Organic Synthesis W carruthers, Cambridge Univ. Press.
4. Modern Synthetic Reactions H O House, W.A Benjamin
5. Advanced Organic Chemistry : Reactions, Mechanisms and Structure, J March Wiley.
6. Principles, of Organic Chemistry Part B F.a Carey and R J. Sundberg, Plenum Press

Department of Higher Education, Govt. of M.P.
Post Graduate Semester wise Syllabus
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Session (सत्र) 2010 – 2011

Class / कक्षा	M.Sc.
Semester / सेमेस्टर	IV
Subject / विषय	Chemistry
Title of Subject Group विषय समूह का शीर्षक	**Chemistry of Natural Products**
Paper No. / प्रश्नपत्र कमांक	**OPT-2 (Code- MCH-515)**
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	Optional
Max. Marks अधिकतम अंक	50

Particulars / विवरण

Unit-1	**Terpenoids and Carotenoids** Calcifications, nomenclature, occurrence, isolation, general methods of structure determination, isoprene rule. Structure determination, stereochemistry, biosynthesis and synthesis of the following representative molecules : Citral, Geraniol α-Terpeneol, Menthol, Farnesol, Zingiberene, Santonin, Phytol, Abietic acid and β-Carotene.
Unit-2	**Alkaloids** Definition, nomenclature and physiological action, occurrence, isolation, general methods of structure elucidation, degradation, classification based on nitrogen heterocyclic ring, role of alkaloids in plants. Structure, stereochemistry, synthesis and biosynthesis of the following : Ephedrine , (+)- Coniine, Nicotine, Atropine, Quinine and Morphine.
Unit-3	**Steroids** Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and stereochemistry, Isolation, Structure determination and synthesis of Cholesterol, Bile acids, Androsterone, Testosterone, Estrone, Progesterone, Aldosterone, Biosynthesis of Steroids.
Unit-4	**Plant Pigments** Occurrence, nomenclature and general methods of structure determination. Isolation and synthesis of Apigenin, Luteolin Quercetin, Myrcetin, Quercetin 3-glucoside, Vitexin, Diadzein, Aureusin, Cyanidin-7arabinoside, Cyanidin, Hirsutidin, Biosynthesis of flavonoids: Acetate pathway and Shikimic acid pathway. **Prophyrins** Structure and synthesis of Haemoglobin and Chlorophyll.
Unit-5	**Prostaglandin** Occurrence, nomenclature, classification, biogenesis and physiological effects. Synthesis of PGE2 and PGF2a. **Pyrethroids and Rotenones** Synthesis and reactions of Pyrethroids and Rotenones. (For structure elucidation, emphasis is to be placed on the use of spectral parameters wherever possible).

Suggested Readings:

1. Natural Products : Chemistry and Biological Significance, J Mann, R.S. Davidson, J.B. Hobbs, D V. Banthrope adn J B Harborne, Longman, Esses.
2. Organic Chemistry Vol 2 IL. Finar, ELBS
3. Stereoselective Synthesis : A Practical Approach, M Norgradi, VCH
4. Rodd's Chemistry of Carbon Compounds, Ed. S. Coffey, Elsevier
5. Chemistry, Biological and Pharmacological Properties of Medicinal Plants from the Americas, Ed Kurt Hostettmann, M.P Gupta and A Marston, harwood Academic Publishers, Switzerland

6. Introduction to Flavonoids, B.A. Bohm. Harwood Academic Publishers.
7. New Trends in Natural Product chemistry, Ataaur Rahman and M.L. Choudhary, Harwood Academic Publishers.
8. Insecticides of Natural Origin, Sukh Dev, Harwood Academic Publishers.

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Session (सत्र) 2010 – 2011

Class / कक्षा	M.Sc.
Semester / सेमेस्टर	IV
Subject / विषय	Chemistry
Title of Subject Group विषय समूह का शीर्षक	**Analytical Chemistry**
Paper No. / प्रश्नपत्र कमांक	**OPT-3 (Code- MCH-516)**
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	Optional
Max. Marks अधिकतम अंक	50

Particulars / विवरण

Unit-I	**Introduction** Role of analytical chemistry Classification of analytical methods classical and instrumental. Types of instrumental analysis. Selecting an analytical method. Neatness and cleanliness laboratory operations and practices. Analytical balance. Techniques of weighing, errors. Volumetric glassware cleaning and calibration of glassware. Sample Volumetric glassware cleaning and Calibration of glassware. Sample preparation-dissolution and decompositions. Gravimetric techniques. Selecting and handling or reagents. Laboratory notebooks Safety in the analytical laboratory. **Errors and Evaluation** Definition of terms in mean and median. Precision-standard deviation, relative standard deviation. Accuracy-absolute error, relative error Types of error in experimental data determinate (systematic), indeterminate (or random) and gross. Sources of error and the effects upon the analytical results. Methods for reporting analytical data. Statistical evaluation of data-indeterminate errors The uses of statistics.
Unit-2	**Food analysis** Moisture, ash, crude protein, fat crude fiber, carbohydrates, calcium, potassium, sodium and phosphate. Food adulteration-common adulterants in food, contamination of foods stuffs. Microscopic examination of foods for adulterants. Pesticide analysis in food prodcuts. Extraction and purification of sample. HPLC. Gas chromatography for organophosphates. Thin-layer chromatography for identification of chlorinated pesticides in food products.
Unit-3	**Analysis of Water Pollution** Origin of Waste water, types, water pollutants and their effects. Sources of water pollution-domestic, industrial, agricultural soil and radioactive wastes as sources of pollution. Objectives of analysis-parameter for analysis-colour, turbidity, total solids, conductivity, acidity, alakalinity, hardness, chloride, sulphate, fluoride, silica, phosphates adn different forms of nitrogen, Heavy metal pollution-public health significance of cadmium, chromium, copper, lead, zinc, managanese, mercurry and arsenic. General survey of instrumental technique for the analysis of heavy metals in aqueous systems. Measurements of DO, BOD, and COD. Pesticides as water pollutants and analysis Water pollution laws and standards.
Unit-4	**Analysis of soil, Fuel, Body Fluids and Drugs** (a) Analysis of Soil, moisture pH total nitrogen, phosphorus, silica, lime, magnesia, manganese, sulphur and alkali salts. Fuel analysis : liquid and gas. Ultimate and proximate analysis-heating values-grading of coal. Liquid fuels-flash point, aniline point, octane number and carbon residue. Gaseous fuels-produced gas and water gas-calorific value.

Unit-5	(a) **Clinical Chemistry** : Composition of blood-collection and preservation of samples. Clinical analysis. Serum electrolytes, blood glucose, blood urea nitrogen, uric acid, albumin, globulins, barbiturates, acid and alkaline phosphates. Immunoassay : principles of radio immunoassay (RIA) and applications. The blood gas analysis trace elements n the body (b) **Drug analysis** : Narcotics and dangerous drug. Classification of drugs. Screening by gas and thin-layer chromatography and spectrophotometeric measurements.

Suggested Readings:

1 Analytical Chemistry, G.D. Christian, J.Wicy.
2. Fundamentals o analytical Chemistry. D.A. Skoog. D.M. West and F.J. Hooler, W.B Saunders.
3. Analytical Chemistry-Principles. J.H. Kennedy. W.B. Saunders.
4. Analytical Chemistry-Principles and Techniques LG. Hargis Prentice Hall.
5 Principles of Instrumental analysis D.A. Skoog and J.L. Loary, W.B. Saunders.
6. Principles of Instrumental Analysis D.A. Skoog W.B. Saunders.
7 Quantitative Analysis, R.A. Day, Jr. and A.L. Underwood, Prentice Hall.
8. Environmental Solution, S.M. Khopkar, Wiley Eastern.
9. Basic Concepts of Analysis Chemistry, S.M. Khopkar, Wiley Eastern.
10. Handbook of Instrumental Techniques for Analytical Chemistry, F. Settle, Prentice Hall

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Class / कक्षा	M.Sc.
Semester / सेमेस्टर	IV
Subject / विषय	: Chemistry
Title of Subject Group विषय समूह का शीर्षक	**Electrochemistry**
Paper No. / प्रश्नपत्र कमांक	**OPT-4 (Code- MCH-517)**
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	: Optional
Max. Marks अधिकतम अंक	: 50

Particulars / विवरण

Unit-1	**1. Conversion and Storage of Electrochemical Energy Present status of energy consumption :** Pollution problem. History of fuel cells, Direct energy conversion by electrochemical means Maximum intrinsic efficiency of an electrochemical converter Physical interpretation of the Carnot efficiency factor in electrochemical energy converters. Power outputs. electrochemical Generators (Fuel Cells) : Hydrogen oxygen cells, Hydrogen Air cell, Hydrocarbon air cell, Alkane fuel cell, Phosphoric and fuel cell, direct NaOH fuel cells, applications of fuel cells **Electrochemical Energy Storage :** Properties of Electrochemical energy storage : Measure of battery performance, Charging and discharging of a battery, Storage Density, Energy Density. Classical Batteries : (i) Lead Acid (ii) Nickel-Cadmium, (iii) Zinc manganese dioxide. Modern Batteries . (i) Zinc-Air (ii) Nickel-Metal Hydride, (iii) Lithium Battery, Future Electricity storers : Storage in (i) Hydrogen, (ii) Alkali Metals, (iii) Non aqueous solutions.
Unit-2	**Corrosion and Stability of Metals :** Civilization and Surface mechanism of the corrosion of the metals; Thermodynamics and the stability of metals, Potential -pH (or Pourbaix) Diaphragmsl; uses and abuses, Corrosion current and corrosion potential -Evans diagrams. Measurement of corrosion rate : (i0 Weight Loss method, (ii) Electrochemical Method **Inhibiting Corrosion :** Cathodic and Anodic Protection. (i) Inhibition by addition of substrates to the electrolyte environment, (ii) by charging the corroding method from external source. anodic Protection, Organic inhibitors, The fuller Story Green inhibitors **Passivation :** Structure of Passivation films. Mechanism of Passivation, Spontaneous Passivation Nature's method for stabilizing surfaces.
Unit-3	**Bioelectrochemistry :** bioelectrodics, Membrane Potentials. Simplistic theory, Modern theory, Electrical conductance in biological organism. Electronic, Protonic electrochemical mechanism of nervous systems, enzymes as electrodes. **Kinetic of Electrode Process :** Essentials of Electrode reaction. Current Density, Overpotential, Tafel Equation, Butler Volmer equation. Standard rate constant (K0) and Transfer coefficient (a), Exchange Current. **Irreversible Electrode processes :** Criteria of irreversibility, informatino from irreversible wave.
Unit-4	**Methods of determining kinetic parameters for quasi-rversible and irreversible** waves : Koutecky's method, Meite Israel Method, [illegible] method

	waves : Koutecky's methods, Meits Israel Method, Gellings method **Electrocatalysis** : Chemical catalysts and Electrochemical catalysts with special reference to purostates, porphyrin oxides of rare earths. Electrocatalysis in simple redox reactions, in reaction involving adsorbed species. Influence of various parameters.
Unit-5	**Potential Sweep Method :** Linear sweep Voltammetry, Cyclic Voltammetry, theory and applications. Diagnostic criteria of cycli voltammetry Controlled current microelectrode techniques : comparison with controlled potentials methods, chronopotentiometry, theory ad applications. **Bulk Electrolysis Methods :** Controlled potential coulometry, Controlled Coulometry, Electroorganic synthesis and its important applications. Stripping analysis : anodic and Cathodic modes, Pre electrolysis and Stripping steps, applications of Stripping Analysis.

Suggested Readings:

1. Modern Electrochemistry Vol. I, IIa. Vol. IIB J'OM Bockris and A.K N. Reddy, Plenum Publication, New York.
2. Polarographic Techniques by L. Meites, Interscience
3. "Fuel Cells . Thjeir electrochemistry". McGraw Hill Book Company, New York.
4. Modern Polarographic Methods by A M. Bond, Marcell Dekker.
5. Polarography and allied techniques by K. Zutshi, New age International publicatin. New Delhi.
6. "Electroaalytical Chemistry by Basil H. Vessor & Galen W ; Wiley Interscience.
7. Electroanalytical Chemistry by Basil H. Vessor & alen w ; Wiley Interscience.
8. Topics in pure and Applied Chemistry, Ed. S. K. Rangrajan, SAEST Publication, Karaikudi (India)

Department of Higher Education, Govt. of M.P.
Post Graduate Semester wise Syllabus
as recommended by Central Board of Studies and approved by the Governor of M.P.
उच्च शिक्षा विभाग, म.प्र. शासन
स्नातकोत्तर कक्षाओं के लिये सेमेस्टर अनुसार पाठ्यक्रम
केंद्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा म प्र के राज्यपाल द्वारा अनुमोदित
Session (सत्र) 2010 – 2011

Class / कक्षा	M.Sc.
Semester / सेमेस्टर	IV
Subject / विषय	Chemistry
Title of Subject Group विषय समूह का शीर्षक	Medicinal Chemistry
Paper No. / प्रश्नपत्र कमांक	OPT-5 (Code- MCH-518)
Compulsory / अनिवार्य या Optional / वैकल्पिक अनिवार्य	Optional
Max. Marks अधिकतम अंक	50

Particulars / विवरण

Unit-1	**Structure and activity :** Relationship between chemical structure and biological activity (SAR). Receptor Site Theory. Approaches to drug design. Introduction to combinatorial synthesis in drug discovery. Factors affecting bioactivity. QSAR-Free-Wilson analysis, Hansch analysis, relationship between Free-Wilson analysis and Hansch analysis.
Unit-2	**Pharmacodynamics:** Introduction, elementary treatment of enzymes stimulation, enzyme inhibition, sulfonamides, membrane active drugs, drug metabolism, xenobiotics, biotransformation, significance of drug metabolism in medicinal chemistry.
Unit-3	**Antibiotics and antibacterials** Introduction, Antibiotic β-Lactam type - Penicillins, Cephalosporins, Antitubercular – Streptomycin, Broad spectrum antibiotics – Tetracyclines, Anticancer - Dactinomycin (Actinomycin D)
Unit-4	**Antifungal –** polyenes, Antibacterial – Ciprofloxacin, Norfloxacin, Antiviral – Acyclovir **Antimalarials** : Chemotherapy of malaria. SAR. Chloroquine, Chloroguanide and Mefloquine
Unit-5	**Non-steroidal Anti-inflammatory Drugs :** Diclofenac Sodium, Ibuprofen and Netopam **Antihistaminic and antiasthmatic agents :** Terfenadine, Cinnarizine, Salbutamol and Beclomethasone dipropionate.

Books recommended

1. Introduction to medicinal chemistry, A. Gringuage, Wiley-VCH.
2. Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, Ed Robert F Dorge.
3. An Introduction to Drug Design, S S Pandeya and J.R. Dimmock, New Age International
4. Burger's Medicianl Chemistry and Drug Discovery, Vol-I (Chapter 9 and Chapter 14), Ed. M E.Wolff, John Wiley
5. Goodman and Gilman's Pharmacoloical Basis of Therapeutics, Mc GRaw-Hill.
6. The Organic Chemistry of Drug Design and Drug Action, R.B. Silverman, Academic Press
7. Strategies for Organic Drug synthesis and Design, D.Lednicer, John Wiley.
8. Principles of Medicinal Chemistry W.O.Foye
9. Medicinal Chemistry, The Role of organic chemist in Drug Research, S M. Roberts and B.J. Price

21.2.12

SEMESTER IV

(Duration: 6-8 hrs in each branch)

Practical examination shall be conducted separately for each branch.

Inorganic Chemistry

Preparation	12
Instrumentation	12
Record	04
Viva Voice	05

Preparation

Preparation of selected inorganic compounds and their study by IR, electronic spectra, and magnetic susceptibility measurements. Handling of air and moisture sensitive compounds involving vacuum lines. Selection can be made from the following :

1. Sodium tetrathionate $Na_2S_4O_6$.
2. cis-[Co(trien) $(NO_2)_2$]Cl.H_2O
3. Metal complex of dimethyl sulfoxide : $CuCl_2$.2DMSO J.Chem. Educ., 1982, 59, 57.
4. Synthesis of metal acethylacetonate : Inorg. Synths, 1957, 5, 130, 1963, 1, 183.
5. tris(acetylacetonato)manganese(III), $[Mn(acac)_3]$;
6. Bis(acetylacetonato) complexes of Cu(II), Co(II), and OV(IV)
7. Cis and Trans $[Co(en)_2Cl_2]^+$.
8. Cu_2HgI_4

Spectrophotometric Determinations

a. Nickel by extractive spectrophotometric method.

b. Copper-Ethylene diamine complex : Slope-ratio method.

d. Determination of Keq of M – L systems such as Fe (III) – Salicylic acid or Fe(III) – β – resorcilic acid by Job's &Mole ratio method.

Flame Photometric Determinations

a. Sodium and potassium when present together.

b. Lithium/calcium/barium/strontium.

c. Cadmium and magnesium in tap water.

Potentiometric Titrations:

1. FAS Vs $K_2Cr_2O_7$
2. FAS Vs. $KMnO_4$
3. Determination of phosphoric acid in cola beverages by pH titration.

Conductometry.

1. Verification of Debye Huckle theory of ionic conductance for strong electrolytes KCl, $BaCl_2$, K_2SO_4, $K_3[Fe(CN)_6]$
2. Conductometric Titrations: (a) NaOH Vs. HCl (b) NaOH Vs. Boric acid
3. Analysis of Electronic Spectra of transition metal complexes at least for one system [dn (Oh) or (Td)] and calculation of Crystal Field parameters, interelectronic repulsion parameter and bonding parameter.

SEMESTER IV

Organic Chemistry

Extraction of Organic Compounds from Natural Sources 12

Spectrophotometric Determinations or Estimations 12

Record 04

Viva Voice 05

Extraction of Organic Compounds from Natural Sources

1. Isolation of caffeine from tea leaves.
2. Isolation of casein from milk
3. Isolation of lactose from milk
4. Isolation of nicotine dipicrate from tobacco.
5. Isolation of piperine from black pepper.
6. Isolation of lycopene from tomatoes.
7. Isolation of b-carotene from carrots.
8. Isolation of eugenol from clove.
9. Isolation of (+) limonine from citrus rind.

Spectroscopy

Identification of organic compounds by the analysis of their spectral data (UV, IR, PMR, CMR & MS)

Spectrophotometric (UV/VIS) Estimations

1. Amino acids 2. Proteins 3. Carbohydrates

Determination of the percentage or number of hydroxyl groups in an organic compound by acetylation method.

Estimation of amines/phenols using bromate bromide solution/or acetylation method.

SEMESTER IV

Physical Chemistry

Thermodynamics/Instrumentation	12
Chemical Kinetics	12
Record	04
Viva Voice	05

Thermodynamics

1. Determination of partial molar volume of solute (e.g. KCl) in a binary mixture.
2. Determination of partial molar volume of ethanol in a binary mixture.
3. Determination of the temperature dependence of the solubility of a compound in two solvents having similar intromolecular in tetractions (benzoic acid in water and in DMSO water mixture and calculate the partial molar heat of solution.

Chemical Kinetics

1. Determination of energy and enthalpy of activation in the reaction of KMnO4 and benzyl alcohol in acid medium.
2. Determination of the velocity constant for the oxidation of iodide ions by hydrogen peroxide study the kinetics as an iodine clock reactions.
3. Kinetics of an enzyme catalyzed reaction.

Potentiometry

15. Estimation of halides (Cl^-,Br^- and I^-) in a binary and ternary mixture potentiometrically.
16. To find out the composition of zinc ferrocyanide precipitate on adding zinc sulphate to acidified potassium ferrocyanide solution potentiometrically.

Books Suggested

1 Vogel's Textbook of Quantitative Analysis, revised, J. Bassett, R.C. Denney, G.H. Jeffery and J. Mendham, ELBS.
2. Synthesis and Characterization of Inorganic Compounds, W.L. Jolly. Prentice Hall.
3. Experiments and Techniques in Organic Chemistry, D.P. Pasto, C. Johnson and M. Miller, Prentice Hall.
4. Macroscale and Microscale Organic Experiments, K.L. Williamson, D.C. Health.
5. Systematic Qualitative Organic Analysis, H. Middleton, Adward Arnold.
6. Handbook of Organic Analysis-qualitative and Quantitative. H. Clark, Adward Arnold.
7. Vogel's Textbook of Practical Organic Chemistry, A.R. Tatchell, John Wiley.
8. Practical Physical Chemistry, A.M. James and F.E. Prichard, Longman.
9. Findley's Practical Physical chemistry, B.P. Levitt, Longman.

10. Experimental Physical Chemistry, R.C. Das and B. Behera, Tata McGraw Hill.
11. Inorganic Experimens, J. Derek Woolings, VCH.
12. Microscale Inorganic Chemistry, Z. Szafran, R.M, Pike and M.M. Singh, Wiley.
13. Practical Inorganic Chemistry, G. Marr and B. W. Rockett, Van Nostrad.
14. The systematic Identification of Organic Compounds, R.L. Shriner and D.Y. curlin.

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Semester wise Syllabus For Postgraduates

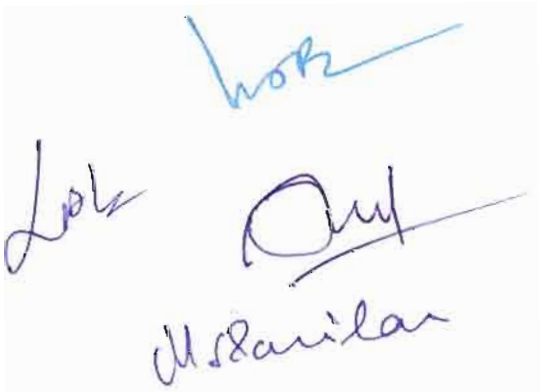
Session
2015-16
M.Sc. Zoology

Department of Higher Education, Govt. Of M.P.

M.Sc. Zoology **Semester I**

2

S.No.	Paper	Topic of paper	Max.Marks	Total
1.	Theory paper I	Biosystematics, Taxonomy and Evaluation	40 +10	200
2.	Theory paper II	Structure and function of invertebrate	40 +10	
3.	Theory paper III	Quantitative biology, Biodiversity and wild life	40 +10	
4	Theory paper III	Bio molecules and structure Biology	40 +10	
5.	Practical paper I	Related to I and II Theory paper	50	100
6.	Practical paper II	Related to III and IV Theory paper	50	



M.Sc. Zoology **Semester II**

S.No.	Paper	Topic of paper	Max.Marks	Total
1.	Theory paper I	General and Comparative animal physiology and Endocrinology	40 +10	200
2.	Theory paper II	Population Ecology and Environmental physiology	40 +10	
3.	Theory paper III	Tools and Techniques for Biology	40 +10	
4	Theory paper III	Molecular cell Biology and Genetics	40 +10	
5.	Practical paper I	Related to I and II Theory paper	50	100
6.	Practical paper II	Related to III and IV Theory paper	50	

M.Sc. Zoology **Semester III**

S.No.	Paper	Topic of paper	Max.Marks	Total
1.	Theory paper I	Comparative anatomy of Vertebrates	40 +10	200
2.	Theory paper II	Limnology	40 +10	
3.	Theory paper III	Ecotoxicology	40 +10	
4	Theory paper III	Aquaculture	40 +10	
5.	Practical paper I	Related to I and II Theory paper	50	100
6.	Practical paper II	Related to III and IV Theory paper	50	

M.Sc. Zoology **Semester IV**

S.No.	Paper	Topic of paper	Max.Marks	Total
1.	Theory paper I	Animal Behaviour and Neurophysiology	40 +10	200
2.	Theory paper II	Gamete Biology, Development and Differentiation	40 +10	
3.	Theory paper III	Optional Paper Group – 1 (a) Fish (Ichthyology) structure and function Or (b) Cell biology Or (c) Entomology Or (d) Wild life conservation Or (e) Biology of vertebrates immune system Or (f) Limnology Or Aquaculture	40 +10	
4	Theory paper IV	Optional Special paper Group 2 (a) Pisci culture and economic importance of fish Or (b) Cellular organization and molecular organization Or (c) Applied entomology Or (d) Environment & Biodiversity Or (e) Molecular endocrinology and reproductive technology Or (f) Limnology and fish productivity Or (g) Applied aquaculture Or (h) Protein Nucleic acids and metabolic regulation Or (i) Sericulture	40 +10	

5.	Practical paper I	Related to I and II Theory paper	50	100
6.	Practical paper II	Related to Optional paper from Group I and Group II	25+25 =50	
7.	Project	Job Work	50	50

M.Sc. Zoology

Semester – I

Semester – II

Semester – III

Semester – IV

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Department of Higher education, Govt. of M.P.
Semester wise Syllabus for Postgraduates
As recommended by Central board of Studies and
Approved by HE the Governor of M.P.
Session 2015-16

M.Sc. Zoology
Semester I
Paper I
Biosystematics, Taxonomy and evoluation

Unit- 1

1. Definition and basis concepts of biosystematics.
2. History of classification.
3. Taxonomy: Chemotaxonomy, cytotaxonomy and molecular taxonomy.
4. Theories of biological classification: hierarchy of categories.

Unit:- 2

1. Taxonomic Characters- Different kinds. Origin of reproductive isolation, biological mechanism of genetic incompatibility.
2. Taxonomic procedures: Taxonomic collections, preservation curetting.
3. Taxonomic keys, different types of keys, their merits and demerits.
4. International code of Zoological Nomenclature (ICZN): Operative principals, interpretations and application of important rules, Formation of Scientific names of various Taxa.

Unit:- 3

1. Taxonomic categories hierarchy categories, higher categories .
2. Species concept- species categories ,Subspecies, infraspecific categories.
3. Shannon weiner Index.
4. Dominance Index : similarity and dissimilarity Index

Unit:-4

1. Concepts of evolution and theories of organic evolution.
2. Concepts of population genetics, Hardy – Weinberg law of genetic equilibrium.
3. Destabilizing forces: Natural selection mutation, genetic drift, migration and meiotic drive.
4. Genetic polymorphism

Unit :- 5

1. Concepts and mechanism of speciation.
2. Micro and Macro Evolution.
3. Theories of Evolution.
4. Gene Evaluation.

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MSc Previous
Subject: Zoology
SEMESTER -I
Paper-I List of Books

SUGGESTED READING MATERIAL

1. M. Koto-The. Biology of biodiversity-Springer
2. E.O. Wilson-Biodiversity-Academic Press Washington.
3. G.G.-Simpson-Principle of animal taxonomy Oxford IBH Publication company.
4. E-Mayer-Elements of Taxonomy
5. Bastchelet-F-Introduction to mathematics for life scientists Springer Verlag, Berling.
6. Skoal R.R. and F.J.Rohiff Biometry-Freeman, San-Francisco.
7. Snecdor, G.W. and W.G. Cocharan Statisical Methods of affiliated-East-West Press, New Delhi.
8. Murry J.D. Mathematical Biology-Springer, Verlag, Berlin.

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Class - M.Sc.
Subject - Zoology
Paper Title - Paper II STRUCTURE AND FUNCTION OF INVERTEBRATES
Semester – I

Max. Mark– 50

UNIT –I

1. Origin of metazoa
2. Organization of Coelom
   - A. Acoclomates
   - B. Pscudocoelomates
   - C. Coclomates
3. Locomotion.
   - A. Amoeboid flageller and cillary movement in protozoa
   - B. Hydrostatic movement in Coelenţrata
   - C. Annelida and Echinodermata

UNIT –II

A: NUTRITION AND DIGESTON

Patterns of Feeding and digestion in lower metazoa, Mollusea, Echinodermata Filter feeding in polychaeta.

B: Respiration

Organs of respiration : Gills, lungs and trachea, respiratory pigments. Mechanism of respiration.

UNIT – III

EXCRETION

Excretion in lower invertebrates.

Excretion in higher invertebrates.

Mechanism of Osmoregulation.

UNIT – IV

NERVOUS SYSTEM.

A. Primitive Nervous systems-Coelenterata and Echinodermata.
B. Advanced nervous system in Annelida, ✓
Arthropoda (Crustacea and Insecta) and Mollusa (Cephalopoda) ✓

UNIT – V

A. INVERTEBRATES LARVAL FORMS AND THEIR EVOLUTIONARY SIGNIFICANCE.

A. Trematoda and Cestoda
B. Larval forms of Crustacea
C. Larval forms of Mollusea
D. Larval forms of Echinodèrmata.

B. 1. Structure affinities and life history of the following minor noncoelomate Phyla -

A. Rotifera
B. Entoprocta

2. Structure affinities and life history of the following minor Phyla

A. Phoronida
B. Ectoprocta

Suggested Reading Material –

1. Hyman, L.H. The invertebrates, Nol. I.protozoa through Ctenophora, McGraw Hill Co., New York
2. Barrington, E.J.W. Invertebrate structure and function. Thomas Nelson anmd Sons Ltd., London.
3. Jagerstein, G. Evolution of Metazoan life cycle, Academic Press, New York & London.
4. Hyman, L.H. The Invertebrates. Vol. 2. McGraw Hill Co., New York.
5. Hyman, L.H. The Invertebrates. Vol. 8. McGraw Hill Co., New York and London.
6. Barnes, R.D. Invertebrates Zoology, III edition. W.B. Saunders Co. Philadelphia.
7. Russel-Hunter, W.D. A biology of higher invertbrates, the Macmillan Co. Ltd., London.
8. Hyman, L.H. The Invertebrates smaller coelomate groups, Vol. V.Mc.Graw Hill Co., New York.
9. Read, C.P. Animal Parasitism. Parasitism. prentice Hall Inc., New Jersey.
10. Sedgwick, A.A. Student text book of Zoology. Vol. I,II and III. Central Book Depot, Allahabad.
11. Parker, T.J., haswell W.A. Text book of Zoology, Macmillan Co., London.

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Session 2008-09

M.Sc. Previous

I Sem III Paper

Quantitative biology, biodiversity and wildlife

Unit – I Quantitative biology

- Basic mathematics for biologists
- matrices and vectors
- Exponential functions
- Differential equations integration
- Periodic functions
- Sprobability distribution properties and probability theory

Unit – II

- Experimental designing and sampling theory
- Completely randomized design and randomized block design
- Analysis of variance
- Co-relation- types of correlation
- Karl personls coefficient correlation
- Regression

Unit – III Biodiversity

- concept and principal of biodiversity
- causes for the lose of biodiversity
- Biodiversity conservation method
- Medicinal uses of forest plant

Unit – IV Wildlife of India, types of wildlife

- Values of wildlife positive and negative
- Wildlife protection Act
- Conservation of wildlife in India
- Endangered and threatened spices

Unit – V Wildlife and conservation

- National Parks and Sanctuaries
- Project Tiger
- Project Gir lion ang Crocodile breeding project
- wildlife in M.P. with references to Reptiles Birds and mammals
- Biospheres reserves

Suggested Readings Materials

- Bataschelet. E. Introduction to mathematics for site scientist springer-verlag, berling
- Jorgenserr, S.E. Fundamental of Ecological modling E. sevier New York
- Lenderen D. Modelling in behavioral ecology. Chapman & Hall London U.K.
- Sokal, R.R. and F. J. Rohit Biometry Freeman San Francisco
- Snedecor, G.W. and W.G. cochran, statical methods, Affilited East, West Press New Delhi (Indian ed.)
- Muray , J.D. Methamatical Biology, Springer Verlag Berlin

- Pelon, E.C. The interpretation of ecological data : A promer on classification and ordivation.
- A. lewis – Biostatics
- B.K. Mahajan Methods in Biostatics
- V.B. Saharia wildlife in India
- S.K. Tiwari wildlife in central India
- J.D. Murrey Mathematical Biology
- Georgs & Wilians Startical method
- R.K. Tondon Biodiversity Texonomy & Ecology
- M.P. Arora An Introduction to prevantology
- P.C. Kotwal Biodiversity and conservation

Ist Semester
Suggested reading materials:

1. M. Koto : The Biology of Biodiversity. Springer.
2. E. O. Wildon : Biodiversity. Academic Press Washington.
3. G.G. Simpson : Principles of Animal Taxonomy. Oxford IBH Publication Company.
4. E. Mayer : Elements of Taxonomy.
5. Dobzansky : Biosystematics.
6. Dallela and Sharma : Animal Taxonomy and Museology.
7. Dodzhansky: The Genetics and origin of species. Columbia University Press.
8. Futuyama D.I. Evolutionary Biology. INC Publishers Dunderland.
9. Jha A.P. : Genes and Evolution – John Publication, New Delhi.

Department of Higher education, Govt. of M.P.
Semester wise Syllabus for Postgraduates
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Session : 08-09

Class: M.Sc.
SEMESTER - I
Paper: IVth Paper
BIOMOLECULES AND STRUCTURAL BIOLOGY

Unit – I
Chemical Foundation of bilogy

- PH, PK, acids bases, buffers, weak bonds
- Free energy, resonance, isomerisation
- Acid soluble pool of living tissues – aminoacids, monosaccorides, oligosaccharides, nucleotides, peptides.
- Nanoparticles
- Biomaterials

Unit – II

1. Primary, Secondry, tertiary and quaternary structures of proteins, protein folding and denaturation
2. DNA & RNA: Double helical structure of DNA, Structure of RNA, role of RNA in gene expression
3. DNA replication, recombination and repair
4. Functional importance of lipid storage and membrane lipids
5. Membrane channels and pumps

Unit – III

1. Basic concepts of metabolism: Coupled and interconnecting reactions of metabolism cellular energy recources and ATP synthesis
2. Glycolysis and glyconeogenesis
3. Citric acid cycle
4. Oxidative phosphorylation : Protein and it's regulation
5. Fatty acid metabolism: Synthesis and degradation of fatty acids

Unit – IV

1. RNA synthesis and splicing
2. Biosynthesis of amino acids
3. Biosynthesis of nucleotides
4. Biosynthesis of membrane lipids and steroids
5. Protein synthesis

Unit – V

1. Enzymes: Terminologies, classification and basics of enzyme kinetics
2. Mechanism of enzyme catalysis
3. Regulation of enzyme action
4. Concept of free energy and thermodynamic principals in biology
5. Energy rich bonds, compound and biological energy transducers

Suggested Readings:

1. Voet, D. and J.G. Voet. Biochemistry John Wiley & Sons.
2. Freifelder, D. Physical Biochemistry W.H. Freeman & Co.
3. Segal, I.H. Biochemical calculations John Wiley and Sons
4. Creighton, T.E. Protein Structure and Molecular Properties W.H. Freeman & Co.
5. Freifelder, D. Essentials of Molecular Biology
6. Wilson, K. and K.H. Goulding A Biologists Guide to Principals and Techniques of Practical Biochemistry
7. Cooper, T.G. Tools of Biochemistry
8. Hawk, Practical Physiological Chemistry
9. Garret, R.H. and C.M. Grisham. Biochemistry. Saunders college Publishers.

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Class: M.Sc.
SEMESTER - I
Practical : Ist

		M,M, 50
1.	Spotting – Classification and identification of various phylum.	10
2.	One major dissection of various systems of invertebrates – Squilla, Prawn, Sepia, Loligo.	10
3.	One minor dissection- Grosshopper, Honeybee, Echinus, Starfish, Aplysia.	5
4.	Mounting material - permanent balsum mount	5
5.	Spottings related with Adaptation. Homologics, Analogics and modification of month parts : 5	
6.	Viva Voce. 10	
7.	Pratical Records, collection	5
Total Marks		50

20

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Class: M.Sc.
SEMESTER - I
Practical : IInd

to

M,M, 50

1.	Problem based on Biodiversity and wild life. Mammals and Fishers group (Spots 5 +5)	20
2.	Exercise on mean, mode, & Median.	5
3.	Cell division preparation of slid on Meiosis & Mitosis.	5
4.	Preparation of different types of chromosomes.	5
5.	Viva – Voce	10
6.	Practical Record and collection.	5
Total Marks		50

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Semester wise Syllabus for Postgraduates
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Class: M.Sc.
SEMESTER - II
Paper: Ist Paper
GENRAL AND COMPARATIVE ANIMAL PHYSIOLOGY AND ENDOCRONOLOGY

Unit – I

1. Respiratory pigments through different phylogenic groups
2. Transport of oxygen and carbon dioxide in blood and body fluids
3. Regulation of respiration
4. Physiology of impulse transmission through nerves and synapses
5. Autonomic nervous system, neurotransmitters and their physiological functions

Unit – II

1. Patterns of nitrogen excretion in different animal groups
2. Comparative physiology of digestion
3. Osmoregulation in different animal groups
4. Thermoregulation in homeotherms, poikilothermas and hibernation
5. Physiology of pregnancy, placental hormones, pregnancy diagnosis tests, parturition and breast and lactation

Unit – III

1. Comparative study of mechanoreception
2. Comparative study of photoreception
3. Comparative study of phonoreception
4. Comparative study of chemoreception
5. Comparative study of equilibrium reception

Unit – IV

2. Bioliminescence as means of communication among animals
3. Pheromones and other semiochemicals as means of communication among animals
4. Chromatophores and regulation of their function among animals
5. Hormones, their classification and chemical nature
6. Mechanisms of hormone action

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Unit –V

1. **Phylogeny of endocrine glands (pituitary, pancreas, adrenal, thyroid)**
2. **Ontogeny of endocrine glands**
3. **Neuroendocrine sysyem**
4. **Hormone receptors – signal transaction mechanisms**
5. **Hormones and reproduction**
    a. **Seasonal breeders**
    b. **Continuous breeders**

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MSc Previous
Subject: Zoology
SEMESTER -II
Paper-I List of Books

SUGGESTED READING MATERIAL

1. EJW Barrington-General & comparative Endoctrinology-Oxford, Claredon Press
2. R.H. Williams-Text Book of Endocrinology-W.B. Saunders
3. C.R. Martin- Endocrine Physiology-Oxford University Press.
4. Molecular CellBiology-J. Darnell, H. Lodish and D. Baltimore-Scientific American Book USA
5. Molecular Biology of the cell-B. Alberts, D-Bray, J.Lewis, M. Raff, K. Roberts and J.D. Watson, Garland Pub. New York.

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M. Sc. Previous
Zoology
Semester II
Paper II

Population Ecology and Environmental physiology

Unit I

1. Populations and their characters.
2. Demography : Life tables, generation time, reproductive value.
3. Population growth: Growth of organisms with non-overlapping generations,stochastic and time lag models of population growth, stable age distribution.
4. Population regulation: Extrinsic and intrinsic mechanisms.

Unit II

1. Adaptations : Levels of adaptions, significance of body size.
2. Aquatic environments : Fresh water, marine, shores and estuarine environments.
3. Eco-physiological adaptations to fresh water environments.
4. Eco-physiological adaptations to marine environments.
5. Eco-physiological adaptations to terrestrial environments.

Unit III

1. Environmental limiting factors.
2. Inter and intra-specific relationship.
3. Predatory- prey relationship, predator dynamics, optimal foraging theory (patch choice, diet choice, prey selectivity, foraging time).
4. Mutulism , evolution of plant pollinator interaction.

Unit IV

Environmental poliution and human health.

1. Conservation management of natural resources .
2. Environmental impact assessment.
3. Sustainable development.

Unit V

1. Concept of homeostasis.
2. Endothermi and physiological mechanism of regulation of the body temperature.
3. Physiological response to oxygen deficient stress.
4. Physiological response to body exercise.
5. Meditation, yoga and their effects.

Suggested Readings:

1. Cherrett,J.M. Ecological Concepts. Blackwell Science Publication, Oxford, U.K.
2. Elseth,B.D. and K.M. Baumgartner,population Biology,Van Nostrand Co., New York.
3. Jorgensen,S.E. Fundamentals of ecological modeling. Elsevier, New York.
4. Krebs, C.J. Ecology. Harper and Row, New York.
5. Krebs,C.J. Ecological Methodology. Harper and Row , New York.
6. Eckert, R. Animal Physiology: Mechanism and Adaptation. W.H. Freeman and Co., New York.
7. Hochachka, P.W. and G.N., Somero. Biochemical adaptation. Priceton, New Jersey.

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Classs M.Sc. IInd Sem. Paper IIIrd

TOOLS AND TECHNIQUES IN BIOLOGY

Unit:- 1 Principle and applications:

1. Light
2. Phase contrast microscope.
3. Confocal microscope
4. Ultra centrifuge

Unit:- 2 cryo techniques

1. Cryopreservation and freeze drying
2. Freeze drying and column chromatography
3. TLC
4. Page
5. Agrose gel electrophoresis

Unit:- 3

1. Radio isotopes
2. Autoradiography
3. Immunodiffusion, immunoelectrophoresis
4. Microtomes

Unit:- 4

1. Tissue fixation and complete procedure for staining.
2. Histochemical demonstration of Lipids.
3. Essential components and preparation of culture media
4. Sterilization, Inoculation & Microbial identification (bacteria, fungi)

Unit:- 5

1. Chromosome banding techniques in situ hybridization (Radio label) & Non radio labeled method.
2. Southern Blotting
3. Northern Blotting.
4. PCR

Signature Not Verified
ARPANA PANDEY
E=ARPANAPANDEY
AJ1@GMAIL.COM,

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MSc Previous
Subject Zoology
SEMESTER -II
Paper-III Tools & Technique Books

SUGGESTED READING MATERIAL

1. Introduction to instrumental analysis-Robert Braun-McGraw Hill.
2. A biologist Guide to principles and Techniques of Practical Biochemistry-K, Wilson and K.H. Goulding ElBS Edn.
3. Clark & Swizer. Experimental Biochemistry. Freeman, 2000.
4. Locquin and Langeron. Handbook of Microscopy. Butterwaths, 1983
5. Boyer. Modern Experimental Biochemistry. Benjamin, 1993
6. Freifelder. Physical Biochemistry. Freeman, 1982.
7. Wilson and Wlaker. Practical Biochemistry. Cambridge, 2000.
8. Cooper. The Cell-A Molecular Approach. ASM, 1997
9. John R.W. Masters. Animal Cell culture- A practical approach. IRL Press.
10. Robert Braun. Introduction to instrumental analysis. McGraw Hill

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II Sem IV Paper

Topic – Molecular Cell Biology and genetics

Unit – I Biomembrane

- Molecular composition arrangement and functional consequences
- Transport across cell membrane diffusion active transport, pumps, uniports, symports and antiports
- Micro filaments and microtubules structure and dynamics
- Cell movements intracellular transport, role of kinesis and dynein

Unit – II Cell – Cell signaling

- Cell surface receptors
- Second messenger system
- Signaling from plasma membrane to nucleus
- Gap junctions and connexius
- Entegrius

Unit – III Cell – Cell adhesion and communication

- Ca^{++} depandant homophilic cell – cell ahension
- Ca^{++} independant homophilic cell – cell ahension
- Gap junctions and connexius
- Genome organization, hierarchy in organization

- Chromosomal organization of genes and non-coding DNA

Unit –IV Sex determination

- Sex determination in dtosophila
- Sex determination in mammals
- Basic concept of dosage compensation
- Cytogenetic of humen chromosoms
- Human genome project (HGP) purpose 2 Implicatic

Unit – V Genetic Diseases and Genomics

- Human gene therapy
- Prenatal diagnosis & genetic counseling
- Genetic screening
- Structural Genomics
- Functional Genomics
- Gene libraries
- Trasgenic animals & their applications

Suggested Readings

- J. Darnell, H. Lodish and D. Baltimore molecular cell biology scientific American book. Inc. USA
- B. Alberts D. Bray, J. Lewis, M. raff, K. roberts and J.D. Wattson. molecular biology of the cell. Garland Publishing Inc. New York.
- John R. W. animal cell culture A practical approach masters. Irl. Press
- Alberts et. all Essentials cell biology garland publishing Inc. New York 1998
- J.M. Barry molecular biology
- Philip E. Hartman Gene Action
- L.C. dunn, principals of Genetics
- A.M. Winchester genetics

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- Edgar Alterbrg Genetics
- L.C. Dunn genetics and the oregin of species
- Bengt A. Kihlman actions of chemicals of dividing cells

Macmillan

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Class: M.Sc.
SEMESTER - II
Practical : Ist

M,M, 50

General & Comarative Physiology and Endocrinology
Population Ecology and Environmental Physiology.

Exercise :

1.	Experiment on Hematology Blood group, Total and different counts.	5
2.	Demonstration of Enzyme Action, and chromatography	10
3.	Estimation of pH.	5
4.	Detection of protein carbohydrate and fats.	5
5.	Endocrinological spots comments on prepared histological slides.	10
6.	Detection of Nitrogenous products in given samples.	5
7.	Viva Voce	5
8.	Practical Records and collection.	5
Total Marks		50

THIRD SEMESTER

1. Course Code :
2. Course Name : **M.Sc. Zoology**
3. Total Paper : **04**
4. Compulsory Paper : **04**
5. Optional Paper : **00**
6. Practical : **02**
7. Practical passing mark: **18 each marks**
8. Maximum marks : **300**
9. Minimum Passing percentage : **36**
10. Internship : **100**
11. Internship passing marks : **36**

Sub. code	Subject Name	Theory									Practical		Total	
		Paper					CCE		Total Marks					
		1st	2nd	3rd	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
	Inetnship	100	0	0	100	36	0	0	100	36	0	0	100	36
Compulsory paper Theory														
	(I) Comparative anatomy of vertebrates	35	0	0	35	13	15	5	50	18	0	0	50	18
	(II) Limnology	35	0	0	35	13	15	5	50	18	0	0	50	18
	(III) Ecotoxicology	35	0	0	35	13	15	5	50	18	0	0	50	18
	(IV) Aquaculture	35	0	0	35	13	15	5	50	18	0	0	50	18
	Practical Related to I & II Theory papers	0	0	0	0	0	0	0	0	0	50	18	50	18
	Practical Related to III & IV Theory papers	0	0	0	0	0	0	0	0	0	50	18	50	18

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Class : M.Sc. Subject : Zoology

S.No.	Semester	Paper	Topic of Paper	Max. M.	Total
3.	Sem-III	Theory Paper – I	Comparative anatomy of vertebrates	35+15 (CCE)	200
		Theory Paper – II	Limnology	35+15 (CCE)	
		Theory Paper – III	Ecotoxicology	35+15 (CCE)	
		Theory Paper-IV	Aquaculture	35+15 (CCE)	
		Practical - I	Related to I & II Theory papers	50	100
		Practical - II	Related to III & IV Theory papers	50	
		~~Internship~~	–	~~100~~	~~100~~

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Session - 2010-2011

Subject - Zoology

Class : **M.Sc**
Semester : **III**
Subject : **Zoology**
Title of Subject Group : **Comparative Anatomy of Vertebrates**
Paper No. : **Paper- I**
Max. Marks : 35

Unit-1	1. Origin of Chordata: Concept of Protochordata 2. Development, structure and functions of integument and its derivatives (glands, scales, feathers and hairs) 3. Respiratory system : Characters of respiratory tissue, external and internal respiration. Comparative account of respiratory organs. 4. Comparative account of Digestive System.
Unit-2	1. Evolution of heart. 2. Evolution of aortic arches and portal systems. 3. Blood circulation in various vertebrates groups. 4. Comparative account of jaw suspensorium and vertebral column.
Unit-3	1. Evolution of urinogenital system in vertebrates. 2. Comparative account of organs of olfactory and taste. 3. Comparative anatomy of brain and spinal cord (CNS). 4. Comparative account of peripheral and autonomous nervous system.
Unit-4	1. Comparative account of lateral line system. 2. Comparative account of electroreception. 3. Flight adaptations in vertebrates. 4. Aquatic adaptations in birds and mammals.
Unit-5	1. Origin, evolution general organization and affinities of Ostracoderms . 2. General organization, specialized, generalized and degenerated characters of Cyclostomes.

	3. Origin, evolution general organization of early Gnathostomes . 4. General account of Elasmobranchi, Holocephali, Dipnoi and Crossoptergii.

SUGGESTED READINGS :

1. Carter, G.S. Structure and habit in vertebrate evolution – Sedgwick and Jackson, London.
2. Kingsley, J.S. Outlines of Comparative Autonomy of Vertebrates, Central Book Depot. Allahabad,
3. Kent, C.G. Comparative anatomy of vertebrates
4. Malcom Jollie, Chordata morphology. East – West Pres Pvt. Ltd., New Delhi.
5. Milton I lildergrand. Analysis of vertebrate structure. IV. Ed. John Wiley and Sons Inc., New York.
6. Smith, H.S. Evolution of Chordata structure. Hold Rinchart and Winstoin Inc. New York.
7. Sedgwick, A.A. Students Text Book of Zoology, Vol.II.
8. Walter, H.E. and Sayles, L.D. Biology of vertebrates, MacMillan & Co. New York.
9. Romer, A.S. Vertebrate Body, IIIrd Ed. W.B. Saunders Co., Philadelphia
10. Young J.Z. life of vertebrates. The oxford University Press, London
11. Parker & Haswell to III Rev. by Marshall willians latested Macmillan Co. ltd.
12. Young J.Z. Life of mammals. The Oxford University Press, London
13. Weichert, C.K. and Presch, W. Elements of chordate anatomy, 4th Edn. McGraw Hall Book Co., New York.

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Session - 2010-2011

Subject - Zoology

Class	: **M.Sc**
Semester	: **III**
Subject	: **Zoology**
Title of Subject Group	: **Limnology**
Paper No.	: **Paper- II**
Max. Marks	: 35

Unit-1	1.Limnology – Definition, historical development and scope of Limnology. 2.Types of freshwater habitats and their ecosystem - (a) Ponds, Streams and rivers. (b) Lakes – Origin and classification. 3.Morphpmetry – Use of various morphometric parameters and Zonation.
Unit-2	Physico – Chemical Characteristics. 1. Light and Temperature- (a) Light as an ecological parameter in freshwater. (b) Temperature- Radiation, Stratification and Heat Budget. 2. (a) Dissolved Solids – Carbonate, Bicarbonates, Phosphate and Nitrate. (c) Physico – Chemical characteristics of freshwater with special reference to different parameters- Turbidity, dissolved gases(Oxygen, Carbon dioxide, Hydrogen Sulphide), Seasonal changes in dissolved gases and pH.
Unit-3	1. Study of Biota (a) Phytoplankton, Zooplankton and their inter-relationship. (b) Aquatic insects, birds and their environmental significance. 2. Ecological classification of aquatic fauna higher aquatic plants and their significance.
Unit-4	1. Methods of water quality testing BOD and COD. 2. Sewage – Definition, composition and its treatment. 3. Bioindicators- Aquatic flora and fauna in relation to water quality in an aquatic environment.

Unit-5	1. Causes of pollution of Aquatic Resources, their management and conservation. 2. Resource Conservation – Aquatic pollution, control, legislation, regulation on discharge of industrial effluents and domestic wastes in rivers and reservoirs. 3. Use and misuse of inland waters.

Suggested Readings :

Anathakrishnan	:	Bioresources Ecology
Goldman	:	Limnology
Odum	:	Ecology
Pawlosuske	:	Physico- chemical methods for water
Wetzal	:	Limnology
Trivedi & Goyal	:	Chemical and biological methods for water pollution studies
Welch	:	Limnology Vols. I-II
Perkins	:	Ecology
Arora	:	Fundamentals of environmental biology

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Session - 2010-2011

Subject – Zoology

Class	: **M.Sc**
Semester	: **III**
Subject	: **Zoology**
Title of Subject Group	: **ECO- TOXICOLOGY**
Paper No.	: **Paper- III**
Max. Marks	: 35

Unit-1	1. General principles of Environmental Biology with emphasis on ecosystems. 2. Abiotic and biotic factors of ecosystems. 3. Communities of the environment, their structure & significance. 4. Energy flow in environment : Ecological energetics.
Unit-2	1. Productivity, Production and analysis. 2. Recycling and reuse technologies for solid and liquid wastes and their role in environmental conservation. 3. Remote sensing –basic concepts and applications of remote sensing techniques in environmental conservation. 4. Environmental indicators and their role in environmental balance.
Unit-3	1. Kinds of environmental pollution and their control methods. 2. Radioactive compounds and their impact on the environment. 3. Vehicular exhaust pollution, causes and remedies. 4. Noise pollution.
Unit-4	1. Toxicology- Basic concepts, Principles and various types of toxicological agents. 2. Toxicity testing principles, hazards, risks and their control methods. 3. Food toxicants and their control methods. 4. Public Health Hazards due to environmental disasters.

Unit-5	1. Pesticides, types, nature and their effects on environment. 2. Important heavy metals and their role in environment. 3. Agrochemical use and misuse, alternatives. 4. Occupational Health Hazards and their Control.

SUGGESTED READINGS :

1. Clark	:	Elements of ecology
2. Odum	:	Fundamentals of Ecology
3. South Woods	:	Ecological methods
4. Trivedi and Goel	:	Chemical and biological methods for water pollution studies

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Session - 2010-2011

Subject - Zoology

Class	: **M.Sc**
Semester	: **III**
Subject	: **Zoology**
Title of Subject Group	: **Aquaculture**
Paper No.	: **Paper- IV**
Max. Marks	: 35

Unit-1	1. Aquaculture: history, definition, scope & importance. 2. Fishery resources of India in general & Madhya Pradesh in particular. 3. Abiotic & biotic factors of water necessary for fish life. 4. Ecological characteristics of lakes & rivers. 5. General ecological characteristics of reservoirs of India.
Unit-2	1. Fish culture :- Mono, Poly, mixed and composite Fish culture. 2. Fresh water prawn culture and its prospects in India. 3. Culture of Mussels , clams,oysters & pearl culture. 4. Sewage fed fish culture, paddy cum fish culture 5. Frog culture.
Unit-3	1. Fish breeding in natural conditions , bundh breeding, hypophysation & stripping. 2. Transport of live fish & seed. 3. Different types of crafts & gears used for fish catching. 4. Plankton- its definition, culture & indentification. 5. Common weeds of fish ponds and methods of their eradication.

Unit-4	1. Fresh water fish farm engineering: selection of site, construction of fish farm & soil chemistry. 2. Designing, layout & construction of different types of fish ponds. 3. Setting and management of fresh water aquarium. 4. Preservation & processing of fish. 5. By products of fish Industry & their utility.
Unit-5	1. Water pollution, its effects on fisheries and methods of its abatment. 2. Common fish diseases & their control. 3. Biochemical composition and nutritional value of fish. 4. Fisheries economics and marketing. 5. Fisheries managements and extension.

Suggested Readings :

1. C.B.L. Shrivastava : Fishes of India
2. Jhingaran : Fish and fisheries of India
3. S.S. Khanna : An Introduction to fishes
4. R.S. Rath : Fresh water Aquaculture
5. Gopalji Shrivastava : Fishes of U.P. & Bihar
6. H.D. Kumar : Sustanibility & Management of Aquaculture & Fisheries
7. A.J.K. Mainan : Identification of fishes
8. R. Sanatam : A Manual of fresh water Aquaculture
9. S.K. Gupta : Fish & Fisheries
10. P.D. Pandey : Fish & Fisheries
11. K.P. Vishwas : Fish & Fisheries

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Session - 2010-2011

Subject - Zoology

Class : **M.Sc**

Semester : **III**

Subject : **Zoology**

Practical I : **Related to I & II Theory Papers**

1. Study of Specimens, slides and bones related to theory papers.
2. Major Dissection- Various systems of Labeo , Wallago, Torpedo
3. Minor Dissection-
   (a) Accessory respiratory organs of Anabas, Clarias, Heteropneustes.
   (b) Herdmania
   (c) Amphioxus.
4. Estimation of DO, chloride, BOD,COD,Hardness, pH and Alkalinity of water.
5. Study of fresh water ecosystem.

Scheme for Practical Examination M.M. 50

1.	Major Dissection	10 Marks
2.	Minor Dissection	04 Marks
3.	Spotting	12 Marks
4.	Limnological exercise	10 Marks
5.	Practical Record	05 Marks
6.	Viva Voce	05 Marks
7.	Collection	04 Marks
	Total	**50 Marks**

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Session - 2010-2011

Subject - Zoology

Class : **M.Sc**
Semester : **III**
Subject : **Zoology**

Practical II : Related to III & IV Theory Papers

1. Study of plankton.
2. Preparation and Maintenance of Aquarium.
3. Study of common weeds of fish ponds.
4. Methods of culture related to theory papers.
5. Study of abiotic factors of water related to fish life.
6. Determination of different toxic chemicals in samples of soil, water and air.
7. Toxicological testing methods , General tests, acute toxicity test and LD 50 test.
8. Identification and comments on Aquaculture animals.

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Session - 2010-2011

Subject - Zoology

Class : **M.Sc**
Semester : **III**
Subject : **Zoology**
Practical II : **Related to III & IV Theory Papers**

Scheme of practical examination **M.M. 50**

1.	Spotting	16
2.	Exercise on toxicology	10
3.	Study of culture methods related to theory	05
4.	Maintenance of aquarium	05
5.	Practical Record	04
6.	Viva Voce	05
7.	Collection	05

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Session - 2010-2011

Subject - Zoology

Class	: **M.Sc**
Semester	: **IV**
Subject	: **Zoology**
Title of Subject Group	: **ANIMAL BEHAVIOUR AND NEUROPHYSIOLOGY**
Paper No.	: **Paper- I (Compulsory)**
Max. Marks	: 35

Unit-1	1. Introduction: - Ethology as a branch of biology. - Animal psychology, classification of behavioral patterns, analysis of behaviour (ethogram) 2. Reflexes and complex behaviour. 3. Perception of the environment: mechanical, electrical, chemical, olfactory, auditory and visual. 4. Evolution and ultimate causation: Inheritance behaviour and relationships.
Unit-2	1. Neural and hormonal control of behaviour. 2. Genetic and environmental components in the development of behaviour. 3. Motivation: Drive, timing and interaction of drives, physiological basis of motivation, hormones and motivation, aggregation. 4. Communication: Chemical, visual, light and audio, evolution of language (primates).

Unit-3	1. Ecological aspects of behaviour: Habitat selection, food selection, optimal foraging theory, anti-predator defenses, aggression, homing territoriality, dispersal, hostparasite relations. 2. Biological rhythms: Circadian and circannual rhythms, orientation and navigation, migration of fishes, turtles and birds. 3. Learning and memory: Conditioning, habituation, insight learning, association learning and reasoning.
Unit-4	1. Reproductive behaviour. Evolution of sex and reproductive strategies, mating systems, courtship, sexual selection. parental care. 2. Social behaviour. aggregations, schooling in fishes, flocking in birds, herding in mammals, group selection, kin selection, altruism, reciprocal altruism, inclusive fitness, social organization in insects and primates.
Unit-5	1. Thermoregulation: Homeothermic animals, poikilotherms & Hiberhnation. 2. Receptor physiology a comparative study – Mechano receptor Photo receptor Phono receptor Chemo receptor Equilibrium receptor 3. Bioluminescence

Suggested Readings -

1. Eibl-Eibesfeldt, I. Ethlogy. The biology of Behaviour. Holt, Rineheart & Winston, New York.
2. Gould, J.L. The mechanism and Evolution of Behaviour.
3. Kerbs, J.R. and N.B. davies : Behaviourable Ecology. Blackwell, Oxford, U.K.
4. Hinde, R.A. Animnal Behaviour : A Synthesis of Ethology and Comparative Psychology. McGraw Hill, New York.
5. Alcock, J. Animal Behaviour : An Evolutionary approach. Sinauer Assoc. Sunderland, Massachsets, USA.
6. Bradbury, J.W. and S.L. Vehrencamp. Principles of Animal Communication. Sinauer Assoc. Sunderland, Massachsets, USA.

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Session - 2010-2011

Subject - Zoology

Class	: **M.Sc**
Semester	: **IV**
Subject	: **Zoology**
Title of Subject Group	: **Gamete Biology, Development and differentiation**
Paper No.	: **Paper- II (Compulsory)**
Max. Marks	: 35

Unit-1	1.	Comparative account of differentiation of gonads in mammals and invertebrate.
ST	2.	Spermatogenesis : Morphological basis in rodents and in any invertebrates. Gamete specific gene expression and genomics
	3.	Biochemistry of Semen : Semen composition and formation, assessment of sperm function.
	4.	Fertilization : Prefertilization events Biochemistry of fertilization post fertilization events.
Unit-2	1.	Ovarian follicular growth and differentiation : morphology, endocrinology, molecular biology oogenesis and vitellogenesis, ovulation and ovum transport in mammals.
ST	2.	Biology of sex determination and sex differentiation a comparative account.
	3.	Multiple ovulation and embryo transfer technology : in vitro oocyte maturation, superovulation.
Unit-3	1.	Hormonal regulation of ovulation, pregnancy and parturition.
DNS	2.	Hormonal regulation of development of mammary gland and lactation.
	3.	Endocrinology and Physiology of placenta.
	4.	Cryopreservation of gametes and Embryo.
	5.	Teratological effects of xenobiotics on gametes.
Unit-4	1.	Cell commitment and differentiation.
DNS	2.	Germ cell determinants and germ cell migration.

	3.	Development of gonands.
	4.	Melanogenesis.
Unit-5 AS	1.	Creating new cell types, the basic evolutionary mystery.
	2.	Cell diversification in early Amphibian embryo, totipotency and pleuripotency.
	3.	Embryonic stem cells, renewal by stem cells, epidermis.
	4.	Connective tissue cell family
	5.	Haemopoietic stem cells : Blood cells formation, stem cell disorders.

Suggested Readings :

1. Long J.A. Evan H.M. 1922 : the oestrous cycle in the Rat and its associated phenomenon.
2. Nalbandou. A.C. – Reproductive physiology
3. Prakash A.S. 1965-66 Marshall's, Physiology Reproduction (3 Vol.)
4. Gilbert, S.F. Developmenal Biology , Sinauer Associated Inc. Massachulsetts.
5. Ethan Bier, the cold Spring. The cold spring Harbor laboratory Press, New York.
6. Balinsky B.I. Introduction to Embryology sanders, Phliedelphia.
7. Berril N.J. and Karp. G. Development Biology. McGraw Hill New York.
8. Davidson, E.H. Gene Activity During Early Development. Academic Press, New York.

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Session - 2010-2011

Subject - Zoology

Class	:	M.Sc
Semester	:	IV
Subject	:	Zoology
Title of Subject Group	:	General Practical-I
Paper No.	:	Paper- I & II (Compulsory) Animal behavior and gamete biology

M.M. : 50

1. Exercise on Animal behavior
   a. Taxes
   b. Reflexes
   c. Biological clocks
   d. Social behavior
   e. Learning behavior
   f. Reproductive behavior

2. Developmental Biology
   - Study of embryological slides
   - Study of gametes of frog and chick
   - Study of fate maps
   - Study of different stages of spermatogenesis and oogenesis

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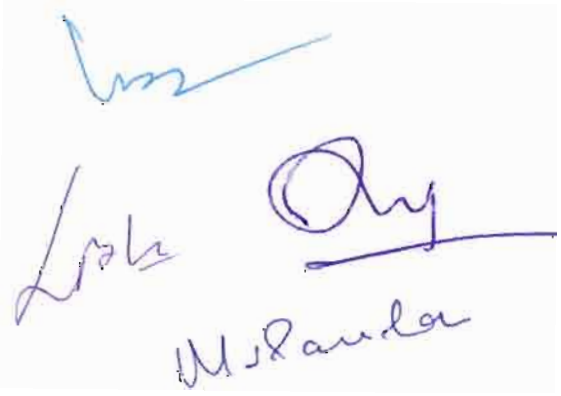
Session - 2010-2011

Subject - Zoology

Class	:	**M.Sc**
Semester	:	**IV**
Subject	:	**Zoology**
Title of Subject Group	:	**General Practical-I**
Paper No.	:	**Paper- I & II (Compulsory)** **Animal behavior and gamete biology**
Max Marks	:	**50**

Scheme for Practical Examination

1.	**Exercise based on animal behavior**	**20**	10 AD
2.	**Exercise based on developmental biology**	**16**	10 DB
3.	**Practical record**	**05**	20 SP
4.	**Viva Voce**	**05**	5 Viva
5.	**Collection**	**05**	5 Co
	Total	**50 Marks**	50



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Session - 2010-2011

Subject - Zoology

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Class	: **M.Sc**
Semester	: **IV**
Subject	: **Zoology**
Title of Subject Group	: **Icthyology (Fish) Structure and Function**
Paper No.	: **Paper- III A (Optional)**
Max. Marks	: 35

Unit-1	1. Origin and evolution of fishes 2. Classification of fishes as proposed by Berg 3. Fish integument 4. Locomotion
Unit-2	1. Alimentary canal and digestion 2. Accessary respiratory organs 3. Air bladder and its functions 4. Weberian ossicles their homologies and functions
Unit-3	1. Excretion and osmoregulation 2. Acoustico-lateral line system 3. Luminous organs 4. Colouration in fishes
Unit-4	1. Sound producing organs 2. Deep sea adaptions 3. Hill stream adaptions 4. migration in fishes
Unit-5	1. Sexual cycle and fecundity 2. parental care in fishes 3. Early development and hatching 4. Poisonous and venomous fishes.

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Session - 2010-2011

Class	: **M.Sc**
Semester	: **IV**
Subject	: **Zoology**
Title of Subject Group	: **Cell Biology**
Paper No.	: **Paper- III B (Optional)**
Max. Marks	: 35

Unit-1	1. Molecular organization of eukaryotic chromosomes : structure of nucleosome particles and higher order compectionof mitotic chromosomes, chromatin remodeling 2. specialized chromosomes:structural organization and functional significance of polytene chromosomes 3. DNA methylation and DNA Aase-1 Hypersensitivity in relation to gene activity and chromatin organization. 4. specialized chromosomes II : structural organization and functional significance of lampbrush chromosome. 5. Organisation and significance of heterochromatin.
Unit-2	1. Structural organization of Eukaryotic genes, interrupted genes and overlapping genes and their evolution 2. Gene families: organization, evolution and significance 3. Transposable genetic elements of prokaryotes and eukaryotes Gene imitation and molecular mechanism of occurrence of mutation repair mechanism
Unit-3	1. Organisation of eukaryotic transcriptional machinery promoter enhancers transcription factors polymerase activators and repressors. 2. DNA binding domains of transcription apparatus zinc finger steroid receptors hemeo domains HILIX-loop, Helix and Leucine Zipper. 3. Eukaryotic transcription of Eukaryotic transcriptional control. 4. Environmental modulation of gene activity (stress response) stress genes and stress proteins

	5. Molecular basis of thalasemias muscular dystrophy cystic fibrosis
Unit-4	1. DNA rearrangement 2. Amplification during development with special response to (a) Ciliates (b) Chlorine gene (c) 58 RNA genes 3. Drosophila development (a) Cleavage (b) Grastrulation Origin of Anterior –Posterior (Maternal effect genes ans segmentation genes
Unit-5	1. Drosophila development II origin of dordal ventral polarity 2. Basic idea of homoetic selector genes and homeotic mutation 3. Basic idea of organization of homeoboxes 4. Evolutionary significance of homeoboxes

Suggested Readings :

1. Robertis, De and Robertis Cell and molecular biology Lea and Febiger.
2. Watson Hopkis Roberts Steitz Weiner, Molecular Biology of the Gene the Benjamin, Cummings Publishin Company inc.
3. Bruce A; berts Bray ewis Raff Roberts Watson Molecular Biology of the Cell,Garland Publishing inc.
4. Watson Gilman Witkowski Zoller Recombinant DNA Scientific American Books.
   a) Karp Gerald Cell Biology.
   b) Lewin B., Genes VII.
   c) King Cell Biology.
   d) Kaniel L. Hartl, Elizabeth W. Jones. Genetics Principals and Analysis, Jones and Bartlett Publishers.
5. Kuby, Immunology, W.H. Freeman and Company.
6. Roitt Male Snustad Immunology.

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Session - 2010-2011

Class	: **M.Sc**
Semester	: **IV**
Subject	: **Zoology**
Title of Subject Group	: **Entomology**
Paper No.	: **Paper- III C (Optional)**
Max. Marks	: 35

Unit-1	1. Insect head types and modification as per their habit and habitat 2. Modification of mouth parts and feeding behavior 3. Structure types and function of antennae 4. Hypothetical wing venation
Unit-2	1. Structure of cuticle and pigment 2. Sclerotisation and tanning of the cuticle 3. Structure of alimentary canal and Physiology of digestion 4. Malphighian tubules – anatomical organization , Transport mechanism
Unit-3	1. Structure of circulatory system 2. Cellular elements in the haemolymph 3. Cell mediated and humoral immunity Structure of compound eye and Physiology of Vision
Unit-4	1. Sound Production in insect 2. Structure and function of endocrine glands 3. Pheromones 4. Embryonic membranous up to the formation of blastoderm
Unit-5	1. Metamorphosis 2. Insecticide effects on CNS 3. Important pest of Soybean • Modern concept of pest management

Suggested Readings :

1. The Insect: Structure and function by R.F. Chapman
2. Comparative Insect physiology, Biochemistry and Pharmacology .Vol :1-13. Edited by G.A. Kerkut and L.I. Gilbert.
3. Entomophagous Insect by Clausen
4. Entomology bu Gilbert
5. Principles of Insect Physiology by Wigglesworth.
6. Fundamentals of Entomology by Elzinga
7. Hand book of economic Entomology for South India by Ayyar.
8. Insect cytogenetics by R.E.F.Symposium.
9. Insects and plants by Sting, Lawton and southwood.
10. Insect and hygiene by Busvine.
11. Insect Physiology by Wigglesworth.
12. Insect morphology by Mat Calf and Flint
13. Applied Agricultural Entomology by Dr. Lalit Kumar Jha

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Session - 2010-2011

Class	: **M.Sc**
Semester	: **IV**
Subject	: **Zoology**
Title of Subject Group	: **Wild Life Conservation**
Paper No.	: **Paper- III D (Optional)**
Max. Marks	: 35

Unit-1	1. Wild life - (a) Values of wild life - positive and negative. (b) Our conservation ethics. (c) Importance of conservation. (d) Causes of depletion. (e) World conservation strategies. 2. Habitat analysis, Evaluation and management of wild life. (a) Physical parameters - Topography, Geology, Soil and water. (b) Biological Parameters - food, cover, forage, browse and cover estimation. (c) Standard evaluation procedures - remote sensing and GIS. 3. Management of habitats - (a) Setting back succession. (b) Grazing logging. (c) Mechanical treatment. (d) Advancing the successional process. (e) Cover construction. (f) Preservation of general genetic diversity.
Unit-2	1.Population estimation. (a) Population density, Natality, Birth rate, Mortality, fertility schedules and sex ratio computation. (b) Faecal analysis of ungulates and carnivores - Faecal samples, slide

	preparation,Hair identification, Pug marks and census method. 2. National Organization. (a) Indian board of wild life. (b) Bombay Natural History Society. (c) Voluntary organization involed in wild life conservation. 3. Wild life Legislation - Wild Protection act - 1972, its amendments and implementation.
Unit-3	Management planning of wild life in protected areas. 2. Estimation of carrying capacity. 3. Eco tourism / wild life tourism in forests. 4. Concept of climax persistence. 5. Ecology of perturbence.
Unit-4	Management of excess population & translocation. 2. Bio- telemetry. 3. Care of injured and diseased animal. 4. Quarantine. 5. Common diseases of wild animal.
Unit-5	Protected areas National parks & sanctuaries, Community reserve. 2. Important features of protected areas in India. 3. Tiger conservation - Tiger reserve in M.P, in India. 4. Management challenges in Tiger reserve.

Suggested Readings :

1. Gopal Rajesh : Fundamentals of wild life management
2. Agrawal K.C : Wild life India
3. Dwivedi A.P (2008) : Management wild life in India
4. Asthana D.K : Envionment problem and solution
5. Rodgers N.A & Panwar H.S : Planning of wild life / Protected area Network in India] vol. the report, wild life Institute of India Dehradun.
6. Odum E.P : Fundamentals of Ecology
7. Saharia V.B : Wild life in India
8. Tiwari S.K : Wild life in Central India
9. E.P Gee : Wild life of India
10. Negi S.S : Wild life conservation (Natraj Publishers)

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Session - 2010-2011

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ass	: M.Sc
;r ster	: IV
ubject	: Zoology
itle of Subject Group	: Biology of vertebr immune system
Paper No.	: Paper– III E (Opt)
Ma.. Marks	: 35

t-1	1. Tissues of Immune system- Primary lymphoid organs, structure functions (Thymus and Bursa of Fabricius) 2. tissues of Immune system- Secondary lymphoid organs, structure and functions (Spleen, lymphnode and Payers patches) 3. Antigen processing 4. Antigen presentation
nit-2	1. T-cell lineage and receptors 2. T-cell activation 3. B-cell lineage and receptors 4. B-cell activation
Jn. 3	1. Immunoglobulin structure, Biological and physical properties of immunoglobulin 2. Gene model for Immunoglobulin gene structure 3. Generation of antibody diversity (Light and heavy chain) 4. Immunization
U jt-4	1. Immediate type of hypersensitivity reaction of Anaphylectic type-1. 2. Antibody dependent cytotoxic type II reaction. 3. Complex mediated type III reaction 4. Delayed type cell mediated hypersensitivity type IV reaction.
Unit-5	1. Enzyme linked immunosorbent assay (ELISA) technique and its applications. 2. Immunofluorescence technique(Direct & Indirect and Sandwich antibody labelling techniques . 3. Immunodiffusion techniques (Mancini and oucheterlony immunodiffusion techniques) Monoclonal antibody technology (Hybridoma technology)

List of practicals:

1. Demonstration of various routes of immunization in mammalian model
    a. Intraperitoneal
    b. Subcutaneous or intra muscular
    c. Caudal
2. Demonstration of collection of blood from various routes.
    a. Cardiac puncture
    b. Intra-orbital sinus puncture
    c. Cardiac vein
3. Demonstration and identification of different components of reticuloendothelial system mainly the major lymphoid organs in situ in mammalian model , like spleen, thymus, bone marroe, and Peyres,s patches
4. Detailed histological structuree of major lymphoid organs like spleen, thymus, Bone marrow, Bursa of Fabricius , Mesenteric lymphnode, and Peyer,s patches.
5. Demonstration of antigen and antibody reaction through simple experiments
    a. Agglutination
    b. Immunodiffusion
    c. Immunoelectrophoresis
    d. ELISA

Scheme of Practical examination		**MM 50**
1.	Immunological exercise No.1	10 Marks
2.	Immunological exercise No.2	10 Marks.
3.	Spotting	16Marks
4.	Viva voce	08 Marks
5.	Practical record	06 Marks
	Total	**50 Marks**

Suggested Readings :

1. Kuby, Immunology, W.H. Freeman, U.S.A.
2. W. Paul. Fundamentals of Immunology.

I.M. Roitt. Essential Immunology, EIBS Edition.

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Session - 2010-2011

Class	:	**M.Sc**
Semester	:	**IV**
Subject	:	**Zoology**
Title of Subject Group	:	**Pisci Culture and Economic Importance of Fishes (Icthyology)**
Paper No.	:	**Paper- IV A (Optional)**
Max. Marks	:	35

Unit-1	1. Collection of fish seed from natural resources. 2. Dry bundh breeding of carps. 3. Wet bundh breeding of carps. 4. Hypophysation and breeding of Indian major camps.
Unit-2	1. Drugs useful in induced breeding of fish 2. Types of ponds required for fish culture farms 3. Management of hatcheries, nurseries and rearing ponds 4. Management of stocking ponds
Unit-3	1. Composite fish culture 2. Prawn culture and pearl industries in India. 3. Fisheries resources of MP 4. Riverine fishries.
Unit-4	1. Costal fishries in India 2. Offshore and deep sea fishery's in India 3. Role of fishries in rural development 4. Sewage fed fishries
Unit-5	1. Methods of fish preservation 2. Marketing of fish in India. 3. Economic importance and by product of fishes 4. Shark liver oil industry in India Transport of live fish &fish seed.

Suggested Readings : Paper III A & IV A

1. JR. Norman - The History of fishes.
2. Nagaraja Rao - An introduction to fisheries.
3. Lagler Ichthyology.
4. Herclen Jones Fish migration.
5. Marshal The life of fishes.
6. Thomas - Diseases of fish.
7. Greenwood - Inter relationship of fishes.
8. Gopalji, Srivastava - Freshwater fishes of U.P. and Bihar.
9. Brown -Physiology of fishes Vol. I & II.
10. Hoar and Randall -Fish physiology of fishes Vol. 1 & IX.
11. Gunther Sterba C.N.H.-Freshwater fishes of the world
12. W. Lanharn -The Fishes.
13. G.V. Nikolsky -The ecology of Fishes,
14. Borgstram -Fish as food Vol. I & II.
15. Nilsson -Fish physiology -Recent Advances.
16. P.B. Myle and J.J. Cech Fishes An Introduction to Ichthyology.
17. Carl E. Bond -Biology of fishes.
18. M. Jobling -Environmental Biology of fishes.
19. Santosh Kumar & Manju Ternbhre -Fish and Fisheries.
20. S.K. Gupta -Fish and Fisheries
21. K.P. Vishwas -Fish and Fishries.
22. Jhingaran -Fish and Fishries.

M.Sc. IV sem. Icthyology practical examination scheme based on paper III(a) and IV (a)

Zoology
Practical II (Special Paper)
Ichthyology (III & IV)

Time: 5 hour **M: M 50**

1. Major dissection Nervous system of Walago, Mystus, Labeo, Toredo.		10
2. Minor dissection of internal ear, accessory, respiratory, organ, pituitary glands, webrian ossicles.		03
3. Mounting preparation of permanent slides.		03
4. Age determination of fish with the help of scales		03
5. Identification of fish		08
6. Spotting of museum specimen slides and bones.		08
7. Viva Voice.		05
8. Practical record, collection.	5+5	10
Total		50

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Session - 2010-2011

Class	: **M.Sc**
Semester	: **IV**
Subject	: **Zoology**
Title of Subject Group	: **Cellular Organization and Molecular Organization.**
Paper No.	: **Paper- IV B (Optional)**
Max. Marks	: 35

Unit-1	1. General organization and characterizes of viruses (Examples SV 40 and HIV). 2. Yeast : Structure, reproduction and chromosome organization: Basic ides of its applications as vectors for gene cloning. 3. Molecular organization of reoiratory chain assemblies, ATP / ADP Translocase and F_0F_1 AT pase. 4. Cell cycle: Cell cycle control in mammalian cells and xenopus.
Unit-2	1. Cytochemistry of Golgin complex and its role in cell seretion., 2. Peroxisomes and training of paroxysmal proteins. 3. Nucleouls : Structure and Biogenesis and functions of lysosomes. 4. Intracellular digestion : Ultrastructure and function of lysosomes.
Unit-3	1. Synthesis and targeting of mitochondrial proteins. 2. Secretary pathways and translocation of secretary proteins across the EPR membrane. 3. Genome complexity: C- value [aradox and cot value]. 4. DNA sequences of different complexity.
Unit-4	1. Difference between normal cells and cancer cells. a. Biochemical changes. b. Cytoskeleton changes. c. Cell surface changes. 2. Genetic basis of human cancer. 3. Chromosomal abnormalities in human cancer.

Unit-5	1. General idea of onchogens and proto onchogens. 2. Onchogence and cancer. 3. Transforming Agents. 4. Tumor Supressor geanes. 5. Receptor – Ligand interaction and signal transduction. Cross – talk among various signaling pathways.

Reference of Book:

1. DeRobertis and De Robertis Cell and Molecular Biology. Lea and Febiger.
2. We Watson Hopking reberts steits, Weiner molecular biology of the gene, the Benjamin / Cummings Publishin Company Inc.
3. Bruce alberts, Bray, Lewis, Raff, Roberts, Watson molecular Biology of the cell garland publishing inc.
4. P.K. Gupta, Molecular Cell Biology Rastogi Publication.
5. Watson Gilman Witkowski, Zoller Recomdinant D.N.A. scientific American Books.
6. Gerald Karp. Cell Biology.
7. Lewin B. Genes VII.
8. King Cell Biology.
9. Baniel L. HArtl Elizabeth W. Jones, Genetics Principles and analysis . Jones and Bartlett Publisher.
10. Lodish, Berk Zipursky, Matsudaira Baltimore Demell Molecular Cell Biology W.H. Freeman and company.
11. J. Travers Immunology current Biology limited.
12. Kubey Immunology W.H. Freeman and Company.
13. Riott, Male snustad Principles of genetics john weley and sons Inc..

Practical List

1. Preparation of mitotic chromosome from bone marrow
2. Karyotype preparation any animal
3. Calculation of *mitotic index*(in bone marrow or in root tip cells)
4. Demonstration of mitochondria, Golgi body ,RNA,DNA in tissue section ,any tissue
5. Sex chromatin demonstration
6. Study of Electron micrographs of pro and eukaryotic cells

7. Karyotype preparation of human syndromes from books
8. G&C banding in mitotic chromosomes
9. Gel Electrophoresis (PAGE) for protein
10. Polytene chromosome preparation
11. Meiosis –slide preparation in testis or in Anther
12. Study of mutants of Drosophila w.m.
13. Histochemical localization of age pigment
14. Demonstration of Alkaline Phosphatase/Ascorbic acid
15. Slides of cancerous tissue

Scheme of Practical Examination Based on Paper III(b) and IV (b)

MM: 50

1.	Demonstration of mitochondria/ Golgi body /RNA/DNA in tissue section (any one)	06
2.	Calculation of mitotic index or Preparation of mitotic chromosomes (in Bone marrow or *Allium* root tips)	06
3.	Demonstration Meiosis (anther/testis)	05
4.	Separation of Protein by PAGE or Histochemical demonstration of age pigment or Demonstration of Alkaline Phosphatase or Ascorbic acid in any tissue (plant/animal)	05
5.	Spotting on - Drosophila mutants (w.m) Karyotype of human syndromes Permanent slides of cytology Electron micrographs Chromosomal aberrations (Total 08 spots, 1.5 mark each)	12
6	Viva voce	08
7.	Practical Record	08
	Total Marks	**50**

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Class	: **M.Sc**
Semester	: **IV**
Subject	: **Zoology**
Title of Subject Group	: **Applied Entomology**
Paper No.	: **Paper- IV C (Optional)**
Max. Marks	: 35

Unit-1	Classification according to imms 1. Classification of apterygota upto families. 2. Classification of following insect orders (a) orthoptera (b) hemiptera (c) diptera. 3. Classification of following insect order (a) hymenoptera (b) lepidoptera (c) coleoptera 4. Collection and preservation of insects.
Unit-2	1. Insect pest-Management strategies and tools 2. Biological control 3. Genetic control 4. Chemical control
Unit-3	1. Pests of Cotton 2. Pests of sugarcane 3. Pests of paddy 4. Pests of stored food grains 5. Pests of citrus fruits and mango 6. Pests of pulses 7. House hold insect pests
Unit-4	1. Insects in relation to forensic science 2. Insects migration, population fluctuation and factors

	3. Insects of medical and veterinary importance 4. Ecological factors affecting the population and development of insects
Unit-5	1. Mulberry and non mulberry sericulture 2. Apiculture 3. Lac culture 4. Insects as human food for future.

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Class	: **M.Sc**
Semester	: **IV**
Subject	: **Zoology**
Title of Subject Group	: **Practical work**

(Entomology)

Paper No.	: **Paper- III & IV C (Optional)**
Max. Marks	: 50

1. Study of museum specimens of different orders and families of insects.
2. Study of permanent slides.
3. Taxonomic identification of insects.
4. Dissection major - Nervous system of grasshopper and cockroach.
   Reproductive system of cockroach male and female.
   Minor - honey bee sting and tentorium of grasshopper.
5. Taxonomical identification of egg, larva & pupa.
6. Collection and preservation of insects.
7.

Scheme of practical exam (III & IV C)

1.	Major dissection	08
2.	Minor dissection	05
3.	slide preparation	05
4.	Spotting	10
5.	Taxonomical identification	08
6.	Identification of egg, larva and pupa	04
7.	Collection & record	05
8.	Viva	05
	Total Marks – 50	

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Theory / Practical

Session		2010-2011
Class		M.Sc.
Semester		IV
Subject	(English)	Zoology
	lfgUnhh	
Paper		IV(d) (Optional)
Title of the paper	(English)	Environment & Biodiversity Conservation
	lfgUnhh	
Medium of instructions (Teaching)		English / fgUnh / Both lnkuh
Question Paper Language		English / fgUnh / Both lnkuh
Max. Marks		

Unit		Syllabus	Periods
Unit I	(English)	• Basic concept of Environmental Biology Scope and Environmental Science • Biosphere and Biogeochemical cycles. • Environmental monitoring and impact assessment. • Environmental and sustainable development. • Water conservation, rain water harvesting, water shed management.	
Unit II	(English)	• Cause, effects and remedial measure of Air pollution, Water pollution. • Noise. radioactive and thermal pollution. • Agriculture pollution • Basic concepts of Bioaccumulation. • Solid waste management.	
Unit III	(English)	Global warming and disaster management • Cause of global warming • Impact of global warming – acid rains and ozone depletion, green house effect. • Control measures of global warming (a) Afforestation (b) reduction in the use of CFCS	

		• Disaster management -floods, earthquake, Cyclones landslides. • Environmental legislation.	
Unit IV	**(English)**	Natural Resources :- **Forest -** - Use and over exploitation of forests. - Timber extraction. **Land** - Land degradation. Landslides. - Soil-ersion and desertification. **Water** - Use and over utilization of surface and ground water - Floods. Drought dams- benefits and problems **Mineral** - Use and exploitation , - Environmental effect of extracting and using mineral resources **Food** - World food problem - Effects of modern agriculture and overgrazing **Energy** - Conventional and nonconventional energy resources. - Using of alternate energy sources • Role of an individual in conservation of natural resources Equitable use of resources for sustainable life	
Unit V	**(English)**	• Conservation of Biodiversity - Biodiversity crisis – habitat degradation poaching of wild life. - Socio economic and political causes of loss of biodiversity. - In situ and exsitu conservation of biodiversity - Value of biodiversity. - Hot spots of Biodiversity.	

Recommended Books	**(English)**	
	lfgUnlk	

List of books of for paper III D & IV D

1. Arora	:	Fundamentals of environmental biology
2. Anathakrishnan	:	Bioresources ecology
3. Bottain	:	Environmental studies
4. Bouhey	:	Ecology of populations
5. Clark	:	Elements of ecology
6. Dowdoswell	:	An introduction to animal ecology
7. Goldman	:	Limnology
8. Kormondy	:	Concepts of ecology
9. May	:	Model ecosystems
10. Odum	:	Ecology
11. Perkins	:	Ecology
12. Simmons	:	Ecology of estuaries and costal water
13. Pawlosuske	:	Physico-chemical methods for water
14. South Woods	:	Ecological methods
15. Trivedi and Goel	:	Chemical and biological methods for water pollution studies
16. Willington	:	Fresh water biology
17. Wetzal	:	Limnology
18. Welch	:	Limnology Vols. I-II

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II- PRACTICAL SYLLABUS

Wild life conservation, Environment & Biodiversity

1. Identification and comments upon wild life animals.
2. Study of endangered species.
3. Study of local birds and their habit habitats
4. Study of ecosystem
5. Study of local Biodiversity.
6. Distribution of wild life India. (National parks and sanctuaries)
7. Soil and water analysis.
8. Interspecific relationship – Naturalism, Symbosis, Mutualism, Commensalism, Parasitism, Predatian Competition.
9. Field – expedition and project report
10. Viva- voice
11. Practical Record & collection.

Scheme

Time : 5 hour Max marks 50

Spotting	10
Endangered species / interspecific relationship	10
Soil & water analysis	5
Field expedition	10
Viva voce	5
Practical Record / collection	10
	50

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Class	: **M.Sc**
Semester	: **IV**
Subject	: **Zoology**
Title of Subject Group	: **Molecular Endocrinology and Reproductive Technology**
Paper No.	: **Paper- IV E (Optional)**
Max. Marks	: 35

Unit-1	1. Definition and scope of molecular endocrinology. 2. Chemical nature of hormones. 3. Purification and characterization of hormones. 4. Production of hormone by r DNA technology
Unit-2	1. Structure – function relationship in hormones comparative analysis and evolutionary perspectives. 2. Eicosanoids and hormone action. 3. Concentration and transport of hormones in the blood. 5. Genetic analysis of hormonal disorders.
Unit-3	1. Hormonal regulation of energy metabolism. 2. Hormonal antagonism. 3. Hypothalamic nuclei and their physiological function. 4. Endocrine – Immune interaction
Unit-4	1. Extraction and estimation of pregnanediol from urine. 2.Extraction of Gonadotrophin from urine. 3.Bioassay of Androgen. 4.Bioassay of progesterone.
Unit-5	1. Contraception. 2. Multiple ovulation and embryo transfer technology. 3. Study of estrous cycle by vaginal smear technology. 4. Surgical technique–castration, ovariectomy, vasectomy, tubectomy and laprotomy.

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Suggested reading material (All latest edition)

1. Benjamin Lewim – Genes VII/ VIII, oxford University press.
2. Lodish etal- Molecular Cell Biology.
3. Zarrow, M.X., Yochin J.M. and Machrthy, J.L. – Experimental Endocrinology.
4. Chatterji C.C.- Human Physiology (Vol- II).
5. Bentley, P.J. – Comparative Vertebrate endocrinology.
6. Hadley Mac. E.- Endocrinology.
7. Chinoy, N.J. Rao, M.V., Desarai, K.J. and High land, H.N. – Essential techniques in reproductively physiology and Endocrinology.
8. Norris, D.O. – Vertebrate Endocrinology.

List of Practical:

1. Purification of any protein hormone.
2. Assay of steroid dehydrogenase.
3. Isolation and characterization of steroid / prostaglandin.
4. Assay for protein phosphorylation by c AMP dependant protein – Kinase.
5. Histological studies of endocrine glands.
6. Cytological studies of endocrine gland.
7. Histochemical studies of endocrine glands.
8. Study of vaginal histology during estrus cycle.
9. Demonstration of estrus cycle study by vaginal smear technique.
10. Hitological demonstration of glycogen during reproductive cycle and pregnancy.
11. Effect of testosteronre, estradiol and progesterone.
    a. Male reproductive study by weight/ Volume measurement.
    b. Female reproductive study by weight/ Volume measurement.
12. Study of accessory reproductive structure after castration or ovariectomy.
13. Sperm count.
14. Demonstration of surgical technique.
    a. Castration b. Ovariectomy c. Laparotomy d. Vaseetomy e. Tubectomy etc.
15. Demonstration of perfusion technique for the fixation of endocrine tissue.
16. Implantation of endocrine gland/tissue.

Scheme of practical Examination

MM: 50

1.	Experiments on molecular endocrinology / Reproductive technology.	10 Marks
2.	Surgical / Experimental Techniques	08 Marks
3.	Histochemical / Histological techniques.	08 Marks
4.	Spotting 1 to 5	10 Marks.
5.	Viva Voce	08 Marks
6.	Practical Record	06 Marks
	Total	**50 Marks**

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Class	: **M.Sc**
Semester	: **IV**
Subject	: **Zoology**
Title of Subject Group	: Limnology and Fish Productivity
Paper No.	: **Paper- IV F (Optional)**
Max. Marks	: 35

Unit-1	1.	Basic principal and development of science of limnology.
	2.	Morfomatry, Origin and Classification of Lake systems of the world.
	3.	Saprobien system indicator organisms and water quality monitoring.
	4.	Waste water treatment.
	5.	Aquatic macrophytes and their control.
Unit-2	1.	Light and its relation in fresh water.
	2.	Heat and its relation in fresh water.
	3.	Role of oxygen and Carbon-dioxide in freshwater.
	4.	Role of organic and inorganic Carbon in freshwater.
Unit-3	1.	Aspects of primary productivity in freshwater.
	2.	Role of physicochemical characteristics in freshwater.
	3.	Plankton its role in freshwater.
	4.	Characteristics Bethic Biota, their substrate preference and significance
Unit-4	1.	Fresh water resources in India and their quality.
	2.	Wetland and its management.
	3.	Fishery and management of reservoir.
	4.	Inland fish breeding.
Unit-5	1.	Reverine fisheries.
	2.	Fish production in pond and its management.
	3.	Indian cultivable fishes and their crop potential in India.
	4.	Preservation processing transport and marketing of fish.

List of Practicals:

1. Soils Analysis.
    a. Particulate analysis.
    b. Moisture content.
    c. Total organic carbon.
    d. Estimation of Phosphate.
    e. Estimation of Nitrates.
    f. Estimation of Na, K, Ca, Mg.
2. Mapping and Drawing techniques.
3. Study of aufwuch communities.
    a. Study of Sponges.
    b. Study of Ectoprocta.
    c. Study of epineustic communities.
4. Water analysis.
    a. Estimation of dissolved oxygen.
    b. Estimation of pH.
    c. Estimation of Alkalinity.
        a. Carbonates.
        b. Bicarbonate.
        c. Free CO_2
    d. Phosphate.
    e. Nitrate.
    f. Silicate.
    g. Calcium, Magnesium.
    h. Chlorophyll.
    i. Conductivity.
    j. B.O.D.
    k. C.O.D.
    l. Total Solids.
    m. Redox potential.
5. Plankton study.
    a. Study and identification of phytoplankton.
    b. Study and identification of Zooplankton.
    c. A collection of common plankton organism to be submitted by the student in the form of slides.
6. Benthic study.
    Collection techniques.
    Isolating techniques of benthic fauna.
    Identification of benthic macro invertebrates.
    Field techniques of pollution monitoring.
7. Productivity studies.
    a. Estimation of primary productivity.
        a. Lentic locale.
        b. Lotic locale.
    b. Estimation of secondry productivity.
8. Ageing and growth techniques of fish.
    a. Scales preparation and ageing.
    b. Tagging technique.
    c. Growth rate study (From hatched embryos).
9. Identification of late fry and fingerlings.

10. Induced breeding technique.
11. Gonadectomy and Thyroidectomy.
12. Oxygen consumption levels and metabolic rates of some food fishes.
    a. *Heteropneustes.*
    b. *Cyprinus carpio.*
13. Behavioural studies of fish.
    a. Agnostic behaviour.
    b. Schooling.
14. Proximate analysis of fish muscle.
    a. Red muscle.
    b. White muscle.
15. Fecundity and Ova diameter of some fishes.
16. Sexing of some fishes.
17. Techniques of estimating fish populations.
18. Estimation of:
    a. Conditioning factor.
    b. L/wt relationship.
    c. Fish maturity.

Scheme of Practical Examination:

MM : 50

1.	Major Limnological Exercise	12 Marks.
2.	Minor Limnological Exercise	08 Marks.
3.	Estimation (Two)	16 Marks.
4.	Practical record	08 Marks.
5.	Viva voce	06 Marks.
	Total	**50 Marks**

List of Reference:

1. E.P. Odum – Fundamental of Ecology.
2. R.G. Wetzel – Limnology.
3. P.S. Welsch – Limnology.
4. P.S. Welsch – Practical limnology.
5. R.G. Wetzel - Laboratory guide of Limnology.
6. J. Schwocrbel – Principles of Limnology.
7. K.A. Ruttner – Fundamentals of Limnology.
8. Hutchinson – A Treatise on Limnology Vol- 1 & 2.

9. V.G. Cole – Limnology.
10. G.A. Cole – Limnology.
11. W.T. Edmondson – Fresh water Biology.
12. R.W. Pennak – Freshwater invertebrates on N. America.
13. J.G. Needham and P.R. Needham – A Guide to freshwater invertebrates.
14. G.T. Tonapi – Freshwater animals of India.
15. S. Krishan Swamy – A Guide to the study of freshwater organism.
16. G.W. Prescott – Freshwater Algae.
17. Deshikachary – A guide for identification of Algae.
18. Published by International Biological program- I.B.P. Hand Books Nos. 1 & 2.
19. H.L. Goltermann – Chemical analysis of freshwaters.
20. K.S. Rao & Suresh Jain – Limnological methods & Principles of fish productivity.
21. O.P. Lind – Practicals Limnology.
22. H.B.N. Hynes – Biology of Running waters.
23. L. Klein – River pollution Vols. I & II.

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Class	: **M.Sc**
Semester	: **IV**
Subject	: **Zoology**
Title of Subject Group	: **Proteins, Nucleic acids and Metabolic regulation**
Paper No.	: **Paper- IV H (Optional)**
Max. Marks	: 35

Unit-1	Protein primary and secondary structures. Protein tertiary and quaternary structures. Purification of proteins. Protein analytical methods (Spectroscopy and X-ray crystallography).
Unit-2	Protein folding. Lipoproteins. G-protein and hormonal signaling. Signal transduction pathways.
Unit-3	1. Forces stabilizing nucleic acid structure. 2. Fractionation and analysis of nucleic acids. 3. DNA damage and repair. 4. DNA Methylation
Unit-4	1. Transfer RNA and its aminoacylation. 2. Restriction endonucleases and restriction fragment length polymorphism (RFLP). 3. Polymerase chain reaction. 4. Gene cloning
Unit-5	1. Proteins biosynthesis. 2. Mitochondrial electron transport. 3. Biosynthesis of purine nucleotides. 4. Biosynthesis of pyrimidine nucleotides.

List of Practical:

1. Standard curve preparation of proteins.
2. Quantitation of Proteins.
3. Quantitation of DNA.
4. Quantitation of RNA.
5. Standard curve preparation of DNA and RNA.
6. Verification of Beerls Law.
7. Paper and thin layer chromatography.
8. Differential centrifugation and fractionation of cytoplasmic organelles.
9. Purification of protein by column chromatography.

Scheme of Practical Examination

MM: 50

1. Preparation of Standard curve/ verification of Berrls Law	10 Marks
2. Quantitation of protein/ DNA / RNA of purification	12 Marks
3. Separation of compuneh by paper chromatography/ TLC / Column chromatography	14 Marks.
4. Viva voce	08 Marks.
5. Practical Record	06 Marks
Total Marks	**50 Marks**

Reference:

1. Biochemistry, D. Voet and J.G. Voet, John wiley & sons. Inc. New York.
2. Text Book of Biochemistry, T.M. Devlin Wiley- Leiss, New York.
3. Principles of Biochmistry, G.L. Zubey; W.W. Parson and D.E. Vance, Wm.C. Brown publisher, U.S.A.
4. Principles of Biochemistry , A.L. Lehninger, A.L. Nelson; M.M. Cox. Worth Pulisher, Inc. USA.

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Class	: **M.Sc**
Semester	: **IV**
Subject	: **Zoology**
Title of Subject Group	**Sericulture**
Paper No.	: **Paper- IV I (Optional)**
Max. Marks	: 35

Unit-1	Introduction and Moriculture 1. Silk Producing Organisms. 2. Planning for profitability in sericulture. 3. Propagation of Mulberry 4. Cultural Practices
Unit-2	plant pathology and Biology of *Bombyx mori* 1. Diseases of mulberry plant. 2. Classification of races of *Bombyx mori* 3. Silk gland of *Bombyx mori* 4. Structure & chemical composition of silk
Unit-3	Rearing facilities and Operation 1. Rearing house and Rearing appliances for rearing of silk worms. 2. Disinfection operation before rearing 3. Maintenance of optimum conditions for rearing 4. Feeding, Bed cleaning and spacing
Unit-4	Moulting, mountaning and Silk Worm disease 1. Moultanism and care during moulting 2. Characteristic features of a ripe silk worm ,mounting, Process of spinning & harvesting of cocoons 3. Pebrine (Protozoan disease) 4. Bacterial, Fungal and Viral disease of silk worm

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Unit 5

Cocoon marketing, silk reeling and Non-mulberry silk worms

1. Cocoon Quality, testing , and grading
2. Silk reeling operation
3. Tasar culture

Ericulture and Muga culture

List of books for Sericulture:

1. Hand book of Silk Worm rearing by Masanori, Shimiza,D. Agri.
2. Sericulture Manual -2
3. Sericulture Manual -3 by S. Kishanaswamy
4. Introduction to Sericulture by Dr. (Mrs.) G. Ganga Dr. (Mrs.) J. Sulochana chetty
5. Principles of Sericulture by Hisao Aruga
6. A Manual of non mulberry Silks Sericulture Vol.-1 by Dr. M.S. Jolly *et al*
7. Sericulture and Silk Industries by Tripurari Sharan
8. Sericulture Manual -1 Mulberry cultivation by Dr. G. Rang swami
9. Sericulture Manual -2 Silkworm rearing by Dr. S. Krishnaswami
10. Sericulture Manual -3 Silk reeling by Dr. S. Krishnaswami
11. Mulberry cultivation by Zheng, Ting-Zing
12. Silkworm rearing by Pva Pang- Chesan
13. Silk worm training manual by Sco Hotim.

Scheme of Sericulture practical (IV Semester)

Syllabus based on sericulture special IV paper of IV semester .The duration of examination shall be $2^{1/2}$ hours.

MM: ~~50~~ 25

9. Dissection / Rendita or Denier	~~10~~ 5
10. Propagation / Preparation of Bed	~~10~~ 5
11. Spotting	~~10~~ 5
12. Viva	~~10~~ 5
13. Practical Record	~~10~~ 5
Total Marks –	~~50~~ 25

Syllabus based on sericulture special IV paper of IV semester

1. Dissection of Silk gland/ Nervous System of Silkworm
2. Propagation of Mulberry by cutting method
3. Preparation of Bed for Silkworm rearing
4. Spotting related to special Sericulture theory paper
5. Find out the Rendita or Denier
6. Practical Record

Department of Higher Education, Govt. of M.P.

Post graduate semester wise syllabus

As recommended by Central Board of studies and approved by the governor of M. P.

उच्च शिक्षा विभाग, मध्यप्रदेश शासन

स्नातकोत्तर कक्षाओं के लिए सेमेस्टर अनुसार पाठ्यक्रम

केन्द्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा म. प्र. के राज्यपाल द्वारा अनुमोदित

Session (सत्र) – 2015-16

Scheme of Marks

M. Sc. Drugs and Pharmaceutical Chemistry

SEMESTER- I

Paper	Comp/ Opt	Paper Title	Code (MCH)	Max. Marks
I	Compulsory	Introduction to Pharmacy, Drug Regulatory Act, Intellectual Property Rights	PC-101	40+10 (CCE) = 50
II	Compulsory	Pharmaceutical Chemistry & Biochemistry	PC-102	40+10 (CCE) = 50
III	Compulsory	Principles of Organic Pharmaceutical Chemistry	PC –103	40+10 (CCE) = 50
IV	Compulsory	Principles of Physical Pharmacy –I	PC-104	40+10 (CCE) = 50
V	Optional- 1	Mathematics and statistics for chemists (for biology background students)	PC –105 (a)	40+10 (CCE) = 50
VI	Optional- 2	Biology for chemists (for mathematics background students)	PC –105 (b)	40+10 (CCE) = 50
		PRACTICAL 1.		50
		PRACTICAL 2.		50
		TOTAL		400

M. Sc. Drugs and Pharmaceutical Chemistry

SEMESTER- II 2016 – 17

Paper	Comp/ Opt	Paper Title	Code (MCH)	Max. Marks
I	Compulsory	Principles of Inorganic Pharmaceutical Chemistry –I	PC-201	40+10 (CCE) = 50
II	Compulsory	Pharmaceutical Analysis –I	PC-202	40+10 (CCE) = 50
III	Compulsory	Pharmaceutical Analysis – II	PC –203	40+10 (CCE) = 50
IV	Compulsory	Principles of Physical Pharmacy –II	PC-204	40+10 (CCE) = 50
V	Optional- 1	Computers for Chemists	PC –205	40+10 (CCE) = 50
		PRACTICAL 1.		50
		PRACTICAL 2.		50
		TOTAL		400

7/7/15

M. Sc. Drugs and Pharmaceutical Chemistry

SEMESTER- III 2015-16

Paper	Comp/ Opt	Paper Title	Code (MCH)	Max. Marks
I	Compulsory	Principles of Physical Pharmacy-Iii	PC-301	40+10 (CCE) = 50
II	Compulsory	Principles Of Pharmacognosy	PC-302	40+10 (CCE) = 50
III	Compulsory	Pharmaceutical Medicinal Chemistry-I	PC -303	40+10 (CCE) = 50
IV	Compulsory	Principles Of Inorganic Pharmaceutical Chemistry- Ii	PC-304	40+10 (CCE) = 50
V	Optional- 1	Instrumental Methods of Analysis	PC -305	40+10 (CCE) = 50
		PRACTICAL 1.		50
		PRACTICAL 2.		50
		TOTAL		**400**

M. Sc. Drugs and Pharmaceutical Chemistry

SEMESTER- IV 2016-17

Paper	Comp/ Opt	Paper Title	Code (MCH)	Max. Marks
I	Compulsory	Pharmaceutical Medicinal Chemistry-Ii	PC-401	40+10 (CCE) = 50
II	Compulsory	Drug Design And Medicinal Chemistry	PC-402	40+10 (CCE) = 50
III	Compulsory	Advance Chemistry	PC -403	40+10 (CCE) = 50
IV	Compulsory	Supplements, Additives And Toxicology	PC-404	40+10 (CCE) = 50
V	Optional- 1	Drug Pharmacokinetics And Drug Development	PC -405	40+10 (CCE) = 50
		PRACTICAL 1.		50
		PRACTICAL 2.		50
		PROJECT		50
		TOTAL		**450**

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ARPANA BHARDWAJ
E=ARPANABHARDWAJ
AJ1@GMAIL.COM,

SEMESTER FIRST

2015-16

M.Sc. (Drugs and Pharmaceutical Chemistry)

Syllabus

Pharmaceutical Chemistry paper I

PC-101 Introduction to Pharmacy, Drug Regulatory Act, Intellectual Property Rights

Unit I

Introduction to Pharmacy, Careers in Pharmacy, Codes of pharmaceutical ethics, Importance of Pharmaceutical Chemistry, Pharmacopeia & its history (IP,BP, USP, NF)

Unit II

Routes of drug administration, Introduction to tablets, capsule, suspension, emulsion, ointments etc, Introduction to NDDS.

Unit III

Drug and Cosmetics Act with special reference to schedule M, GMP, GLP, GCP, USFDA, NDA, ANDA, Clinical Trials

Unit IV

Concept of Quality & total Quality Management, Quality Assurance & Quality Control, IPQA, IPQC.

Unit V

Documentation and Maintenance of records, Intellectual property rights patents, Trademarks, Copyrights, Patents Act.

Books Recommended:

1. Willing, S.W., & Stoker, Good Manufacturing Practices for Pharmaceuticals, Marcel Dekker, New York.
2. Guarino, R.A., New Drug Approval Process, Marcel Dekker, New York.
3. Drug & Cosmetic Act.
4. Patents Act.
5. Consumer Protection Act.
6. Environmental Protection Act.
7. Federal Food, Drug & Cosmetic Act.
8. Bansol, IPR Guidelines for Pharm students and Researchers.
9. Pisano-FDA Regulatory Affairs.
10. Phillip W. Grubb, Patents for Chemicals, Pharmaceuticals and Biotechnology.
11. Lehninger principles of biochemistry, Albert L. Lehninger, David Lee Nelson, Michael M. Cox , W.H. Freeman, 2008.
12. Harper's Illustrated Biochemisty, Robert K. Murray, Mc. Graw Hill.
13. Biochemistry, keshav Trehan, New age Publishers.

Pharmaceutical Chemistry paper II

14. Remington- vol I & II

Dr Kalpana Sir

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Pharmaceutical Chemistry paper II

PC-102 PHARMACEUTICAL CHEMISTRY & BIOCHEMISTRY

Unit I

Chemical structure and biological activity, Study of relationship between physico-chemical properties and biological potencies of drugs. Metabolic changes of drugs & related organic compounds in the body.

Unit II

Classification of drugs on the basis of

(i) Chemical Structure

(ii) Therapeutic action (at least one example of each class).

Drug Receptors:

(i) Nature of drug receptors

(ii) Isolation of drug receptors

(iii) Receptor theories

(iv) Types of drug receptors

Unit III

Heterocycles: - Synthesis reactivity reactions applications and biological significance of the following: -

(A) Mono Hetero Atom Systems: - Indole, Quinoline, Isoquinoline.

(B) Multi Hetero Atom Systems: - Diazole, Pyrazole, Oxazole.

Unit IV

Biochemical organization of the cell and transport processes across cell membrane, bioenergetics, production of ATP and its biological significance.

Enzymes: Nomenclature, Kinetics and its Mechanism of action, Mechanism of Inhibition, Isoenzymes, enzymes in technical diagnosis.

Unit V

Disorders of Carbohydrate, Lipid and Protein Metabolism, Biomedical Importance and Implications in Clinical Biochemistry, Diagnostic tests for detection of metabolic disorders,

Urea cycle, metabolic disorders of urea cycle.

Books Recommended:

1. Smith HJ, Williams H, eds, "Introduction to the principles of Drug Design" Wright Boston.
2. Harpers- illustrated Biochemistry.
3. A. C. Deb- fundamental of biochemistry.
4. Martin YC. "Quantitative Drug Design" Dekker, New York.
5. Lien EJ. SAR " Side effects and Drug Design" Dekker, New York.
6. William H, Malick JB " Drug Discovery and Dovelopment" Humana Press Clifton.
7. Delgado JN, Remers WA eds "Wilson & Gisvolds's Text Book of Organic Medicinal &Pharmaceutical Chemistry" Lippincott, New York.
8. Foye W.O.- "Principles of Medicinal chemistry 'Lea & Febiger.
9. Hetrocyclic Chemistry- R.K. Bansal, New Age Publication.
10. Name reactions and reagents in organic synthesis- Bradford P. Mundy, Michael G. Ellerd, Wiley Publisher.

Kalpana Singh

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Pharmaceutical Chemistry paper III

PC –103 PRINCIPLES OF ORGANIC PHARMACEUTICAL CHEMISTRY

Unit I

Stereo Chemistry and Conformational Analysis:

Optical Isomerism- Concept of Chirality, recognition of symmetry elements and chiral structures, R-S nomenclature, Diasterisomerism in acyclic and cyclic systems, Optical activity without asymmetric carbon atom (allenes, spiranes and biphenyls)

Unit II

Geometrical Isomerism: Geometrical isomerism of olefins and oximes, E-Z nomenclature.

Conformational Analysis: conformational analysis of ethane, butane, cyclohexane and decalines. Effect of conformation on reactivity in acyclic compounds and cyclohexanes, Interconversion of Fischer, Newman and Sawhorse projections.

Stereo selective Synthesis: Asymmetric Synthesis

Unit III

(A) Reaction Intermediates: Structure, formation and examples of participation in chemical reaction of the following: - Carbocation, Carbanion, Nitrenes, Carbenes, Arynes, Free radicals.

(B) Mechanism of Organic Reactions: - Types of reactions, thermodynamic and kinetic requirements. Potential energy diagram, methods of determining reaction mechanisms,

(C) Aliphatic Nucleophilic Substitution: SN_1, SN_2, SN_i, factors affecting mechanism, hydrolysis of ester,

Unit IV

Elimination Reactions: E_1, E_2 and E_1cb mechanism, Hoffman and Saytzeff elimination.

Addition Reactions: General mechanism, hydroboration, epoxidation, Wittig reaction.

Aromaticity concept: Huckle's rule and its limitations, Benzenoid and non- benzenoid compounds, cyclopentadienyl anion, tropylium cation, azulenes, fullerenes.

Synthetic applications, mechanisms and stereochemistry (wherever applicable) of the following organic reactions and molecular rearrangements; - Pinacol - pinacolone rearrangements, Benzilic acid rearrangement, Backmann rearrangement, Hoffmann- Curtius, Lossen and Schmidt rearrangement, Claisen rearrangement .

Unit V

Study of reactions of synthetic importance: mechanisms and stereochemistry (where ever applicable) Birch reduction, Mannich reaction, Meerwein Pondorf - Verley reduction and Oppeneaur oxidation, Ozonolysis and hydrogenation, Diel's Alder reaction, Reformatsky reaction, Grignard reaction.

Books Recommended:

1.Eliel, E.L., Stereochemistry of Carbon compounds. MC.Graw Hill Book Company, Inc. New York.

2. March, J., Advanced Organic Chemistry, Reaction Mechanism and Structure, John Wiley and sons, New York.

3. Singh, H and Kapoor, V.K., Organic Pharmaceutical Chemistry, Vallabh Prakashan Delhi.

4. Gould, E.S., Mechanism and structure in Organic Chemistry, Holt, Rinewart and Winston , New York.

5. Abraham D.J., ed.,Burger's Medicinal Chemistry & Drug Discovery, Vol. I-VI, John Wiley & sons, New Jersey.

6. Ford M.E., Catalysis of organic reactions, Marcel Dekker Inc., New York.

7. Laszlo Kurti, Barbara Czako, Strategic Applications of Name reaction in Organic Synthesis, Elsevier, Academic Press, New York.

8. P S Kalsi, Organic reactions and their mechanism.

9. Wohalard- organic chemistry.

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Pharmaceutical Chemistry Paper IV
PC-104 PRINCIPLES OF PHYSICAL PHARMACY –I

Unit I
Basic Principles of Physical Pharmacy
Thermodynamics: the first law of thermodynamics, isothermal and adiabatic processes, ideal gases and the first law, heat of formation, Hess's law and heat of combustion, heats of reaction from bond energies, second and third law of thermodynamics, free energy functions and applications, Gibbs- Helmholtz equation.

Unit II
Determination of the physical properties of molecules: Molecular structure, additive and constitutive properties, refractive index and molar reflection, types of solutions, concentration expressions (molarity, molality, normality, mole fraction), ideal and real solutions, Raoults law, Henry's law.

Unit III
Buffers in pharmaceutical and biological system: buffer, the buffer equation, factors affecting pH of buffer, buffer capacity, in-vivo biological buffer system, pharmaceutical buffers, preparation of pharmaceutical buffer solutions, influence of buffer capacity and pH on tissue irritation, methods of adjusting tonicity and pH.

Unit IV
(A) Interfacial Phenomena, Application of Surfaces Active Agents, Electric Properties of Interfaces, Application in Pharmacy.
(B) Micromeritics
Particle size and size distribution, Methods for determining particle Size, Derived Properties of Powders, Application in Pharmacy.

Unit V
Rheology
Introduction, Newtonian Systems, Non-Newtonian Systems, Thixotropy, Determination of Rheology Properties, Viscoelasticity, Application in Pharmacy.

Books recommended:

1. Martins- Physical Pharmacy and Pharmaceutical Sciences, Patrick J. Sinko, Lippincot Williams and Wilkins.
2. Textbook of Physical Pharmaceutics, CVS Subrahmanyam, Vallabh Parkashan, New Delhi.
3. Physical Chemistry, P.W. Atkins, ELBS.
4. Chemical Kinetics, K.J. Laidler, McGraw-Hill Kinetics and Mechanism of Chemical Transformation J. Rajaraman and J. Kuriacose, Mc Millan.
5. Text Book of Polymer Science, Fred. W.Billmeyer, 3rd edition, Wiley Interscience Publication, John Wiley and Sons.
6. Introduction to Polymers Sciences and Technology, S.D. Dawande,1st edition, Denett and Co., Nagpur.
7. Polymer Science, V.R.Gowarikar, N.V.Vishwanathan, Jayadev Sreedhar, New Age International, New Delhi.
8. Polymers in Drug Discovery,Ijeoma.F.Vihegbu,Andreas G.Scchatzlein, Taylor andFrancis.
9. Biodegaradable hydrogels for drug delivery, Kinam Park, Waleed S.W.Shalaby, CRC Publisher.
10. Organic Chemistry, IL Finar, Vol.-I and II,6th Edition , Pearson Education Asia.
11. Chemistry of Natural Products, S.V.Bhat, B.A.Nagasampegi, M.Sivakumar, Spiringer Publication.
12. Glycopeptides and Glycoproteins, Synthesis, Structure and Applications Volume

Edition, V.Whittmann, Springer Publications.

Pharmaceutical Chemistry paper V

PC –105 (a) MATHEMATICS AND STATISTICS FOR CHEMISTS (for biology background students)

Unit I

Matrix Algebra: - Addition and multiplication inverse adjoint and transpose of matrices, special matrices (Symmetric, skew symmetric Hermitian, Skew Hermitian, unit diagonal, unitary etc.) and their properties. Matrix equations - : homogeneous, non independence linear equations and conditions for the solution linear dependence and independence introduction to vector spaces, matrix eigen values and eigen vectors diagonalization, determination (examples form Huckles theory)

Unit II

Differential Calculus: - Functions continuity and differentiability, rules for differentiation, applications of differential calculus including maxima and minima exact and inexact differentials.

Unit III

Integral Calculus: - Basic rules for integration, integration by partial fraction and substitution, Reduction formulae, Applications of integral calculus, Functions of several variables partial differentiation co-ordinate transformation (e.g. Cartesian to spherical polar) curve sketching.

Unit IV

Elementary Statistics:-Organizing and displaying data, Variables, univariate data bivariate data, random variables.

Summarizing data and variation; The mean, the median the mode, the mean deviation, the variance and standard deviation, coefficient of variation.

Unit V

Permutations and combinations: -

Probability, Definitions rules of probability Distributions (binomial and normal distributions) Regression and correlation, Introduction, simple linear regression model correlation coefficient.

Book Recommended:

1. Bolton, Pharmaceuticals Statistics- Practical & Clinical Applications, Marcel & Dekker, New York.
2. Fisher, R.A., Statistical Methods for Research Works, Oliver & Boyd, Edinburgh.
3. Chow, Statistical Design and Analysis of Stability Studies, Marcel Dekker, New York.
4. Buncher, Statistics in the Pharmaceutical Industry, Marcel Dekker, New York.
5. Finney, D.J., Statistical Methods in Biological Assays, Hafner, New York.
6. Montgomery, D.C., Introduction to Statistical Quality Control, Willy.
7. Khan, Irfan A., Biostatistics for Pharmacy.

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Pharmaceutical Chemistry paper V

PC –105 (b) BIOLOGY FOR CHEMISTS (for mathematics background students)

Unit I

Cell Structure and Functions

Structure of prokaryotic and eukaryotic cells intracellular organelles and their functions, Comparison of plant and animal cells. Overview of metabolic processes-catabolism and anabolism.

Unit II

Carbohydrates, Conformation of monosaccharides structure and functions of important derivatives of monosaccharides, disaccharides and polysaccharides.

Role of sugars in biological systems, Carbohydrate metabolism-Kreb's cycle, glycolysis, glycogenesis and glycogenolysis gluconeogenesis, pentose phosphate pathway.

Unit III

Lipids, Fatty acids, essential fatty acids, function of triacylglycerols, glycerophospholipids, sphingolipids cholesterol, bile, prostaglandins, Liporoteins.

Lipid metabolism, oxidation of acids.

Unit IV

Amino –acids, Peptides and proteins, Chemical and enzymatic hydrolysis of proteins to peptides, Amino acids, Primary & secondary structure of proteins, Chemistry of oxytocin and tryptophan releasing hormone (TRH).

Unit V

Nucleic Acids, Purines and pyrimidine bases of nucleic acids, base pairing via-H-bonding. Structure of ribonucleic acids (RNA) and deoxyribonucleic acids (DNA), double helix model of DNA, replication of DNA transcription, translation and genetic code.

Book Recommended

1. Trease and Evans, Pharmacognosy, 15th edition, Elsevier.
2. Burger's Medicinal Chemistry, 6th edition, Vol-I, Wiley Interscience, New York.
3. Chemistry of natural products by S.V. Bhat, B.A. Nagasampegi, Springer publications. New York.
4. Finar, Organic Chemistry, Vol-I
5. Drug Discovery and Evaluation, Pharmacological assays, H. Gerhard Vogel, 2nd edition, Springer publications,
6. Quality Control of Herbal drugs, an approach to evaluation of botanicals, by Pulok Mukherjee, Business Horizon Publications.
7. Pharmacognosy and Pharmacobiotechnology, by Ashutosh Kar, New age International publications.
8. Role of Biotechnology in Medicinal and Aromatic plants, Vol-XIII, Ukaaz Publications, Hyderabad.
9. Supplement to cultivation and utilization of medicinal plants, S.S. Handa and M.K. Kaul, RRL Jammu.
10. Chemistry of Natural Products, by O.P. Agarwal, Vol-I & II.
11. Harpers- Illustrated Biochemistry.
12. A.C. Deb- Fundamental of Biochemistry.

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SEMESTER FIRST
2015-16
M.Sc. (Drugs and Pharmaceutical Chemistry)
Practical Syllabus

First semester Practical's

1) Stereochemical studies of organic compounds with the help of molecular model kit.
2) Preparation of drug or organic compound.
3) Organic Synthesis Using Microwave Oven.
4) Synthesis of metal complexes and determination of their anti microbial activity.
5) Inorganic Preparation of compounds like Ferrous sulphate, magnesium Carbonate, calcium carbonate, alum, zinc oxide, magnesium trisilicate, dicalcium phosphate.
6) Limit test for chloride and sulphate.
7) Determination of particle size by microscope.
8) Determination of derived properties of powders.
9) Preparation of suspensions and study of its sedimentation parameter.
10) Preparation of emulsions.
11) Preparation of ointment.
12) Preparation of pharmaceutical buffer and study of its theoretical and calculated pH.
13) Preparation of aromatic waters, spirits, solutions, tinctures.
14) Preparation of simple syrup as per IP and USP.

SEMESTER FIRST
M.Sc. (Drugs and Pharmaceutical Chemistry)
Examination scheme

Duration -8 Hours **Total Marks -100**
Minimum Passing Marks-33

Examination scheme: - First semester

1. Synthesis of drug and organic compound. (10 marks)
2. Preparations of Inorganic compound. (10marks)
3. Limit test. (10 marks)
4. Pharmaceutical Preparations like Suspension, Aromatic water, Solutions, Spirits. (Any two) (20 marks)
5. Preparation of pharmaceutical buffer and study of its Theoretical and calculated pH. Or Preparation of suspensions and study of its sedimentation parameter (15 marks)
6. Preparation of tinctures. (5 marks)
7. Preparation of simple syrup IP and USP (5 marks)
8. Viva-Voce (15 marks)

Practical Record (10 marks)

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SEMESTER SECOND

2015-16

M.Sc. (Drugs and Pharmaceutical Chemistry)

Syllabus

Pharmaceutical Chemistry paper I

PC 201 PRINCIPLES OF INORGANIC PHARMACEUTICAL CHEMISTRY –I

Unit I

Impurities in Pharmaceutical Substances and their tests:-

(A) Sources of impurities in pharmaceutical chemicals.

(B) Effect of impurities.

(C) Permissible impurities in pharmaceutical substances.

(D) Limit tests.

Synthesis, properties and uses of inorganic compounds of pharmaceutical importance

(A) Topical drugs: - dusting powders, Lubricants astringents

(B) Gastro–intestinal drugs: - antacids, digestants, emetics

(C) Respiratory drugs: - expectorants and antitussives.

Unit II

Structure and Bonding I

A) Chemical periodicity, structure and bonding in homo and heteronuclear molecules including shapes of molecules (VSEPR theory)

B) Concepts of acids and bases, Hard-Soft acid base concept, Non-aqueous solvents

Unit III

Transition elements and Coordination compounds: Allotropy, synthesis, structure and bonding, industrial importance of the compound.

Inner transition elements: Spectral and magnetic properties, reaction mechanism

Unit IV

A) Complexing and chelating agents used in therapy,

B) Dental product: Dentifrices, anti-caries agents.

C) Bioinorganic Chemistry: photosystems, porphyrin, metalloenzymes. Oxygen transport, electron-transfer reactions: nitrogen fixation

Unit V

Structure and Bonding II

Boron hydrides: Polyhedral boranes, hydroboration, carboranes and metallo-carboranes

Cages and metal clusters.

Books Recommended:

1. Roger's Inorganic Pharmaceutical Chemistry, Charles Herbert Rogers, Tailo Olaf Soine, Lea and Fabiger pub.

2. Inorganic Pharmaceutical Chemistry, K. G. Bothra, Nirali Prakashan.

3. Inorganic Pharmaceutical Chemistry, G. R. Chatwal, Himaliya Publicaltion

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Pharmaceutical Chemistry paper II

PC- 202 PHARMACEUTICAL ANALYSIS –I

Unit I

UV-Visible Spectroscopy: Basic principles and brief outline of instrumentation, Types of electronic transition, Effect of solvent on transition, Chromophores and their interaction with UV-visible radiation and their utilization in structural, qualitative and quantitative analysis of drug molecules, Woodward-Fieser rule, Fundamentals of Optical rotatory dispersion, Cotton effect curves, Octant rule, Circular dichorism.

Unit II

Infrared Spectroscopy: Basic principles and brief outline of instrumentation, Infrared radiation and its interaction with organic molecules, Vibrational mode of bonds, effect of hydrogen bonding and conjugation on absorption bands, applications, interpretation of IR spectra, FTIR and ATR.

Unit III

Nuclear magnetic resonance spectroscopy: Basic principles and brief outline of instrumentation, Magnetic properties of nuclei, field and Precession, chemical shift concept, isotopic nuclei, reference standards and solvents, ^{1}H NMR spectra, chemical shifts, multiplicity, coupling constants, free induction decay, average time domain and frequency domain signals, Spin-spin and spin-lattice relaxation phenomenon. Protein noise decoupled spectra. Nuclear overhauser enhanced ^{13}C NMR spectra, their interpretation and application, APT and DEPT techniques, Introduction of 2D NMR techniques, COSY, with application.

Unit IV

Mass spectrometry: Basic principles and brief outline of instrumentation, Ion formation, molecular ion, metastable ion, fragmentation process in relation to molecular structure and functional groups, Relative abundance of isotopes, chemical ionization, FAB, ESI, Maldy, GC-MS and other recent advances in mass spectrometry.

Unit V

Electron spin resonance spectroscopy: - Basic principles zero field splitting and Kramer's degeneracy, Factors affecting the "g" value, Isotropic and anisotropic hyperfine coupling, Spin Hamiltonian, spin densities and Mc Connel relationship measurement techniques, applications.

Books Recommended:

1. Willard, H.H., Merrit, L.L., Dean, J.A., Settle P.A., Instrumental Methods of Analysis, Van Nostrand.
2. Skoog, D.A., Heller, F.J., Nieman, T.A., Principles of Instrumental Analysis, WB Saunders.
3. Hunson, J.W., ed. Pharmaceutical Analysis, Modern Methods, part A & B, Marcel Dekker.
4. Schirmer, R.E., ed. Modern Methods of Pharmaceutical Analysis, Vols 1, 2. Boca Raton F.L., CRC Press.
5. Mann, C.K., et al., Instrumental Analysis Harper & Row.
6. Jaffe, H.H., Orchin M., Theory & Applications of Ultraviolet Spectroscopy, Willy.
7. Silverstein, Spectrometric identification of Organic Compounds, Willy.
8. Bovey, F., Jelinski, L., Miran, P., Nuclear Magnetic Resonance Spectroscopy, Sau:Diego Academic.
9. Stothers, J.B., Carbon-13 NMR.Spectroscopy, Academic.
10. Gordy, W., Theory & Applications of Electron Spin Resonance, Willy.
11. Haswell, S.J., ed. Atomic Absorption Spectroscopy, Elsevier.
12. Ardrey, R.E., Pharmaceutical Mass Spectra, Pharmaceutical Press, London.
13. Budzikiewicz, et al., Interpretation of Mass Spectra of Organic Compounds, Holden-Day San Francisco.
14. Beckett and Stenlake, Practical Pharmaceutical Chemistry, CBS.

15. Stahl, E., Thin Layer Chromatography- A laboratory Handbook, Springer-Verlag
16. Giddings, J.C., Principles and Theory- Dynamics of Chromatography, Marcel Dekker.
17. Sethi, P.D., Quantitative Analysis of Pharmaceutical formulations, CBS Publishers, New Delhi.
18. Kemp William, Organic spectroscopy, Pal grave, New York.
19. Kalsi, P.S., Spectroscopy of organic compounds, New age publishers, New Delhi.
20. Gross - Mass Spectrometry
21. WHO - Quality Assurance of Pharmaceuticals, Vol. I, II.
22. Sethi, P.D., HPLC, Quantitative Analysis of Pharmaceutical Formulations, CBS Publishers, Delhi.
23. Sethi, P.D., HPTLC, Quantitative Analysis of Pharmaceutical Formulations, CBS Publishers, Delhi.
24. Haffmann, Chromatography.
25. Sethi and Charegankar, Identification of Drugs in Pharmaceutical Formulations by TLC.
26. Robert D. Braun, Introduction to Instrumental Analysis.
27. Wilfried, M.A. Niessen- Liquid Chromatography-Mass Spectrometry
28. Harry G. Brittain, Spectroscopy of Pharmaceutical Solids.
29. George, S., Steroid Analysis in Pharmaceutical Industry.
30. Higuchi, Pharmaceutical Analysis.
32. Hoffmann, Mass Spectrometry: Principle and Application.
33. Scott, Techniques and Practice of Chromatography.
34. Wilkins, Identification of Microorganism by Mass Spectrometry.
35. G. R. Chhatawal- Instrumental Method of Analysis.

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Pharmaceutical Chemistry Paper III
PC –203 PHARMACEUTICAL ANALYSIS – II

Unit I
Chromatography: General principles, classification of chromatographic techniques, normal and reversed phase, bonded phase, separation mechanisms.

Unit II
Principles Instrumentation and applications of - Thin layer chromatography, column chromatography, gas –liquid chromatography and Flash chromatography

Unit III
High performance liquid chromatography, ion exchange chromatography, size exclusion gel chromatography, Chiral Chromatography

Unit IV
Principle of liquid-liquid extraction and solid liquid extraction, distribution law, factors favouring solvent extraction, Sequences of the extraction process, Extraction techniques, soxhlet extraction, Important applications of liquid-liquid extraction.

Unit V
A) General Titrimetry and Gravimetric analysis, determination of dissolved oxygen (DO) Biological oxygen demand (BOD), Chemical oxygen Demand (COD).
B) I.P. methods for water analysis, zeta sizer, C,H,N analyzer.

Books Recommended:

1. Pharmaceutical analysis, David C. Lee, Michael Webb, Wiley India.
2. Handbook of Modern Pharmaceutical Analysis, Satinder Ahuja, Stephens Scypinski, Academic Press
3. Willard, H.H., Merrit, L.L., Dean, J.A., Settle P.A., Instrumental Methods of Analysis, Van No strand.
4. Skoog, D.A., Heller, F.J., Nieman, T.A., Principles of Instrumental Analysis, WB Saunders.
5. Hunson, J.W., ed. Pharmaceutical Analysis, Modern Methods, part A & B, Marcel Dekker.
6. Schirmer, R.E., ed. Modern Methods of Pharmaceutical Analysis, Vol. 1-2. Boca Raton F.L., CRC Press.
7. Mann, C.K., et al., Instrumental Analysis Harper & Row.
8. Jaffe, H.H., Orchin M., Theory & Applications of Ultraviolet Spectroscopy, Willy.
9. Silverstein, Spectrometric identification of Organic Compounds, Willy.
10. Bovey, F., Jelinski, L., Miran, P., Nuclear Magnetic Resonance Spectroscopy.

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Pharmaceutical Chemistry Paper IV
PC –204 PRINCIPLES OF PHYSICAL PHARMACY –II

Unit I
Pharamacokinetics
Introduction including clinical pharmacokinetics, toxicokinetics and clinical toxicology, therapeutic concentration range, doses regimen, plasma drug concentration.
Pharmacokinetic and pharmacodynamic parameters including peak plasma concentration, time of peak concentration, area under the curve, minimum effective concentration, maximum safe concentration, fraction of the drug absorbed.

Unit II
Chemical Kinetics I
Rates of chemical reaction, factors influencing the rate of a reaction: concentration, temperature, pressure, solvent, light, catalyst Concentration dependence of rates. Mathematical characteristics of simple chemical reactions – zero order, first order, second order and third order reactions, methods of rate determination, Arrhenius equation, Concept of activation energy.
Simple collision theory based on bard sphere model transition state theory (equilibrium hypothesis) Expression for the rate constant based on equilibrium constant and thermodynamic aspects.

Unit III
Electro Chemistry: Electrical transport, Conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution, Migration of ions and Kohlrausch law. Arrhenius theory of electrolytic dissociation and its limitations, weak and strong electrolytes Oswald's dilution law its uses and limitations.

Unit IV
Polymer Science
Historical Background, general concepts, properties, addition & condensation polymers, preparation of polymer solution, Pharmaceutical Application of Polymers.

Unit V
Statistical thermodynamics: Boltzmann distribution: Kinetic theory of gases: partition functions and their relation top thermodynamic quantities-calculation for model system.

Books recommended:-

1. Martins- Physical Pharmacy and Pharmaceutical Sciences, Patrick J. Sinko, Lippincot Williams and Wilkins.
2. Textbook of Physical Pharmaceutics, CVS Subrahmanyam, Vallabh Parkashan, New Delhi.
3. Physical Chemistry, P.W. Atkins, ELBS.
4. Chemical Kinetics, K.J. Laidler, McGraw-Hills
   Kinetics and Mechanism of Chemical Transformation J. Rajaraman and J. Kuriacose, Mc Millan.
5. Text Book of Polymer Science, Fred. W.Billmeyer, 3rd edition, Wiley Interscience Publication, John Wiley and Sons.
6. Introduction to Polymers Sciences and Technology, S.D. Dawande,1st edition, Denett and Co., Nagpur.
7. Polymer Science, V.R.Gowarikar, N.V.Vishwanathan, Jayadev Sreedhar, New Age International, New Delhi.
8. Polymers in Drug Discovery,Ijeoma.F.Vihegbu,Andreas G.Scchatzlein, Taylor andFrancis.
9. Biodegaradable hydrogels for drug delivery, Kinam Park, Waleed S.W.Shalaby, CRC Publisher.
10. Organic Chemistry, IL Finar, Vol.-I and II,6th Edition , Pearson Education Asia.
11. Chemistry of Natural Products, S.V.Bhat, B.A.Nagasampegi, M.Sivakumar, Spiringer Publication.
12. Glycopeptides and Glycoproteins, Synthesis, structure and Applications Ed. Anthon, V.Whittmann, Springer Publications.
13. Current Science, Vol.-91, No.5, 10th September 2006.
14. New J.Chem,.2008, Royal Society of Chemistry, 2008.

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15. Perfect Symmetry, Jim Baggott, 1994, Oxford University Press.
16. Charles E.Carraher Jr ' Polymer Chemistry sixth edition, Marcel Dekker Inc. NewYork.

Pharmaceutical Chemistry Paper V
PC –205 COMPUTERS FOR CHEMISTS

Unit I
Introduction to Computers, development & generation of computers, input &output devices, data representation in computers.

Unit II
Basic structure and functioning of computers with a PC as an illustrative example, Memory I/O devices, Secondary storage, Computer languages, Operating systems with DOS as an example, Architecture of seven layers of communication

Unit III
Computer application in pharmaceuticals and clinical studies, Chemdraw, Chem-3D, Maestro, Docking programs.

Unit IV
Use of Computer Programmes
The students will learn how to operate a PC and how to run standard programmes and packages such as MS Word, MS Excel. Execution of linear regression X-Y plot numerical integration and differentiation as well as differential equation solution programmes.

Unit V
Application of Internet of chemistry with search engines, various types of files like PDF, JPG, RTF and Bitmap, Scanning, OMR, Web camera.

Book Recommended:
1. Fundamentals of Computer: V. Rajaraman (Prentice Hall)
2. Computer in Chemistry: K.V. Raman (Tata Mc Graw Hill)
3. Computer Programming in FORTON IV: V. Rajaraman (Prentice Hall)

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SEMESTER SECOND
2015-16
M.Sc. (Drugs and Pharmaceutical Chemistry)
Practical Syllabus

Second Semester Practical's

1) Fisher indole synthesis.
2) Friedal Craft reaction.
3) Standardization of Analytical weight and Calibration of volumetric apparatus.
4) 'Thin layer chromatography of amino acids.
5) Extraction of some phyto-constituents of Different herbal Drugs by Soxhlet extraction.
6) UV-visible determination of some official formulations for Assay (percentage purity) and related substance.
7) Interpretation of Some Unknown Infrared and NMR spectra.
8) Acid-Base Titration.
9) Determination of solubility and surface tension.
10) Preparation of Calamine lotion.
11) Preparation of Turpentine Liniment.
12) Preparation of Compound Sodium Chloride Mouthwash.
13) Preparation of Antacid.
14) Software lab to be used for the following: -MS office, MS word, MS PowerPoint, MS Excel.
15) Computer operating system.
16) Internet feature (Email browser).
17) Separation and Identification of components from binary or ternary organic mixture.

SEMESTER SECOND
M.Sc. (Drugs and Pharmaceutical Chemistry)
Examination scheme

Duration -8 Hours **Total Marks -100**
Minimum Passing Marks-33

Examination scheme: - Second semester

1) Fisher indole synthesis	(10 marks)
2) Acid Base Titration's.	(15 marks)
3) Component separation using TLC.	(10 marks)
4) Preparation of Calamine Lotion	(10 marks)
5) Preparation of Turpentine Liniment.	(10 marks)
6) Preparation of Sodium Chloride Mouthwash.	(10 marks)
7) Software lab.	(10 marks)
8) Viva-Voce	(15 marks)
9) Practical Record	(10 marks)

Signature Not Verified
Digitally signed by ARUNA BHARADWAJ
E=ARUNABHARADWAJ1@GMAIL.COM,

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SEMESTER THIRD
2015-16
M.Sc. (Drugs and Pharmaceutical Chemistry)
Syllabus

Pharmaceutical Chemistry Paper I
PC –301 PRINCIPLES OF PHYSICAL PHARMACY-III

Unit I
Colloids
Introduction: Types of Colloidal system, Optical Properties of Colloids, Kinetic Properties of Colloids, Electric Properties of Colloids, Solubilization, thermodynamics of Micellization.

Unit II
Diffusion and Dissolution
Steady- State Diffusion, Procedure and Apparatus, Dissolution, Drug Release, Drug in polymer matrix, release from granular matrices, multiplayer diffusion membrane control and diffusion layer control, Thermodynamic of diffusion, Fick's Second Law.

Unit III
Catalysis- Characteristics of catalysed reactions classification of catalysts acid – base catalysis, kinetics of enzyme catalysed reactions, Decomposition and Stabilization of Medicinal Agents, Photo degradation, Accelerated Stability Analysis.

Unit IV
Chemical bonding in Diatomic: elementary concepts of MO and VB theories: Huckel theory for conjugated Π- electron system

Unit V
Basic of solubility in different states of matter, partition coefficient, phase rule, determination of degree of dissociation of acid and base.

Book Recommended:
1. Martins- Physical Pharmacy and Pharmaceutical Sciences, Patrick J. Sinko, Lippincot Williams and Wilkins.
2. Textbook of Physical Pharmaceutics, CVS Subrahmanyam, Vallabh Parkashan, New Delhi.
3. Physical Chemistry, P.W. Atkins, ELBS.

Sharma 7/7/15

Pharmaceutical Chemistry Paper II
PC –302 PRINCIPLES OF PHARMACOGNOSY

Unit I

(A) Introduction to pharmacognosy, Contribution of pharmacognosy in modern medicine. Present status and future trends in pharmacognosy.

(B) Natural Sources of drugs: - Higher plants, microbes, animals, and marine organisms. Classification of drugs from natural origin: Morphological, taxonomical, pharmacological (therapeutically), chemical classification.

Unit II

Primary & secondary metabolites, basic metabolic pathways, Shikmik acid pathway, Acetate pathway, Mevalonic acid pathway

Unit III

Carbohydrate- Classification Isolation of a carbohydrate drug, Identification Characterization & Pharmacognostic study of Isapgol, Acacia, Dextran,

Glycoside drug- Classification Isolation of a Glycoside drug Biological Significant of Glycoside drug, O- Glycoside, Medicinally Important Glycoside Anthraquinon Glycoside (Seena Leaf and Fruit), Flavonoid Glycosides, Cardiac Glycoside, (Ditoxin Digitalis)

Unit IV

Alkaloid drugs- Classification Isolation of Alkaloid drug Identification Characterization & Pharmacognostic study of Rauwolfia, Opium, Belladonna Herb, Cinchona,

Unit V

Terpens- Classification and Isolation of Terpens drug Identification Characterization & Pharmacognostic study of Eucalyptus oil, Turpentine oil, Pepeeerment oil,

Books Recommended:-

1. Trease and Evans, Pharmacognosy, 15th edition, Elsevier.
2. Pharmacognosy, S.B. Gokhle, C.K. Cokate, Nirali Publication.
3. Fundamentals of Pharmacognosy and Phytotherapy, Michel Heinrich, Joanne Barner, Churchill Livingstone

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Pharmaceutical Chemistry paper III

PC –303 PHARMACEUTICAL MEDICINAL CHEMISTRY-I

Unit I

Central Nervous System depressants:

(A) General anesthetics: General Discussion, Inhalation, ultra short acting barbiturates, dissociative anesthetics such as cyclopropane, halothane, nitrous oxide, chloroform, thiopental sodium, tribromoethanol.

(B) Local anesthetics: Discussion ,classification Mechanism of action . structure, properties, synthesis , therepeutic application , side effect and doses Benzoic acid derivatives procaine, lighocaine ,eucaine ,cocaine and benzocaine .

Unit II

(A) Anxiolytic, Sedatives, hypnotics- Classification ,Structure Activity Relationship (SAR) and synthesis of Barbiturates. Structure ,synthesis ,mode of action ,therepeutic application ,side effect and doses of following drugs- Allobarbital,Hexabarbital, pentabarbital.

(B) Anticonvulsant-Classification of anticonvulsant drug ,structure,synthesis ,therepeutic application ,side effect and doses of following drugs-phenobarbital, phenytoin sodium.

Unit III

Adrenergics and Antiadrenergic system and drugs- Classification,Mechanism of action . structure, properties, synthesis , therepeutic application , side effect and doses of following drugs-Adrenaline,Isoprenaline, Phenoxy benzamine, Nephazoline.

Unit IV

Cholinergics and Anticholinergics system and drugs- SAR of Cholinergic Agonist, Classification Mechanism of action . structure, properties, synthesis , therepeutic application , side effect and doses of following drugs- Acetyl Choline,Echothiophate iodide

Unit V

(A) Analgesics, Antipyretics and Anti-inflammatory agents:- Classification and SAR of analgesic &Antipyretic drugs. Mode of action & SARof morphine & its analogues. Structure,synthesis mechanism of action, , side effects and doses of following drugs- Mefenamic acid, Ibuprofen,Paracetamol , Phenyl butazone & aspirin.

Books Recommended:-

1. Medicinal Chemistry by Kadam and Bothra.
2. Medicinal Chemistry by Ashutosh kar.
3. Medicinal Chemistry by Berger.
4. Medicinal Chemistry- W. O. Foye.
5. Organic Medicinal Chemistry- Wilson & Gisvold.
6. Organic Chemistry, IL Finar, Vol.-I and II,6th Edition , Pearson Education Asia.
7. Chemistry of Natural Products, S.V.Bhat, B.A.Nagasampegi, M.Sivakumar, Spiringer Publication.

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Pharmaceutical Chemistry paper IV

PC – 304 PRINCIPLES OF INORGANIC PHARMACEUTICAL CHEMISTRY- II

Unit-I

Calcium and iron compounds as Pharmaceutical agents :- Calcium acetate, Calcium gluconate, Calcium hydroxide, Calcium lactate, Ferric ammonium citrate, Ferrous fumarate, Ferrous gluconate, Ferrous sulphate .

Unit-II

(A) Diagnostic drugs, Antithyroid drugs, Disinfectants.

(B) Major intra and extra cellular electrolytes, physiological acid base balance, electrolytic combination therapy.

Unit-III

Coordination Chemistry I

Stability of complexes; thermodynamic aspects of complex formation; factors affecting stability, Determination of stability constants by spectrophotometric, polarographic and potentiomteric methods.

Unit-IV

Coordination Chemistry II and Macrocyclic Ligands

Macrocyclic ligands; types; porphyrins; corrins, Schiff bases; crown ethers; crypts. Crystal field theory and its limitations, d-orbital splittings, LFSE, spectro chemical Series

Unit-V

Radiopharmaceuticals

Basic properties, production, quality control, stability, clinical and medicinal applications of radioisotopes used in pharmacy and medicine preparations of diagnostic and therapeutic agents.

Books Recommended:-

1. J.E. Huheey, Inorganic Chemistry - Principles, Structure and Reactivity, Harper Collins, New York, IV Edition (1993)
2 F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry - A Comprehensive Text, John Wiley and Sons, V Edition (1988)
3 K.F. Purcell and J.C. Kotz, Inorganic Chemistry - WB Saunders Co., USA (1977)
4M.C. Day and J. Selbin, Theoretical Inorganic Chemistry, Van Nostrand Co., New York (1974)
5J.E. Huheey, Inorganic Chemistry, Harper Collins NY IV Edition, (1993)
6. G.S. Manku, Inorganic Chemistry (1984)

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Pharmaceutical Chemistry paper V
PC –305 INSTRUMENTAL METHODS OF ANALYSIS

Unit I
Naphelometry and Turbidimetry:- Theory of Naphelometry and turbidimetry, Instrumentation Single and double beam, Factors affecting measurements, applications of turbidimetry and naphelometry.

Unit II
Fundamentals of Potentiometry, Potentiometeric Titrations (acid base titration, complexometric titration, oxidation reduction titration, precipitation titration) The Hydrogen electrode, the calomel electrode, the glass electrode
Polarography- Introduction, apparatus, factors affecting the limiting current and its applications
Karl Fisher titrations

Unit III
Amperometry- Principles, types of end points, amperometric titrations, apparatus, advantages and applications.
Fluorimetry- Intorduction, theory, instrumentation and applications.

Unit IV
Basic principle, instrumentation and applications of Atomic absorption spectroscopy and Flame Photometry.
Basic principle, instrumentation and applications of X-Ray diffraction

Unit V
Basic principle, instrumentation and applications of Differential scanning calorimetry (DSC), Thermo-gravimetric analysis (TGA), Differential thermal analysis (DTA).

Books Recommended:-

1. Medicinal Chemistry by Ashutosh kar,
2. Foy'S Medicinal Chemistry
3. Bergers Medicinal Chemistry,
4. Drug Design By Pattrick.
5. Vogel's Textbook of Quantitative Analysis.
6. Instrumental Method of Analysis by Gurdeep Chatwal.
7. Smith HJ, Wiiliams H, eds, " Introduction to the principles of Drug Design" Wright Boston.
8. Silverman R.B. "The organic Chemistry of Drug Design and Drug Action" Academic Press New York.
9. Robert GCK, ed., " Drug Action at the Molecular Level" University Prak Press Baltimore.
10. Martin YC. "Quantitative Drug Design" Dekker, New York

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SEMESTER THIRD
2015-16
M.Sc. (Drugs and Pharmaceutical Chemistry)
Practical Syllabus

Third Semester Practical's

1) Studies of different type of colloids and their properties.
2) Shelf life determination and expiration dating of pharmaceuticals.
3) Morphology of turmeric, ginger, mentha.
4) Identification of Crude drugs.
5) Morphology and microscopy of clove, fennel, senna.
6) Microscopically measurement of starch grains.
7) General chemical test for alkaloids, glycosides, tannins, saponins, flavonoids.
8) Chemical test for acacia, tragacanth, agar.
9) Preparation of Vicks.
10) Preparation of Balm.
11) Preparation of Menthol Aqueous inhalation.
12) Determination of Stomatal index.
13) Preparation and Standardization of EDTA Solution.
14) Project work- Preparation of Herbarium sheet/ Pharmaceutical Museum.

SEMESTER THIRD
M.Sc. (Drugs and Pharmaceutical Chemistry)
Examination scheme

Duration -8 Hours

Total Marks -100
Minimum Passing Marks-33

Examination scheme: - Third semester

1)	Microscopy of Clove.	(10 marks)
2)	Identification and morphology of Crude drugs. (Any three)	(15marks)
3)	PPN and standardization of EDTA Solution.	(15 marks)
4)	General chemical test for alkaloids.	(10 marks)
5)	Preparation of Vicks.	(10 marks)
6)	Preparation of Aqueous Inhalation.	(10 marks)
7)	Viva-Voce	(15 marks)
8)	Practical Record	(10 marks)

Pharmaceutical Chemistry Paper I

PC –401- PHARMACEUTICAL MEDICINAL CHEMISTRY-II

Unit I

(A) Antihypertensive drugs: Classification,Mechanism of action . structure, properties, synthesis ,. therepeutic application , side effect and doses of following drugs-Captopril, Propranalal Hydrochloride, Methyl dopa,Guanithidine.

(B) Diuretics: Classification,Mechanism of action . structure, properties, synthesis , therepeutic application , side effect and doses of following drugs

Hydrochlorothiazide,Hydroflumethiazide,Ethacrynic acid, Furosemide, Acetazolamide

Unit II

Central Nervous System Stimulants: Classification,Mechanism of action . structure, properties, synthesis , therepeutic application , side effect and doses of following drugs-Xanthene derivative –caffeine ,theophylline , theobromine.Analeptic drug-Nikethamide,Pentetrazol.

Unit III

Chemotherapy: Classification,Mechanism of action . structure, properties, synthesis , therepeutic application , side effect and doses of following drugs-mechlorethamine,chlorambucil,Uracil mustard ,Cyclophoshamide.

Unit IV

Sulphonamides: Classification,Structure activity Relationship (SAR) , Mechanism of action of suphonamides, structure, synthesis and use of sulphacetamide, suphaguianidine, sulphadimidin, Mefenide.

Unit V

(A) **Antitubercular drugs**: Structure, synthesis, mechanism of action, therapeutic application, side effect and doses of following drugs: Ethambutol, Isoniazid, Rifampicin, Streptomycin.

(B) **Gastrointestinal drugs, Drugs for Peptic ulcer:** Antacid, Aluminium hydroxide gel, Calcium carbonate, Magnesium carbonate, Milk of magnesia.

Books Recommended:-

1. Foye W, "Principles of Medicinal Chemistry" Lea & Febiger.

2. Delgado J.N., Remers WA eds, "Wilson & Giswolds Text Book of organic Medicinal & Pharmaceutical chemistry" Lippincott, New York.

3. Monographs and relevant review articles appearing in various periodicals and journals.

4.Alex Gringauz- "Introduction to Medicinal Chemistry" Wiley-VCH, Inc. New York.

5. Abraham DJ,ed., Burger's Medicinal Chemistry & Drug Discovery, Vol-I-VI, John Wiley & sons, New Jersey.

6. Medicinal Chemistry by Ashutosh kar,

7. G. L. Patric- Medicinal Chemistry.

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Pharmaceutical Chemistry Paper II

PC – 402 DRUG DESIGN AND MEDICINAL CHEMISTRY

Unit I

Structure and activity: Relationship between chemical structure and biological activity (SAR) , Receptor site Theory. Approaches to drug design . Introduction to Combinatorial synthesis in drug discovery. Factors affecting bioactivity. QSAR- Free – Wilson analysis , Hansch analysis , relationship between Free- Wilson Analysis and Hansch analysis

Unit II

Pharmacodynamics: Introduction , elementary treatment of enzymes stimulation ,enzyme inhibition , sulphonamides , membrane active drugs , drug metabolism , xenobiotics , biotransformation, significance of drug metabolism in medicinal chemistry.

.Unit III

Antibiotics and antibacterials: Introduction , Antibiotic B- Lactam type – Penicillins , Cephalosporins , Antitubercular – Streptomycin , Broad spectrum antibiotics –Tetracycline , Anticancer – Dactinomycin (Actinomycin D)

Unit IV

Antifungal –Polyenes ,Antibacterial- Ciprofloxacin , Norfloxacin, Antiviral – Acyclovir

Antimalarials : Chemotherapy of malaria. SAR, Chloroquine ,Chloroguanide and Mefloquine

Unit V

Non- steroidal Anti-inflammatory Drugs : Diclofenac Sodium , Ibuprofen and Netopam

Antihistaminic and Antiasthmatic Agents : Terfenadine, Cinnarizines , Salbutamol and Beclomethasone dipropionate

Book Recommended:-

1. Trease and Evans, Pharmacognosy, 15th edition, Elsevier.

2. Burger's Medicinal Chemistry, 6th edition,Vol-I,Wiley Interscience, New York.

3. Chemistry of natural products by S.V.Bhat, B.A.Nagasampegi, Springer publications. New York.

1. Finar, Organic Chemistry, Vol-I

5. Drug Discovery and Evaluation, Pharmacological assays, H.Gerhard Vogel, 2nd edition, Springer publications,

6. Quality Control of Herbaldrugs, An approach to evaluation of botaniocals, by PulokMukherjee, Business Horizon Publications.

7. Pharmacognosy and Pharmacobiotechnology, by Ashutosh Kar, New age Internationalpublications

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Signature Not Verified

ARPANA BHARDWAJ
E=ARPANABHARDW
AJ1@GMAIL.COM,

PC–403 ADVANCE CHEMISTRY

Unit I

Pericyclic reactions- electrocyclic, cycloaddition, sigmatropic rearrangements and other related concerted reactions, principle and applications of photochemical reactions in organic chemistry.

Unit II

Chemical Kinetics and Elements of Group Theory

Acid - Base catalysis - mechanism of acid - base catalysed reactions - Bronsted catalysis law.

Symmetry elements and symmetry operations- group, multiplication table, sub groups, similarity transformation and classes - identifications of symmetry operations and determination of point groups - reducible and irreducible representations.

Unit III

Applications of Group Theory

Orthogonality theorem and its consequences - construction of character table for C_2V and C_3V - hybrid orbitals in non linear molecules (H_2O, CH_4, XeF_4, BF_3, SF_6 and NH_3).

Determination of representations of vibrational modes in non linear molecules (H_2O, CH_4, BF_3, and NH_3), Symmetry selection rules for infra-red and Raman spectra, application of group theory for the electronic spectra of ethylene and formaldehyde.

Unit IV

Organometallic compounds: synthesis, bonding and structure, and reactivity, Nuclear Chemistry: nuclear reactions, fission and fusion, radio-analytical techniques and activation analysis.

Unit V

Organic Transformations and reagents: Functional group interconversion including oxidation and reduction; common organic reagents- Lithium Aluminium Hydride , Osmium tetra oxide, Lead tetra acetate, organomagnesium, $HIO_4.O_3$, organolithium , organozinc, organomurcury, organocadmium compounds , Chemo, regio and stereoselective transformation.

Book Recommended:-

1. Sethi, P.D., Quantitative Analysis of Pharmaceutical formulations, CBS Publishers, New Delhi.
2. Kemp William, Organic spectroscopy, Pal grave, New York.
3. Kalsi, P.S., Spectroscopy of organic compounds, New age publishers, New Delhi.
4. Gross - Mass Spectrometry
5. WHO - Quality Assurance of Pharmaceuticals, Vol. I, II.
6. Sethi, P.D., HPLC, Quantitative Analysis of Pharmaceutical Formulations, CBS Publishers, Delhi.
7. Sethi, P.D., HPTLC, Quantitative Analysis of Pharmaceutical Formulations, CBSPublishers, Delhi.
8. Haffmann, Chromatography.
9. Sethi and Charegankar, Identification of Drugs in Pharmaceutical Formulations by TLC.
10. Robert D. Braun, Introduction to Instrumental Analysis.
11. Wilfried, M.A. Niessen- Liquid Chromatography-Mass Spectrometry.
12. Harry G. Brittain, Spectroscopy of Pharmaceutical Solids.
13. George, S., Steroid Analysis in Pharmaceutical Industry.

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Pharmaceutical Chemistry Paper IV

PC – 404 FOOD SUPPLEMENTS, ADDITIVES AND TOXICOLOGY

Unit I

(A) Historical and dietary importance of vitamins A, B complex, C, D, E, K and minerals, Biological role of vitamins and minerals.

(B) Artificial sweeteners, their availability, regulation of use and potential toxicity.

Unit II

(A) E- numbers and their use in classifying food additives.
(B) Fluoride in toothpaste and water supplies and the implications in supplementation of diet.
(C) Salt and monosodium glutamate in processed foods, and the implications for health.

Unit III

(A) Definition and types of toxicology, Basic principles of toxicology. Drugs and pregnancy.
(B) Drugs addiction and drug dependence, drug abuse,
(C) Toxicology and treatment of Drugs such as salicylates, paracetamol. Opium, quinine, ethyl alcohol, nicotine, digitalis, barbiturates etc.
(D) Toxicology and treatment of metals such as lead. Aluminium, mercury, arsenic, antimony etc.

Unit IV

(A) The role of herbal supplements in the diet
(B) Marketed preparations that are used as a supplement in various diseases like diabetes, arthritis, hypertension etc.

Unit V

General treatment of different types of pollution such as Air pollution, water pollution and noise pollution.

Books Recommended:-

1. Food Additives- A. Larry Branen, P. Michel Davidson, Eastern Hemisphere Distributors.
2. Toxicology- Gary D. Osweiler, Lippincott Williams and Wilkins.
3. P S Kalsi, Organic reactions and their mechanism.
4. March, J., Advanced Organic Chemistry, Reaction Mechanism and Structure, John Wiley and sons, New York.

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Pharmaceutical Chemistry Paper V

PC-405 DRUG PHARMACOKINETICS AND DRUG DEVELOPMENT

Unit I

Drug Targets – Nature and mechanism of functioning of drug targets: - Enzymes, receptors, proteins, nucleic acids.

Unit II

Pharmacokinetics: - Introduction

(A) Drug absorption: - Introduction, cell membrane, drug solubility.

(B) Drug distribution: - Introduction, distribution around the blood supply, distribution to tissues, distribution to cells, other distribution factors, blood brain barrier, placental barrier.

Unit III

Pharmacokinetics

(a) Drug excretion: - Definition, lungs, the bile duct, other routes and the kidneys.

(b) Drug Administration: Definition, oral administration, mucous membranes, Rectal, inhalation, topical, injection, subcutaneous implants.

(c) Drug dosing: - Dosing, drug-half life, steady-state concentration, drug tolerance

Unit IV

Biological testing and bioassays – drug testing, drug testing in vitro, drug testing in vivo.

Drug Dissolution & disintegration, apparatus and uses.

Unit V

Structure activity relationships: - Definition & importance

(A) Binding Interaction (Drug target) with one example of each type- ionic bonding, hydrogen bonding, Vender walls interaction, Dipole-dipole interactions and covalent bonds.

(B) Functional groups as binding groups:- Alcohols and phenols, amines, aldehydes and ketones and Carboxylic acids.

Books Recommended:

1. Smith HJ, Williams H, eds, "Introduction to the principles of Drug Design" Wright Boston.
2. Silverman R.B. "The organic Chemistry of Drug Design and Drug Action" Academic Press New York.
3. Robert GCK,ed., "Drug Action at the Molecular Level" University Prak Press Baltimore.
4. Martin YC. "Quantitative Drug Design" Dekker, New York.
5. Lien EJ. SAR "Side effects and Drug Design" Dekker, New York.
6. William H, Malick JB "Drug Discovery and Development" Humana Press Clifton.
7. Delgado JN, Remers WA eds "Wilson & Gisvolds's Text Book of Organic Medicinal &Pharmaceutical Chemistry" Lippinco', New York.
8. Foye WO " Principles of Medicinal chemistry ' Lea & Febiger.
9. Koro Ikovas A, Burckhalter JH. "Essentials of Medicinal Chemistry" Wiley Interscience.
10. Wolf ME, ed "The Basis of Medicinal Chemistry, Burger's Medicinal Chemistry" JohnWiley & Sons, New York.
11. Ariens EJ "Drug Design" Academic Press New York.
12. Olson EC "Computer Assisted Drug Design" American Chemical Society ACS Symposium Series 112.
13. Roberts SM, Price B.J.Eds. "Medicinal Chemistry. The Role of Organic Chemistry in Drug Research "Academic Press New York.
14. Pope & Perruuns "Computer Aided Drug Design " Academic Press New York.
15. Thomas, G.Medicinal Chemistry-An Introduction John Wiley and sons Ltd.
16. Patrick Graham, L., An Introduction to Medicinal Chemistry, Oxford University Press.
17. Fischer Janos, Ganellin C. Robin "Analogue-based drug Discovery, Wiley-VCH Ver & Co. KG &A.
18. Pandi, Veerapandian "Structure based drug design New York Marcel Dekker inc., 199

SEMESTER FOURTH
2015-16
M.Sc (Drugs and Pharmaceutical Chemistry)
Pratical Syllabus

Fourth Semester Practical's

1) Synthesis of Organic Compound.
2) Isolation of caffeine from tea leaves.
3) Isolation of Starch from potato.
4) Chemical test of tea.
5) Extraction of active constituents from extraction method.
6) Preparation and standardization of titrants like silver nitrate.
7) Preparation and standardization of redox titrants.
8) Preparation of Borax Cold Cream.
9) Preparation of Suppositories.
10) Preparation of Calcium Carbonate Paste.
11) Preparation of Talcum Powder.
12) Preparation of Coconut oil Shampoo.
13) Preparation of Lipsticks.
14) Project work- a report on marketed preparations based on traditional drugs mentioned in theory.

SEMESTER FOURTH
M.Sc. (Drugs and Pharmaceutical Chemistry)
Examination scheme

Duration -8 Hours **Total Marks -100**

Minimum Passing Marks-33

Examination scheme: - Fourth semester

1.) Synthesis of organic compound.	(10 marks)
2.) Isolation of starch from potato.	(10 marks
3.) Isolation of caffeine from tea leaves	(10 marks)
4.) Preparation of Calcium Carbonate Paste.	(15 marks)
4) Preparation of Talcum Powder.	(10 marks)
5.) Preparation of Lipsticks.	(10 marks)
6.) Preparation of Suppositories.	(10 marks)
7.) Viva-Voce	(15 marks)
8.) Practical Record	(10 marks)

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Signature Not Verified
ARPANA BHARDWAJ
E=ARPANABHARDWAJ1@GMAIL.COM,

M.Sc. Applied Microbiology

Revised in 2017

From 2017-2018 onwards

INFORMATION BROCHURE

(2 yearsMaster degree course)

CO-ORDINATOR
Microbiology
Govt. Madhav Vigyan Mahavidyalava
UJJAIN (M.P.)

Post Graduate Department of Microbiology

Govt. Madhav Science College Ujjain (M.P.) 456010

Vikram University, Ujjain. (M.P.)

P.G. DEPARTMENT OF MICROBIOLOGY
GOVT. MADHAV VIGYAN MAHAVIDYALAYA UJJAIN (M.P.) 2012-13

M.Sc. (APPLIED MICROBIOLOGY) SYLLABUS

(SEMESTER SYSTEM)

Year	Semester	Paper	Name of the Papers	Mark	Internal (CCE)	Practicals (Internal)	Marks
M.Sc. I Previous	Sem. I	AM101	General Microbiology	40	10	On the basis of paper I&II	50
		AM102	Growth & Physiology of Microorganism	40	10		
		AM103	Bioinstrumentation	40	10	On the basis of paper III & IV	50
		AM104	Biochemistry	40	10		
			(T) 200			(P) 100	
			Total (Theory + Practical+ Internal)	TOTAL			300

Year	Semester	Paper	Name of the Papers	Marks	Internal (CCE)	Practicals (Internal)	Marks
M.Sc. I Previous	Sem. II	AM201	Virology & Mycology	40	10	On the basis of paper I&II	50
		AM202	Cyanobacteria, Archea & Eubacteria	40	10		
		AM203	Environmental Microbiology	40	10	On the basis of paper III & IV	50
		AM204	Food & Industrial Microbiology	40	10		
			(T) 200			(P) 100	
			Total (Theory + Practical+ Internal)	TOTAL			300

Fee structure for M.Sc. Applied Microbiology (Two-year course)

1. Tuition Fee	40000-00 (For two year)
2. Library Fee	1000-00 (For two years)
3. Gaution Money	1000-00 (Once the course)
4. Laboratory Fee	2000-00 (For two year)
Total Fee	**44000-00 (Forty four Thousand Only)**

Examination fees: – Rs.1750/-+college forwarding fees Rs.200/- =1950/-

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M.Sc. APPLIED MICROBIOLOGY Semester I (I year)

Paper-I GENERAL MICROBIOLOGY (MM-40)

Unit-1 History of Microbial world & Scope of Microbiology

- Branches of Microbiology: Scope and future relevance of microbiology,
- Contribution of Scientists: Antony Von Leeuwenhoek, Louis Pasteur, Robert Koch (Koch postulate and molecular Koch postulate), Joseph Lister, Edward Jenner, Lazaro Spallanzani, Alexander Fleming, S.A.Waksman, Iwanovsky, Watson & Crick, Barbara McClintock, Sergei winogradsky, Martinus Beijernick, Twort and D Herelle,

Unit-2 General Account on Members of Microbial world

- Microbes and origin of life; Origin and Evolution of prokaryotes and eukaryotic cells (unicellular and multicellular). The Conflict debate: Spontaneous generation Vs. Biogenesis.
- General account on Bacteria, Protozoa, Algae, Fungi, and Viruses.

Unit-3 Principles of Staining & staining techniques

- Smear preparation, fixation methods for Light Microscopy, Physical and chemical theories of staining. Dyes in staining.
- Staining techniques: Positive and Negative staining, Differential Staining- Gram's, Acid fast staining, Endospore, Capsule staining. **Structural staining**: Flagella, Cell wall, PHB, and Nuclear staining.
- Different fixation and staining techniques for EM. Freeze-etch and freeze- fracture methods for EM.

Unit-4 Diversity of the Microbial World

- Overview of classification: Nomenclature, taxonomy rank, characteristics used in taxonomy.
- Characterizing Strain Differences: Biochemical Typing, Serological Typing, Genomic Typing, Phage Typing, Antibiograms.
- Types of classification system: Phenetic, Numerical, Phyletic, Molecular taxonomy, Molecular Chronometers
- Two, Five and Eight kingdom classification. Three domain classification. Bergey's manual of determinative and systematic bacteriology.

Unit-5 Structure of Prokaryotes & Eukaryotes

- Structure of Prokaryotes: Size, shape and arrangement, Cell organelles internal (cell membrane, Mesosomes, Gas vacuoles, Cytoplasmic matrix: Ribosomes, Nucleoid & Cytoplasmic Inclusions. External surface appendages Flagella, Pili, Prostheceae and Stalk. Surface layers of bacteria: cell wall, glycocalx & sheath.
- Structure of Archaea, Cyanobacteria, and Mycoplasma
- Structure of Eukaryote cell: Cell organelles internal and external to the cell membrane.

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M.Sc. APPLIED MICROBIOLOGY Semester I (I year)

Paper-II: GROWTH & PHYSIOLOGY OF MICROORGANISMS (MM-40)

Unit: 1-Growth, Measurement &Preservation

- Nutritional types of bacteria. Culture media (types and uses), Isolation techniques and cultivation of aerobic and anaerobic microbes. Factors affecting microbial growth.
- Growth curve and phases of growth cycle. Batch, continuous and synchronous cultures; diauxic growth. Mathematical expression of bacterial growth. Measurement of bacterial growth by cell mass, cell number and cell activity. Maintenance and preservation of cultures.

Unit: 2-Photosynthesis &Nitrogen fixation

- Bacterial photosynthesis: Structure and types of electron carriers, Photosynthetic reaction center, cyclic flow of electrons, bacterial photo-phosphorylation in various groups of phototrophic bacteria, electron donors for anoxic photosynthesis.
- Nitrogen metabolism: Nitrogen fixation, symbiotic &non symbiotic. Nitrogenase enzyme: structure, mechanism and regulation. Structure of 'NIF' genes and its regulation.

Unit: 3-Respiration and Bioenergetics

- Respiratory metabolism: EMP, ED pathway, Krebs's cycle, PPP, Gluconeogenesis, Glyoxalate pathway, Pasteur Effect. Electron transport chain, chemiosmotic theory. Anaerobic respiration.
- Bioenergetics: law of thermodynamics, types of reaction, free energy change. Structure of ATP, phosphoryl group transfer and ATP, Bioluminescence and Methanogenesis in bacteria.

Unit: 4- Physical &Chemical Controlling Agent

- Control of microorganisms: Fundamentals of control-Death rate of bacteria, Antimicrobial agents and their mode of action, Physical agents-Temperature, Desiccation, Osmotic Pressure, Radiation, Surface tension and Filtration.
- Major groups of antimicrobial agents-Phenol and Phenolic compounds, Alcohols, Halogens, Heavy metals and their compounds. Dyes, Synthetic detergents, Quaternary ammonium compounds, Aldehydes and Gaseous agents.

Unit: 5- Antibiotics

- History of antibiotics, characteristics of antibiotics.
- Antibacterial drugs, antifungal drugs, antiviral drugs.
- Classification and mode of action, drug resistance- mechanism, and antimicrobial sensitivity test.

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M.Sc. APPLIED MICROBIOLOGY (Semester -I)

List of reference & text books for paper I & II

1. Fundamentals of Microbiology 'Alcamos'. (7th edition.) by Jeffrey C. Pmmerville.
2. General Microbiology. (7th edition) by Hans G. Schlegel.
3. Microbiology. (6th, 7th edition) by Lansing M. Prescott, John P. Harley & Donald A. Klein.
4. Frontiers in Applied Microbiology(Vol- I)K.G. Mukerji, N.C. Pathak&Ved pal Singh.
5. Microbiology, Authors- Pelczar, Chan and Kreig.
6. Microbiology- an Introduction- (8th Edn), Authors- Tortora, G.J., Funke, B.R., Case, C.L.
7. Introduction to Microbiology, Authors- Ingraham and Ingraham.
8. Biology of Microorganisms, Authors- Brock and Madigan.
9. Microbiology Fundamentals and Applications.(6th edition) by S.S. Purohit.
10. Microbiology principles and Explorations. (6th edition) by Jacquelyn G. Black.
11. Microbiology (1st edition) by T. Stuart Walker.
12. Text book of Microbiology (6th edition) by Anantnarayan and Paniker's
13. Textbook of Microbiology, Authors- Dubey and Maheshwari.
14. General Microbiology, Authors- Stanier, Ingharam, Wheelis and Painter.
15. Principles of Biochemistry. By Lehniger, 4th edition by Nelson and Cox (Worth) 2007
16. Biochemistry. By Stryer 5th edition, W.H. Freeman 2001.
17. Environmental Microbiology, Author, P.D. Sharma.

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M.Sc. APPLIED MICROBIOLOGY (Semester -I)

List of Practical's:

1. Preparation of solid and liquid culture media and their sterilization.
2. Growth of bacteria on agar slant, agar stab, Petri plate and in broth.
3. Ubiquity of Microorganism.
4. Motility by hanging drop method & wet mount preparation method.
5. Simple and Negative staining and its differentiation.
6. Dark Field Microscopy
7. Isolation of microorganisms by streak plate Pour plate & spread plate method
8. Differential staining techniques: Gram Staining, Acid fast staining
9. Special Staining technique: Capsule, Endospore staining, Flagella, cell wall and Nucleic acid staining of microbial cultures
10. Effect of temperature on the growth of bacterial culture.
11. Effect pH on the growth of bacterial culture.
12. Effect osmotic pressure (salt and sugar concentration) on the growth of bacterial culture.
13. Effect of UVon bacterial growth.
14. Antimicrobial sensitivity test of the given bacterial culture.
15. Phenol coefficient test.

Practical scheme	**Marks**
Q.1 Major experiment	15
Q.2 Minor experiment (A)	05
Q.3 Minor experiment (B)	05
Q.4 Viva	08
Q.5 Spotting	10
Q.6 Practical record	07
	Total 50

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M.Sc. APPLIED MICROBIOLOGY Semester I (I year)

Paper-III: BIOINSTRUMENTATION (MM-40)

Unit: 1 - Basic laboratory Instruments

- Principle and working of pH meter, LAF. Centrifuge: Types, sedimentation velocity, sedimentation equilibrium, density gradient. Principle, application of centrifuge in life science
- Autoclave, Incubator, Colony counter, Haemocytometer, Spectrophotometer

Unit: 2- Principles of Microscopy

- Properties of light, Glass lens and Microscope: Working principles and applications.
- Resolving power, numerical aperture, and magnification. Image processing.
- Types of Microscopy and its principles: Bright field microscope, Dark field microscope. Phase contrast microscope, Fluorescence Microscope, Confocal and Electron Microscopy- TEM and SEM.

Unit: 3- Electrophoresis & Chromatographic Techniques

- Basic principles of electrophoresis, theory and application of paper, starch gel, Agarose, native and denaturing PAGE, Isoelectric focusing.
- Theory, principles and applications of paper, thin layer, gel filtration, ion-exchange, affinity, gas liquid, HPLC.

Unit: 4- Spectroscopy

- Spectroscopic techniques, theory and applications
- UV-Visible, IR, NMR, Fluorescence,
- Atomic Absorption, CD, ORD

Unit: 5- Radioisotopic techniques

- Use of radioisotopes in life sciences, radioactive labeling, principle and application of tracer techniques.
- Detection and measurement of radioactivity using ionization chamber, proportional chamber, Geiger- Muller and Scintillation counters, autoradiography and its applications.

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M.Sc. APPLIED MICROBIOLOGY Semester I (I year)

Paper-IV: PRINCIPLES OF BIOCHEMISTRY (MM-40)

Unit: 1-Biomolecules

- Structure of atoms, molecules and chemical bonds (Vander Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.)
- The concept of pH, dissociation and ionization of acids and bases, pKa, buffers and Buffering mechanism, Henderson Hasselblach equation, dissociation of amino acids and determination of pKa .
- **Vitamins:** structure and biochemical properties of water soluble and fat soluble vitamins and their coenzyme activity.

Unit: 2- Carbohydrates and Proteins

- **Carbohydrates:** Composition, structure and function of carbohydrates: classification, general characteristics of carbohydrates, role of carbohydrates in living cells, example of monosaccharide, oligosaccharides and polysaccharides. Metabolism of carbohydrates. Mucopolysaccharides and amino sugars.
- **Proteins:** Classification, structure and properties of amino acids, biologically active peptides, classification and properties of proteins, sequencing of proteins, conformation(Ramachandran plot, secondary structure, domains, motif, and folds) and structure of proteins-primary, secondary, tertiary and quaternary structure, coagulation and denaturation of proteins: synthesis of protein(only general account)

Unit: 3- Lipid Metabolisms

- Lipids: classification, Structure, function, distribution and biological importance of fats and fatty acids. Chemical properties and characterization of fats. Phospholipids and proteolipids. Steroids and bile salts. Prostaglandins. Metabolism: synthesis (lipids and fatty acid, membrane phospholipids, triacylglycerols) and oxidation (alpha, beta oxidation).
- Biosynthesis of amino acids, Nucleic acid, steroids

Unit: 4- Bioenergetics

- Bioenergetics: Anabolism, catabolism and metabolism, Coupled reaction, Group transfer, Biological energy transducers.
- Bioenergetics, laws of thermodynamics (no derivation). The concept of Gibbs free energy, exergonic and endergonic reactions, redox potential. High energy bond and key position of ATP, substrate level and oxidative phosphorylation. The importance of organophosphates. High energy compound (NADH, FADH and NADPH).

Unit: 5- Enzymology

- **Principles of catalysis:** enzymes (Nomenclature and classification) and enzyme kinetics (concept of Michaelis-Menten), Activation energy, Enzymes and their industrial applications. Immobilized enzymes: types and applications.
- **Enzyme regulation:** General mechanisms of enzyme regulation, Allosteric enzymes.

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M.Sc. APPLIED MICROBIOLOGY (Semester -I)

List of reference and text books for paper III

1. Principles of Biochemistry. By Lehniger, 4th edition by Nelson and Cox (Worth) 2007
2. Biochemistry. By Stryer 5th edition W.H. Freeman 2001.
3. Harper's Biochemistry, 26th (McGraw-Hill).
4. Fundamentals of Biochemistry, Author- J. L. Jain
5. Biochemistry by- Voet and Voet.
6. Textbook of Biochemistry- S.P. Singh.
7. Text book of Biochemistry (Physiological chemistry)by A. K. Agrawal.
8. Microbial Biochemistry by George & Cohen.
9. Instant Biochemistry by S. Nagini.
10. Text book of Biochemistry by U. Satynarayan.

List of reference and text books for paper IV.

1. Principles of Biochemistry. By Lehniger, 4th edition by Nelson and Cox (Worth) 2007
2. Biochemistry. By Stryer 5th edition W.H. Freeman 2001.
3. Harper's Biochemistry, 26th (McGraw-Hill).
4. Text book of Biotechnology by B.D. Singh.
5. Principles of Fermentation Technology By P. F STANBURY, A. WHITAKER, S.J. Hall.
6. Hand book of biomedical instrumentation (2nd edition) by Khandpur.
7. Principles and Practice of Chromatography by Raymond P. W. Scott
8. Book on Electrophoresis by W Scott
9. Textbook of Medical Biochemistry by U. Satynarayan.

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M.Sc. Applied Microbiology (Semester -I)

List of Practical's based on paper III & IV

1. Qualitative estimation of carbohydrates, proteins and lipids.
2. Quantitative estimation of protein by Folin Lowry's Method.
3. Quantitative estimation of carbohydrates by Nelson Smogyi's Method.
4. Separation of bimolecular by paper chromatography.
5. Separation of bimolecular by thin layer chromatography.
6. Effect of pH on enzyme activity.
7. Effect of temperature on enzyme activity.
8. Counting of cell by hemocytometer.
9. Principles and working knowledge of instruments like autoclave, pH meter, incubator, hot air oven, centrifuge, microscope and colony counter.

Practical scheme	Marks
Q. 1 Major experiment	15
Q.2 Minor experiment (A)	05
Q.3 Minor experiment (B)	05
Q.4 Viva	08
Q.5 Spotting	10
Q.6 Practical record	07
	Total 50

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M.Sc. APPLIED MICROBIOLOGY Semester II (I year)

Paper-I: VIROLOGY & MYCOLOGY (MM-40)

Unit: 1- General account on Virus

- History: General characteristics of virus. Host range, Shape, Size, Isolation, cultivation and identification of virus and their Classification.
- Structure of plant and animal virus.
- Bacteriophages: T4, T7, M13 & Lambda. Lytic & Lysogeny cycle, viral replication, nucleic acid and protein synthesis. One step growth curve.
- Oncogenic viruses: Oncogene, oncogenesis.

Unit: 2- DNA & RNA virus

- Structure and lifecycle of DNA viruses: Adenovirus, Baculovirus, EBV, Hepatitis-B, Parvovirus, Poxviruses, Simian virus 40, Varicella Zoster virus.
- Structure and lifecycle of RNA viruses: HSV, Hepatitis A,C,D & E, Human Immuno Virus, Influenza, Measles virus, Mumps virus, Polio Virus, Retroviruses, Rotavirus, Rhabdo virus. Molecular biology of genetic shift and drift in influenza virus,
- Plant viruses: TMV. Other forms of Infectious agent: Prions, Viroid.

Unit: 3- Introduction to Fungi

- Introduction: Significance of Fungi to Human Welfare, Somatic structure, Vegetative growth, Reproduction and Systematics of Fungi.
- Fungal nuclei, Nuclear division and Parasexual cycle. Yeast as model for genetic studies.

Unit: 4- Chytridiomycota, Zygomycota, Ascomycota/other fungi

- Chytridiomycetes & Zygomycetes: Classification(General account), and their characteristic features.
- Ascomycetes: Classification, Structure, Development and Type of ascocarps;
- Classification. Archeascomycota and Ascomycetous Yeasts : General Account.
- Slime Moulds: General Structure and Life cycle of Myxomycota and Plasmodiophoromycota.
- Oomycota: Classification, General Structure and Reproduction.

Unit: 5- Deuteromycota and Basidiomycota

- Deuteromycetes: Classification (General account), Conidial types and Ontogeny, Asexual reproduction in *Sclerotium, Aspergillus, Penicillium, Cladosporium and Alternaria* sp.
- Basidiomycetes: General introduction,Classification, Clamp connection, Dolipore septum, Types and Development of Basidiocarps, Heterothallism, Compatability.

Signature Not Verified

M.Sc. APPLIED MICROBIOLOGY

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List of Reference & Text books:

1. General Virology (1978). III ed. by Luria, E.E., Darnell, J.E.Jr., Baltimore, D. and Campbell, A.
2. Microbiology. (1980) IV Ed, by Davis, B.D., Dulbecco, R., Eisen, H.N. and H.S. Ginsberg.
3. Molecular Virology (1974) by King, C.A.
4. Plant Virology. The Principles. (1976) by Gibbs, A. and Harrison, B.
5. Molecular Biology of Gene. .(1998) V ed . by Watson, J.D., Hopkin, H.N., Robert J.W., Sietz, J.A. and A.M.
6. Principles of Molecular Viroloogy (2001). III Ed. By Cann, A.J.
7. Introduction to Modern Virology (2001). by Dimmock, N.J., Easton, A.J. and Leppard, K.N.
8. Introductory Mycology (1996).. IV ed , by Alexopoulos, C.J., C.W. Mims and Blackwell, M.
9. Introduction to Fungi II ed. (1980). by Webster, J.
10. The Fungal Nucleus(1981). by Gull, K.S. and Tiker, S.G.
11. Fungal Geneties. (1979) by Fincham, J.R.S., Day P.R. and Radford, A.
12. Molecular Biology of Gene (1998). Ved. By Watson, J.D., Hopkins, H.N. Robert J.W., Sietz, J.A. and Weiner, A.M.
13. The Yeasts. (1971). By London, J.
14. An Introduction to Mycology. (1990) by Mehrotra, R.S. and Aneja, K.R.

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M.Sc. APPLIED MICROBIOLOGY Semester II (I year)

Marks 40

Paper-II: CYANOBACTERIA, ARCHEOBACTERIA & EUBACTERIA

Unit: 1- Blue green algae & Algae

- Cyanobacteria: Classification, Cell structure, Range of thalli, Reproduction, Photosynthesis, Heterocyst and Nitrogen fixation, Use of blue-green algae as biofertilizers,
- Algae: Distribution of algae, Classification of algae, Algal nutrition, reproduction, green algae, diatoms, euglenoids, brown algae, red algae, Microalgae.

Unit: 2- Ancient prokaryotic

- Archaea : Introduction, General characteristics, Structure , Genetics & Classification.
- Ecology, Morphology and Physiology of thermophile. Adoptation for thermal life.
- Ecology, Morphology and Physiology of Halophile.Photosynthesis in *Halobacterium Sp.*
- Ecology, Morphology and Physiology of Methanogen & Methanotroph. Reductive TCA cycle.

Unit: 3- Gram Negative Bacteria-A

- Gram-negative Aerobic Eubacteria : Classification, Morphology, Physiology and Ecology of representatives of Pseudomonads, Azotobacters, Rhizobia, Sheathed bacteria. Spirilla, *Campylobacter*, *Bdellovibrio*, Gliding Myxobacteria, .
- Enteric Group and Related Eubacteria : Classification, Morphology, Physiology, Ecology, Methods of analysis of Enterobacters, Vibrios,Photobacteria.

Unit:4- Gram Negative Bacteria-B & Actinomycetes

- Gram-negative Anaerobic Eubacteria: Classification, Morphology and Physiology, Ecology of Bacteroides, Sulphur-reducing bacteria.
- Spirochetes, Rickettsias and Chlamydias: Classification, Morphology, Physiology, Differentiation.
- Actinomycetes : Classification, Morphology, Reproduction, Biological importance of actinomyces, Nocardioform, Dermatophilus group, Streptomyces, Actinoplanales

Unit:5- Gram Positive bacteria

- Gram-positive Endospore Forming Bacteria: Classification, Differentiation and Biochemistry of spores, Ecology of *Bacilli*, *Clostridia*, *Desulfotomaculum*.
- Gram-positive Nonsporulating Eubacteria: Classification, Morphology, Physiology of Staphylococci, Streptococci, Lactobacilli, Micrococci,Thermus, Corynebacteria, Propionibacteria, Arthrobacters.

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List of Reference & Text books:

1. Fundamentals of Microbiology 'Alcamos'. (7th edition.) by Jeffrey C. Pmmerville.
2. General Microbiology. (7th edition) by Hans G. Schlegel.
3. Microbiology. (6th and 7th edition) by Lansing M. Prescott, John P. Harley & Donald A. Klein.
4. Frontiers in Applied Microbiology(Vol- I)K.G. Mukerji, N.C. Pathak&Ved pal Singh
5. Microbiology, Authors- Pelczar, Chan and Kreig.
6. Microbiology- an Introduction- (8th Edn), Authors- Tortora, G.J., Funke, B.R., Case, C.L.
7. Introduction to Microbiology, Authors- Ingraham and Ingraham.
8. Biology of Microorganisms, Authors- Brock and Madigan.
9. Microbiology Fundamentals and Applications.(6th edition) by S.S. Purohit.
10. Microbiology principles and Explorations. (6th edition) by Jacquelyn G. Black.
11. Microbiology (1st edition) by T. Stuart Walker.
12. Text book of Microbiology (6th edition) by Ananthanarayan and Paniker's
13. Textbook of Microbiology, Authors- Dubey and Maheshwari.
14. General Microbiology, Authors- Stainer, Ingharam, Wheelis and Painter.
15. Environmental Microbiology, Author- P.D. Sharma.
16. Environmental Microbiology, Author- K.G. Mijaya.

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M.Sc. Applied Microbiology

List of Practicals:

1. Study of morphological and biochemical characters and identification of Gram- positive bacteria.
2. Study of morphological and biochemical characters and identification of Gram- negative bacteria.
3. Study of selected group of cyanobacteria.
4. Cultivation of cyanobacteria
5. Isolation of *E.coli* Bacteriophages
6. Phage typing of *E. coli* Bacteriophages
7. Induction of lambda lysogen by UV radiations.
8. Demonstration of double layer agar plate method for detection of Bacterial Viruses
9. Cultivation of Molds and their identification
10. Isolation of Yeast from selected samples
11. Study of selected group of fungi and yeasts.
12. Yeast cell counting by haemoctometer.
13. Isolation and identifaction of enteric bacteria from water sample.
14. Determination of bacterial growth by turbidity measurement.

Practical scheme

	Marks
Q. 1 Major experiment	15
Q.2 Minor experiment (A)	05
Q.3 Minor experiment (B)	05
Q.4 Viva	08
Q.5 Spotting	10
Q.6 Practical record	07
	Total 50

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M.Sc. APPLIED MICROBIOLOGY Semester II (I year)

Paper-III: ENVIRONMENTAL MICROBIOLOGY

Marks 40

Unit: 1- Introduction to Ecosystem

- Concept of Habitat and Ecosystem; Flow of energy and Biogeochemical cycles ofcarbon, nitrogen, sulphur, iron and phosphorus.
- Determination of Microbial number and biomass, Sample collection, and Processing.
- Aeromicrobiology: Brief account of air borne transmission of microbes, Air borne Pathogenic microbes, Aerosol and nuclei droplets.

Unit: 2- Water and Waste water Microbiology

- Aquatic Microbiology: Fresh water (ponds, lakes, river and stream)
- Marine water (estuaries, mangroves, deep sea hydrothermal vents, salt pans, coral reefs) Habitat, zonation of ecosystem, Upwelling, Eutrophication.
- Microbial assessment of water and waste water quality, Water borne diseases.

Unit: 3- Soil Microbiology, Interactions and Nitrogen fixation

- Soil types and its Microflora: Brief account of physical and chemical characteristics of soil, Abiotic and biotic factors (Producer, consumer and decomposer)
- Microbial Interaction: Mutualism, Commensalism, Amensalism, Competition and Parasitism.
- Biological Nitrogen fixation, Nitrogenase, nif genes, nod genes, Symbiotic nitrogenfixation, Nonsymbiotic nitrogen fixation. Biofertilizer (PSB)

Unit: 4- Rhizosphere and Waste treatment

- Rhizosphere and Phyllosphere: Habitat character, Microorganisms and Biological control diseases.
- Waste water Treatment aerobic & anaerobic: Types of liquid and solid wastes, Liquid waste treatment, Solid waste treatment Bio gas plant.

Unit: 5- Role of Microbes in Environemt cleaning

- Bioremidiation: Approaches, Environmental modification, Bioremidiation of various ecosystem, Air pollution, Marine oil spills.
- Role of Microorganisms in Environment: Positive role, Biodegradation of pesticides, Lignin and recalcitrants, Bioaccumulation of metals and detoxification.
- Negative role; Biodegradation of paper, textiles, leather, Wool, Biocorosion, Biofouling Biomagnification and Bioaccumulation, GMO and their impact.

List of reference & Text books:

1. Introduction to Soil Microbiology. Alexander, M.
2. Microbial Ecology. Atlas, R.M. and Bartha, R
3. Microbial Ecology. Campbell, R..
4. Microbiological Aspects of Pollution Control . Dart, R.K., Shettorn, R.J.
5. Environmental Microbiology. Grant, W.D. and Long, P.E.
6. Environmental Biotechnology: Principles and Application. Rittman, B.E. and McCarthy.
7. Environmental Microbiology. Mitchel, R.

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M.Sc. APPLIED MICROBIOLOGY Semester II (I year)

Marks 40

aper-IV: FOOD & INDUSTRIAL MICROBIOLOGY

nit: 1- Introduction and Spoilage of food

- Food as a Substrate for Microorganism and Microorganisms Important in Food Microbiology: Molds, Yeasts and Bacteria.
- Principles of Food Preservation: Asepsis, Anaerobic conditions, High and low temperatures, Drying, Chemical preservatives, Food additives.
- Food Spoilage and Food Borne Infections: General principles underlying food spoilage and contamination spoilages, Food poisoning.

nit: 2- Fermented Food and Beverages

- Canned Food : Sugar products, Vegetables, Fruits, Meat and meat products,
- Milk and milk Products Fish, Seafood and Poultry.
- Fermented Beverages: Beer, Wine, Cider.

nit: 3- Industrial Products of Microbial Activity

- Production of Industrial alcohols.
- Microbial Transformations of Gluconic acid, Sorbose, Steroids, Penicillins.
- Production of Enzymes : Protease, lipase, amylase.

nit: 4- Fermented Foods

- Oriental fermented foods: Miso, Sake, Tomphe, Soy sauce, Koji
- SCP, Protein for animal feed, Mass production of baker's yeast.
- Fermented Microbial Foods: Fermented milk yoghurt and curd, Cheese, Fermented meat, Fish. Indian Fermented food.

nit:5- Mushroom and other human welfare product

- Mushroom Cultivation and Production.
- Production of Polysaccharides, Insecticides, Organic acids (Lactic Acid, Citric acid, Sorbic acid, Acitic acid{Vinegar}), Vitamins (C and B_{12}).
- Production of Antibiotics. Penicillin,Bacitracin, Streptomycin.

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List of reference & text books:

1. Food Microbiology, Authors- Frazier and Westhoff.
2. Food Microbiology, Authors- Adams and Moss.
3. Textbook of Industrial Microbiology, Author- A. H. Patel.
4. Industrial Microbiology, Author- L. E. Cassida,
5. Microbial Technology. (1977). Authors -Peppler H.J.
6. Industrial Microbiology. Authors -Prescot, C.S. and Dunn, G.C.
7. Industrial Applications of Microbiology. Authors - Riviere.
8. Fungal Biotechnology. Authors - Anke, T.
9. Principles of Fermentation Technology. Authors - Stanbury, P.F. and Whiitaker A.
10. Basic Food Microbiology, Authors - Banwart, G.J.
11. Modern Food Microbiology. Authors - Jay, J.M..
12. Food Microbiology Authors - Frazia, W.C. and D.C. Westhoff.
13. Moulds, Toxins and Food. Authors - Moreau, C. and M. Moss.
14. An introduction to Industrial Mycology. Authors Smith, G.H.
15. Basic Biotechnology. Authors Ratledge, C. and Krisliansn.
16. Industrial Microbiology: An Introduction. Authors - Waites, M.J., Morgan, N.L., Rockey, J.S. and Higton, G.
17. Biotechnology:A Text Book of Industrial Microbiology. Authors - Crueger, W. and Creagan, A.
18. Food Microbiology: Fundamentals and Frontiers . Authors - Boyle,M.P.; Deuchat,L.R. and Jis, Montville.

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List of Practicals:

1. Isolation and identifaction of rhizospheric microorganisms of soil.
2. Isolation of root nodule bacteria.
3. Physical, chemical and bacteriological analysis of water.
4. Isolation of amylase, protease and lipase producing microorganisms from soil.
5. Isolation of food poisoning bacteria from contaminated foods,
6. Isolation of antibiotic producing microorganisms from soil.
7. Isolation of microorganisms from milk by SPC method.
8. Isolation of air microoganisms (bacteria, fungi) by settle plate method.
9. Study of winogradsky column.
10. Isolation and identification of IAA producing fungi from soil/cattle dunk/compost.
11. Qualitative analysis of milk by MBRT.
12. Microscopic examination of dairy products and grains.
13. Diastatic power of malt.
14. Immobilization of yeast cell by sodium alginate method.
15. Role of yeast in doughing quality of bread.
16. Study of interaction of microrganisms by dual culture method.
17. Study of vermicomposting

Practical scheme	Marks
Q. 1 Major experiment	15
Q.2 Minor experiment (A)	05
Q.3 Minor experiment (B)	05
Q.4 Viva	08
Q.5 Spotting	10
Q.6 Practical record	07
	Total 50

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M.Sc. (APPLIED MICROBIOLOGY) SYLLABUS

(SEMESTER SYSTEM)

Semester	Paper	Name of the Papers	Marks	Internal (CCE)	Practical (Internal)	Mar
Sem. III	AM301	Medical Microbiology and Immunology	40	10	On the basis of paper I&II	50
	AM302	Statistics and Computer for biology	40	10		
	AM303	Bioinformatics and Biotechnology	40	10	On the basis of paper III & IV	50
	AM304	Microbial Genetics,Molecular Biology & Cell Biology	40	10		
			(T) 200			(P) 10
		Total (Theory + Practical+ Internal)	TOTAL	300		

Semester*	Paper	Name of the Papers	Marks	Internal (CCE)	Practicals (Internal)	Marks
Sem. IV*	AM401	Pharmaceutical Microbiology	40	10	On the basis of paper I&II	50
	AM402	Applied Microbiology	40	10		
	AM403	Microbial Fermentation Technology	40	10	On the basis of paper III&IV	50
	AM404	Marine Microbiology	40	10		
			(T) 200			(P) 100
	Project/Survey/Dissertation: Students will complete a short term project/Survey/Dissertati from different institutes including NGO, Govt. Organizations. **Marks:** Project Submission + Viva(25+25)= 50					
	Total (Theory + Practical+ Internal+ Project)		TOTAL			350

Note: Fourth Semester Papers are specifically selected and designed in a manner for the students to jump into different applied areas of microbiology and to get possible job opportunities.

Fee structure for M.Sc. Applied Microbiology (Two-year course)

1.	Tuition Fee	40000-00 (For two year)
2.	Library Fee	1000-00 (For two years)
3.	Caution Money	1000-00 (Once the course)
4.	Laboratory Fee	2000-00 (For two year)
Total Fee		**44000-00 (Forty Four Thousand Only)**

Examination fees: – Rs.1750/- +college forwarding fees Rs.200/- =1950/-

M.Sc. APPLIED MICROBIOLOGY Semester III (II year)

Paper-I: MEDICAL MICROBIOLOGY AND IMMUNOLOGY (MM-40)

UNIT: 1- Introduction to Medical Microbiology

- Importance of Medical Microbiology: Introduction, Definition of various terms. Anotomy of Human being
- Clinical Microbiology: Collection, Microscopic examination, and culture technique for clinical specimens, Methods of culture, techniques and organisms encountered in CSF, blood culture, sputum, pus, urine, stool, UTI, endocarditis, Bone and joint infections.
- Hospital acquired infections, Mechanism of Pathogenesis.

UNIT: 2- Viral, Bacterial and Protozoan Diseases of Human

- **Bacterial Diseases**: Bacterial pneumonia, Whooping cough, Tuberculosis, Streptococcal Pharyngitis, Scarlet and Rheumatic fever, Diptheria, Streptococcal pneumonia, Menincoccal Meningitidis, Leprosy, Wound infections
- Dental caries, Dental plaque, Gingivitis, Diarrhea, Dysentery, Cholera, Shigellopsis, Gastroenteritis, Types of Viral Diseases &Protozoal diseases

UNIT: 3- Principles of Immunology

- Immunity: Innate (nonspecific) Immunity: Physical, chemical and biological barriers.
- Specific Immunity: Acquired immunity, Lymphocytes-B cells, T cells &NK Cells.
- Primary Lymphoid organs and Secondary Lymphoid organs.
- Antigens, haptens. Immunoglobulins and their types.

UNIT: 4- Serological Techniques

- Serological Techniques: Agglutination tests, Precipitin tests, ELISA, Complement fixation tests, Immuno assays,
- Autoimmunity and Autoimmune diseasesand Tumour Immunology.
- Hypersensitivity

UNIT: 5- Types of cells and their receptors

- Biology of B-cell and T-cell receptor, Dendritic Cells
- MHC
- Antigen presentation,
- Monoclonal antibody

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M.Sc. APPLIED MICROBIOLOGY Semester III (II year)

Paper-II: STATISTICS AND COMPUTER FOR BIOLOGY (MM-40)

UNIT: 1- Introduction to Biostatistics

- Definition, Role and application in biology, Data: classification, Role of applied Statistics.
- Preliminary Concepts: Variable and constants, variables in biology, random samples, Discrete and continuous variable, summation sign.
- Tabulation and Frequency distribution: Frequency table, Frequency distribution,
- Graph representation, types of graph- line, bar, pie, sector. Pictograph and Histograph.

UNIT: 2- Measurement of Central Tendency

- Characteristics of Central Tendency, types of mean. Merits, Demerits and use of mean.
- Median: Definition, Calculation. Merits, Demerits and use of median.
- Mode: Types. Merits, Demerits &use of mode. Relationship of mean, median and mode.

UNIT: 3- Tools of Biostatistics

- **Student't' test:** Introduction, Distribution, Properties, application. Test of significance for single and two means.
- **Chi square test**: Introduction, Degree of freedom, distribution, ψ^2 test.
- **Standard Deviation**: Introduction, variability, Calculation of SD for individual and discrete series.

UNIT: 4- Introductions to Computer

- Computer Basics: History, Operating Systems, DOS and Windows. Hardware, Software, Multimedia network concept. Parts of Computer and working. Generation of Computer.
- Internet: Introduction, WWW, HTML, LAN. Properties of internet.

UNIT: 5- Tools for computer and Internet

- Different tools of Internet: file- JPEG, XTML, PDF, WORD, PPT, Bitmap,
- Computer in human welfare: Use and misuse of internet, pyracy and legal action.

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List of Practical's for Paper I & II:

1. Introduction: Collection of clinical samples and sample processing methods
2. Different test: VDRL test, Blood group, WIDAL test
3. Preparation of Blood agar and demonstration of types of hemolysis
4. Microbiological analysis of microbial flora of skin, nasal, eye, ear, and mouth
5. Ouchterlony double immune diffusion test
6. Differential Leukocyte Count of blood sample.
7. Total Leukocyte Count of blood sample.
8. Isolation and identification of microorganisms from different body parts.
9. Physical, Chemical and Microbiological analysis of urine.
10. Isolation of antibody by SDS-PAGE.
11. Separation of serum protein by submerged Agarose gel electrophoresis.
12. ESR estimation of blood sample.
13. Determination of Hemoglobin of blood.
14. Calculation of Mean, Median and mode of different samples.
15. Ψ^2 and 't' test of biological samples.
16. Preparation of Power Point presentation on computer.
17. Typing and use of MS-Office in computer.
18. Preparation of email.

Practical scheme	Marks
Q. 1 Major experiment	15
Q.2 Minor experiment (A)	05
Q.3 Minor experiment (B)	05
Q.4 Viva	08
Q.5 Spotting	10
Q.6 Practical record	07
	Total 50

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List of Books for Paper I & II:

- Nalwa HS. 2005. *Handbook of Nanostructured Biomaterials and Their Applications in Nanobiotechnology*. American Scientific Publ.
- Niemeyer CM &Mirkin CA. 2005. *Nanobiotechnology*. Wiley Interscience.
- Akihiko Yoshimura, Tetsuji Naka and Masato Kubo, (2007), *SOCS proteins, cytokine signaling and immune regulation,* Nature Reviews, Immunology, 7:454-465.
- Austyn J. M. and Wood K. J. (1993) *Principles of Molecular and Cellular Immunology*, Oxford University Press,
- Baron D. N. *Short Text book on Chemical Pathology*, ELBS, London.
- Barret James D. (1983) *Text Book of Immunology* 4th edition, C. V. Mosby & Co.London.
- Biotechnology by open learning series (BIOTOL), (1993), *Defence Mechanisms*,Butterworth and Heinemann Ltd., Oxford
- Boyd William C. (1966) *Fundamentals of Immunology*, Interscience Publishers, NY.
- Chatterji C. C. (1992) *Human Physiology* Vol. I, &2, Medical Allied Agency, Calcutta.
- Kuby J. (1996) *Immunology* 3rd Ed. W. H. Freeman & Co.
- Michael C Carroll, (2004), *The complement system in regulation of adaptive immunity*,Nature Immunology **10**:981-986.
- Pathak S. S. and Palan V. (1997) *Immunology - Essential and Fundamental*, Pareen Publications Bombay.
- Laboratory manual of Medical Microbiology.
- Roitt Evan, Brostoff J. Male D. (1993) *Immunology* 6th Ed., Mosby & Co. London.
- Roitt I. M. (1988) *Essentials of Immunology*, ELBS, London.
- Roitt M. (1984) *Essentials of Immunology*, P. G. Publishers Pvt. Ltd., New Delhi.
- Black Microbiology
- A text book of Microbiology by Panikar and Anantanarayana.
- Medical Microbiology by Nester.
- Biostatics by Malhan and Parihar.

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M.Sc. APPLIED MICROBIOLOGY Semester III (II year)

Paper-III: BIOTECHNOLOGY **(MM-40)**

UNIT: 1- Introduction to Bioinformatics and Biotechnology

- Biotechnology: History, scope and importance, branches, recent trends in biotechnology. Introduction to Techniques: Introductory history, Laboratory organization, maintaining Aseptic environment, Basic concepts in cell culture.
- Principles of Bioinformatics, biological databases – primary, secondary and structural, Protein and Gene Information Resources – PIR, SWISSPROT, PDB, gene-bank, DDBJ, BLAST and FASTA versions. Sequence alignment, local and global alignment,

UNIT: 2- Enzyme Technology

- Enzyme Technology: Immobilization of enzymes,
- whole cell immobilization and their application,
- commercial production of enzymes, RNA-catalysis,
- Catalytic antibodies -abzymes, Industrial production of lipase, protease & asparaginase

UNIT: 3- Microbial Biotechnology

- Genetically engineered micro-organisms (GEMS), Examples of GEMS,
- Biodiesel from hydrocarbons, Use of microbes in environmental bioremediation
- YAC, BAC, Microbial production of bioplastics (PHB, PHA),

UNIT: 4- Plant Biotechnology

- Principles of Biotechnology: plant tissue culture; Culture media. Various types of culture; callus, suspension, nurse, root, meristem, etc.; Plant growth regulators: mode of action, effects on *in vitro* culture and regeneration.
- Micro propagation; Soma-clonal variation; Synthetic seeds.
- Somatic hybridization; protoplast fusion, cybrids, asymmetric hybrids, Transgenic plants

UNIT: 5- Animal Biotechnology

- Structure of animal cell, Cell culture media and reagents,
- Culture of mammalian cells, primary culture, secondary culture, continuous cell lines. *In situ* and *ex situ* preservation of germplasm, pregnancy diagnostic kits.
- Structure of sperms and ovum, artificial insemination, *in vitro* fertilization, culture of embryos, cryopreservation of embryos, embryo transfer, Animal cloning basic concept.

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M.Sc. APPLIED MICROBIOLOGY Semester III (II year)

Paper-IV: CELL BIOLOGY, MOLECULAR BIOLOGY, MICROBIAL GENETICS (MM-40)

UNIT:1- Introduction of Cell biology

- General structure and constituents of cell; Similarities and distinction between plant and animal cells;
- Organization of eukaryotic genomes, Membrane transport; Transport of water, ion and Biomolecules; Signal transduction mechanisms; Protein targeting, Apoptosis.
- An overview of cell cycle; Process and phases of mitosis & meiosis and its significance, Regulation of Cell cycle.

UNIT:2- Molecular Biology

- rDNA Technology
- Isolation and Quantification of DNA and RNA,
- Host controlled Restriction –Modification system, Restriction Endonucleases. Cutting and joining of DNA molecules *in vitro*, Phosphates,Ligases and Polymerases. Vectors: types and use.

UNIT: 3-Techniques in Molecular Biology

- Gel electrophoresis- Agarose and PAGE (nucleic acids and proteins); Isolation of plasmid DNA from bacteria; isolation of phage DNA; Isolation of high molecular weight DNA.
- Sequencing methods: Northern Blotting, Southern Blotting, and Western Blotting.
- Construction of gene libraries; Synthesis and cloning of cDNA and Types of PCR, RAPD, AFLP, RFLP
- Gene transfer methods in animals: Microinjection, Electroporation,Micro projectile bombardment, Shot Gun method, Ultra sonication, Lipofection.

UNIT: 4- Microbial Genetics

- Nucleic acids as carriers of genetic information.Components of nucleic acids, Types of DNA, Denaturation and melting curves.
- DNA Replication: General principles, Various modes of replication. Properties of DNAP,Proof reading.
- Mutation: Number of mutation in a mutant. Revertant and reversion. Uses of mutation. Biochemical basis of mutation. Mutagenesis: Base analogue mutagens, Chemical mutagens,intercalating substances. Expression of mutations (Replica plate). Isolation of mutants. Reversion and Suppression.

UNIT: 5- Microbial Genetics: Transcription and Translation

- Transcription: Definition, Central Dogma of Molecular Biology. Structure of bacterial RNA polymerase, bacterial promoter, Transcription: initiation, elongation and termination.
- Processing of RNA: RNA splicing, t-RNA processing, RNA editing, Capping of mRNA and polyadenylation transcription regulation based on mRNA stability and localization,
- Translation: genetic code, characteristics of genetic code, t-RNA: Structure, modified bases in t-RNA, aa- t-RNA synthetase. Role of Ribosome and its structure, Translation: Translation process.

List of Practical's for III and IV:

1. Laboratory set-up (Biotechnology).
2. Preparation of nutrient media; handling and sterilization of plant material; inoculation, sub culturing and plant regeneration.
3. Anther and pollen culture.
4. Suspension cultures and evaluation of secondary metabolites.
5. Practicals related with Gel electrophoresis.
6. Isolation of bacterial DNA.
7. Gel electrophoresis of proteins and nucleic acids
8. Isolation of mutants by Gradient plate technique.
9. Demonstration of PCR.
10. Chlorophyll estimation by spectrophotometer.
11. Study of Mitosis and Meiosis.
12. Estimation of plant growth hormones.
13. Study of bioinformatics tools (software).

Practical scheme	Marks
Q.1 Major experiment	15
Q.2 Minor experiment (A)	05
Q.3 Minor experiment (B)	05
Q.4 Viva	08
Q.5 Spotting	10
Q.6 Practical record	07
	Total 50

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List of Recommended Books Paper III & IV:

- Benjamin Lewin. (2008) *Genes IX,* Jones and Bartelett Publishers Inc.
- Brown T., (2007) *Genome 3*, 3rd Edition, Garland Science.
- Klug WS & Cummings MR. 2003 *Concepts of Genetics*. Peterson Education.
- Lewin B. 2008. *Genes IX*. Jones & Bartlett Publ.
- Russell PJ. 1998. *Genetics*. The Benzamin/Cummings Publ. Co.
- Strickberger MW. 1990. *Genetics*. Collier MacMillan.
- A new horizon of Biotechnology by H.B. Singh.
- A text book of Biochemistry by Satyanarayana.
- Baldi, P. and Brunak, S. (2001) *Bioinformatics: The machine learning approach.* Bradford Book, MIT Press, Cambridge.
- Baxevanis, A. D. and Ouellette, B. F. F. (2001) *Bioinformatics: A practical guide to the analysis of genes and proteins.* Second Edition. John Wiley & Sons, New York.
- Ewens Warren J. and Gregory R. Grant (2004) *Statistical Methods in Bioinformatics, An Introduction*, Springer, New York.
- Lacroix, Z. and Critchlow, T. (Eds.) 2003. *Bioinformatics. Managing Scientific Data.* Morgan Kaufmann Publishers.
- Misener, S. and Krawetz, S. A. (Eds.) 2000. *Methods in Molecular Biology*, Volume
- Bioinformatics: Methods and Protocols. Humana Press, New Jersey.

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M.Sc. APPLIED MICROBIOLOGY Semester – IV (II year)

Paper-I: PHARMACEUTICAL MICROBIOLOGY (MM-40)

UNIT:1- Introduction to Pharmaceutical Microbiology

- Introduction to pharmaceutical industry: Role of a microbiologist in a Pharmacy industry (Active Pharmaceutical Ingredient), Research and Development, Role of Quality Assurance and Quality control in microbiology laboratory.
- Pharmacopoeias with special reference to Indian, British, United States, Food& Drug Administration role, Good Manufacturing Practices (GMP) and Good Laboratory Practices (GLP) in pharmaceutical industry.
- Quality assurance and quality management in pharmaceuticals: ISO, WHO and US certification.

UNIT: 2- Microbiological analysis in Pharmaceuticals

- Microbiological analysis: Standard operating producers for microbiological assay of antibiotics, vitamins and amino acids, Water analysis, Microbial limit test, Sterility test, Pyrogen test (BET), Growth promotion test.
- SOP of Aerobic and anaerobic count of microorganism, Enumeration of *Pseudomonas*, *Salmonella*, and *E. coli* from raw water and treated water.
- Microbial contamination and spoilage of pharmaceutical products (raw materials, sterile injectable, ophthalmic preparations and implants), Chemical disinfectants, antiseptics and preservatives

UNIT: 3- Antibiotics: (structure, types and mode of action)

- Antibacterial antibiotics: Beta-lactam and non-beta lactam antibiotics,
- Amino glycosides, Streptomycin, Tetracyclines,
- Chloramphenicol, Macrolides, Fluoroquinolones
- Synthetic drugs: Sulphonamides, Trimethoprim, Nitrofurans and Isoniazid.
- Bacterial resistance to antibiotics: Origin and mechanism of resistance (Cellular permeability, beta-lactamases, Efflux pump mediated resistance, and drug diffusion and ESBL detection in bacteria.
- Antifungal and Antiviral drugs.

UNIT: 4-Drug development in pharmaceutical process

- Production of biopharmaceutical biotechnology products by geneticallyengineering methods: Hormones (Humulin, Humatrope), Interferons (Intron A), t-plasminogen activator (Activase).
- Monoclonal antibody (Monocloate, Orthoclone OKT3), Streptokinase.
- Vaccines: DNA vaccines: synthetic peptide vaccine, Multivalent subunit vaccines

UNIT: 5- Drug targeting

- Drug delivery in gene therapy: Liposomes, Microencapsulation.
- Clinical studies: Toxicological evaluation of drug: LD50, Acute, subacute and chronic toxicity, LAL test, Teratogenicity. Drug interactions, Drug metabolism: activation/inhibition of drug *in vivo*, adverse drug reactions.

M.Sc. APPLIED MICROBIOLOGY Semester IV (II year)

Paper-II: APPLIED MICROBIOLOGY (MM-40)

UNIT:1- Principles of Forensic Microbiology

- Forensic Science: Introduction to forensic microbiology, Immunology, Examination of Biological Trace material Evidence.
- Development of forensic microbiology, Types and identification of microbial organisms/ fungi of forensic significance, Techniques in forensic microbiology.
- Microscopic Appearances of Important Staining techniques, Observation, Collection-Preservation & Forwarding of Pathological & Microbial Evidence.

UNIT: 2- Diagnostic Forensic Microbiology

- DNA fingerprinting, Forensic Application of recombinant DNA technology/ Forensic Biotechnology, Polymorphism in DNA system – DNA markers RAPD, VNTRs, SNP,
- Understanding Bioterrorism: - Types of biological agents – Category A, B, C.
- Punishments for Bioterrorism act under Prevention of Terrorism Act, 2002. Study of spore, powdered minerals and pollens of forensic importance, Use of pollen grains & spores in criminal or civil investigation,

UNIT: 3- Nano-Technologies (Basics)

- Introduction to Bio-macromolecules: Concepts to describe the conformation and dynamics of biological macromolecules: scattering techniques, micromanipulation techniques, drug delivery applications etc.
- Chemical, physical and biological properties of biomaterials (Proteins, DNA and polysaccharides) and bio-response: bio-mineralization.
- Nano particular carrier systems; Micro- and Nano-fluidics; Drug and gene delivery system; Biosensors, Chip technologies, Nano- imaging, Gene therapy.

UNIT: 4- Biosafety, Bioethics, and other issue

- Introduction to Bioethics and Biosafety, Human Genome Project and its Ethical Issues.
- Biosafety Guidelines and Regulations. Legal and Socio-economic Impacts of Biotechnology. Genetically Modified Organisms and their Release in the Environment. Hazardous Materials used in Biotechnology and their Handling and Disposal.
- Intellectual Property Rights and Agricultural Technology,
- Bioethics in Biodiversity and Resource Management. Ethical Issues in Genetically Modified Organism.

UNIT: 5- Entrepreneurship in Microbiology

- Mushroom Cultivation
- Vermicomposting
- Biofertilizers
- Spirulina Production,
- Plant tissue culture

Practical List of Paper I & II:

1. Study of larval stages of *Drosophila* as Forensic evidence.
2. To Study and differentiation between bacterial spores as a Forensic evidence.
3. Practicals related with nanotechnology.
4. An overview of different practical aspects of Vermicomposting.
5. Extraction of magnetic nanoparticles (Ferofluids).
6. Cultivation of Mushroom – *Pleurotus* Sp., *Agaricus bisporus* **(Demonstration).**
7. Study of biofertilizers e.g., PSB, *Rhizobium*, VAM isolation and characteristics.
8. Practicals related with Pharmaceutical microbiology e.g., antimicrobial testing.
9. Detection of Efflux pump mediated antibiotic resistance in bacteria.
10. Preparation of Liposomes
11. Quantitative determination of DNA, Protein and Carbohydrates by Spectrophotometer.

Practical scheme	**Marks**
Q.1 Major experiment	15
Q.2 Minor experiment (A)	05
Q.6 Minor experiment (B)	05
Q.4 Viva	08
Q.5 Spotting	10
Q.6 Practical record	07
	Total 50

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Books recommended for Paper I & II:

1. Text of book of Microbiology. Author- R. Ananthanarayanan and C.K. JayaramPanicker, Orient Longman,
2. Medical Microbiology Authors-Mackie and McCartney Vol. 1- Microbial Infection and Vol. 2- Practical
3. Medical Microbiology, Churchill Livingstone, 1996.
4. Microbiology in Clinical Practice. Author- D.C. Shanson, Wright PSG, 1982.
5. Bailey and Scott's Diagnostic Microbiology Authors- Baron EJ, Peterson LR and Finegold SM, Mosby.
6. Biochemistry of Antimicrobial Action. Authors- Franklin, T.J., Snow G.A. (1981), Champman and Hall.
7. Epidemiology and Infections. Author- Smith, C.G.C. (1976): Medowlief Press Ltd., Shildon, England.
8. Lecture Notes in Immunology, Author- Todd, I.R. (1990): Blackwell Scientific Publications Ltd., Oxford.
9. Microbial infections, Vol. 2: Practical Medical Microbiology: Churchill Livingstone London.
10. Bailey and Scott's Diagnostic Microbiology.
11. Cellular Microbiology. 1999. Henderson *et.al*., Wiley.
12. Agarwal S. S. and Paridhavi M., (2007), *Herbal Drug Technology*, Universities Press (India) Pvt. Ltd.
13. Altreuter D., and D S. Clark, (1999), *Combinatorial Biocatalysis: Taking the Lead From Nature*, Curr. Opin. Biotechnol. **10,** 130.
14. Bentley's Textbook of Pharmaceutics, Edition E. A. Rawlins, 8th Ed. (2002), BAillieреTindall, London.
15. Burn J. H. (1957) *Principles of Therapeutics*, Blackwell Scientific Pub. O. Ltd. Oxford.
16. Chatwal G. P. (2003) *Biopharmaceutics and Pharmacokinetics*, Himalaya Publishing House, Mumbai.
17. Bioinstrumentation by
18. Becker JM, Gold Well GA &Zachgo EA. 2007. *Biotechnology a Laboratory Course*. Academic Press.

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M.Sc. APPLIED MICROBIOLOGY Semester IV (II year)

Paper-III: MICROBIALFERMENTATION TECHNOLOGY (MM-40)

UNIT: 1- Introduction to Fermentation Technology

- Principles of Microbial growth–Batch, fed-batch and continuous cultures (definition and kinetics).Bioreactor/Fermenter – types, working & operation of Bioreactors, Fermenter (Stirred tank, bubble columns, airlift.
- Bioreactors, Static, Submerged and agitated fermentation), advantages & disadvantages of solid substrate &liquid fermentations.

UNIT: 2- Isolation and Improvement of strains

- Isolation of industrially important microorganisms, their maintenance and improvement, Microbial growth kinetics, Sterilization. Media for Fermentations, Development of Inoculum.
- Experiments on microbial fermentation process, harvesting, purification and recovery of end products.
- Use of various types of sensors and biosensors for monitoring environmental parameters (pressure, pH, temperature, DO), Basic principles of operation, types of biosensors

UNIT:3- Instrumentation and control

- **Upstream processing** (Strain selection, Sterilization of fermenter, Air supply Sampling, Foam control, Transfer of inoculum.
- **Downstream Processsing,** Downstream processing, Filtration, Centrifugation, Cell disruption, Liquid-liquid Extraction, Chromatography, Membrane processes.
- Instrumentation and Control, Definition of terms, Manual and automatic control, Types of automatic control.

UNIT:4- Roles of Biotechnology

- Biotechnology in specific medical & industrial applications, microbial process for immunization (Production of monoclonal antibodies)
- Deterioration of paper, textiles, painted surfaces and their prevention, Biofilms, microbial biopolymers, bio surfactants, Microbial culture selection with high yield potential.

UNIT:5- Agitation and types of growth

- Agitation:- Functions of agitation. Flow patterns with different types of impellers.
- The types of growth (mycelia pellet form, mycelia filamentous form, free cell,
- Cells producing exopolysaccharides affect mass transfer of nutrients, oxygen and heat.

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M.Sc. APPLIED MICROBIOLOGY Semester IV (II year)

Paper-IV: MARINE MICROBIOLOGY (MM-40)

Unit: 1- Microbes in the marine environment

- Scope of Oceanographic research and Premier world Institutes. The world's oceans and seas, what is marine microbiology, Chemical and physical factors in the marine environment.
- Properties of seawater, Marine microbial habitats - water column, Sediments, mangroves, salt marshes. Biofilms and Microbial mats, Microbial life at surfaces of living and non-living systems, Quorum sensing in marine microbes and significance. Microbial interactions.

Unit: 2- Physiology of marine prokaryotes

- Metabolic diversity and the importance of microbial communities. Energy-yielding processes: Phototrophy and primary productivity, Fermentation, respiration, Methanogenesis.
- Carbon dioxide fixation in autotrophs, nitrification and denitrification. Specific nutrients needed for growth: Macronutrients, micronutrients and trace elements.

Unit: 3- Methods in Marine microbiology

- Sampling and experimental approaches, specific staining procedures for Microscopy, study of cellular and sub-cellular organization using Confocal laser scanning microscopy (CLSM), cellular composition using Flow cytometry (FCM).
- Laboratory culture: The importance of cultural conditions, viable but non-culturable (VBNC) organisms.

Unit: 4- Methods in Marine Microbiology

- Enrichment culture, Isolation, Biochemical methods for identification and taxonomy.
- Molecular tools in study of marine microbial diversity, Phylogenetic analysis, Metagenomics, Community fingerprinting,
- Limitations of analysis of nucleic acids directly from marine environment, Genomic fingerprinting and molecular markers; RAPD; Fluorescence in situ hybridization (FISH).

Unit: 5- Microbes in ocean processes

- Photosynthesis, Microbes in nitrogen cycling, importance of iron, microbial loop in ocean food webs.
- Microbial processes in eutrophication of coastal waters
- Microbial processes and climate change. Beneficial and Harmful effects.
- Biofouling and bio deterioration, indicator organisms and pollution control.

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Practical

List of Paper III & IV:

1. Study of different types of growth.
2. Production of Organic acids *(Aspergillus niger)*, lactic and *(A. oryzee)*.
3. Phenol coefficient, TDP and TDT.
4. Preparation of marine water for marine microbial study.
5. Isolation and identification of microbes from sea.
6. Study of biofilm microorganisms.
7. Detection Hydrolytic Enzyme of the marine and Soil isolates.
8. Enrichment techniques for VBNC.
9. Production of Wine
10. Separation and Production of citric acid
11. Demonstration of vinegar production
12. Screening of antibiotic producing actinomycetes
13. Diastatic power of malt

Practical scheme	**Marks**
Q. 1 Major experiment	15
Q.2 Minor experiment (A)	05
Q.3 Minor experiment (B)	05
Q.4 Viva	08
Q.5 Spotting	10
Q.6 Practical record	07
	Total 50

Books recommended for paper III & IV:

1. Marine Microbial Diversity: David Karl & Merry Buckley
2. Microbial Ecology of the Oceans: Ralph Metchell
3. Ocean & health: Pathogens of the Marine Environment Rita Colwell &ShinishonBelkin
4. Biological Oceanography-Charles Meller.
5. Patel: Fermentation Technology.
6. Brown CM, Campbell I & Priest FG. 2005. *Introduction to Biotechnology*.Panima
7. Singh BD. 2006. *Biotechnology Expanding Horiozon*. Kalyani.
8. Industrial microbiology by Parihar.

CO-ORDINATOR
Microbiology
Govt. Madhav Vigyan Mahavidyalaya
UJJAIN (M.P.)

M.Sc. APPLIED MICROBIOLOGY Semester IV (II year)

PROJECT/SURVEY/DISSERTATION

1. **Project/Survey/Dissertation:** Students will complete a short term research project/Survey/Dissertation from different institutes including NGO, Govt. Organizations.

Marking Scheme:

2. **Marks:** Project Submission and Viva **(25+25)= 50**

CO-ORDINATOR
Microbiology
Govt. Madhav Vigyan Mahavidyalaya
UJJAIN (M.P.)

MATHEMATICS

Papers	Theory (M.M)	Continuous Comprehensive Evaluation (M.M.)	Practical (M.M.)	Total (M.M.)
Paper I. Advanced Abstract Algebra - I	40	10	-	50
Paper II. Real Analysis	40	10	-	50
Paper III. Topology - I	40	10	-	50
Paper IV. Complex Analysis - I	40	10	-	50
Paper V. Optional (Any One) :-				
(i) Differential Equations - I	40	10	-	50
(ii) Advanced Discrete Mathematics - I	40	10	-	50
(iii) Differential Geometry of Manifolds - I	40	10	-	50
(iv) Programming in C- I (Theory & Practical)	25	10	15	50
Paper VI. Comprehensive Viva-Voce				50
Total				**300**

COURSE STRUCTURE

M.A./M.Sc. SEMESTER - II, (Regular Students)

MATHEMATICS

Papers	Theory (M.M)	Continuous Comprehensive Evaluation (M.M.)	Practical (M.M.)	Total (M.M.)
Paper I. Advanced Abstract Algebra - II	40	10	-	50
Paper II. Lebesgue Measure and Integration	40	10	-	50
Paper III. Topology - II	40	10	-	50
Paper IV. Complex Analysis - II	40	10	-	50
Paper V. Optional (Any One) :-				
(i) Differential Equations - II	40	10	-	50
(ii) Advanced Discrete Mathematics - II	40	10	-	50
(iii) Differential Geometry of Manifolds - II	40	10	-	50
(iv) Programming in C - II (Theory & Practical)	25	10	15	50
Paper VI. Comprehensive Viva-Voce				50
Total				**300**

Note : At the end of each Semester a Comprehensive Viva-Voce is to be conducted by a board of atleast three examiners which includes at least one external examiner.

MATHEMATICS

Papers	Theory (M.M)	Continuous Comprehensive Evaluation (M.M.)	Practical (M.M.)	Total (M.M.)
Paper I. Advanced Abstract Algebra - I	50	-	-	50
Paper II. Real Analysis	50	-	-	50
Paper III. Topology - I	50	-	-	50
Paper IV. Complex Analysis - I	50	-	-	50
Paper V. Optional (Any One) :-				
(i) Differential Equations - I	50	-	-	50
(ii) Advanced Discrete Mathematics - I	50	-	-	50
(iii) Differential Geometry of Manifolds - I	50	-		50
(iv) Programming in C- I (Theory & Practical)	35	-	15	50
Paper VI. Comprehensive Viva-Voce				50

M.Sc./M.A. SEMESTER - II (Private Students)

MATHEMATICS

Papers	Theory (M.M)	Continuous Comprehensive Evaluation (M.M.)	Practical (M.M.)	Total (M.M.)
Paper I. Advanced Abstract Algebra - II	50	-	-	50
Paper II. Lebesgue Measure and Integration	50	-	-	50
Paper III. Topology - II	50	-	-	50
Paper IV. Complex Analysis - II	50	-	-	50
Paper V. Optional (Any One) :-				
(i) Differential Equations - II	50	-	-	50
(ii) Advanced Discrete Mathematics - II	50	-	-	50
(iii) Differential Geometry of Manifolds - II	50	-	-	50
(iv) Programming in C - II (Theory & Practical)	35	-	15	50
Paper VI. Comprehensive Viva-Voce				50

Note : At the end of each Semester a Comprehensive Viva-Voce is to be conducted by a board of atleast three examiners which includes at least one external examiner.

Regular	Private
Theory Marks : 40 **C.C.E. Marks : 10**	**Theory Marks : 50**

M.Sc./M.A. Mathematics

SEMESTER I

Paper I Advanced Abstract Algebra - I

Unit 1 -

Automorphisms, Normal and subnormal series of groups, composition series, Jordan-Holder Theorem.

Unit 2 -

Commutator subgroup, Solvable series and Solvable groups, Cenral series and Nilpotent groups.

Unit 3 -

Extension fields, Roots of polynomials, Algebraic and transcendental extensions, Splitting fields, Separable and inseparable extensions.

Unit 4 -

Perfect fields, Finite fields, Algebraically closed fields.

Unit 5 -

Automorphism of extensions, Galois extensions, Fundamental theorem of Galois theory. Solution of polynomial equations by radicals, Insolvability of the general equation of degree 5 by radicals.

Recommended Books :

[1] I. N. Herstein. Topics in algebra, Wiley Eastern Ltd. New Delhi, 1975.

[2] Vivek Sahai and Vikas Bist, Algebra, Narosa Publishing House, 1999.

[3] P.B. Bhattacharya, S.K. Jain and S.R..Nagpaul, Basic Abstract Algebra (2nd Edition), Cambridge University Press, Indian Edition, 1997.

Reference Books :

[1] N.Jacobson, Basic Algebra, Vols.I & II,,W.H.freeman, 1980 (also published by Hindustan Publishing Company).

[2] S. Lang, Algebra, Addison-Wesley.

[3] I.S. Luther and I.B.S. Passi, Algebra, Vol.I - Groups, Vol. II - Rings, Narosa Publishing House (Vol. I -1996, Vol.II - 1999).

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Max. Marks 50

Regular	Private
Theory Marks : 40 **C.C.E. Marks : 10**	**Theory Marks : 50**

M.Sc./M.A. Mathematics

SEMESTER I

Paper II Real Analysis

Unit 1 -

Definition and existence of Riemann-Stieltjes integral, Properties of integral, integration and differentiation, the fundamental theorem of Calculus.

Unit 2 -

Integration of vector valued functions, Rectifiable curves. Rearrangement of terms of a series, Riemann's theorem. Sequences and series of functions, pointwise and uniform convergence.

Unit 3 -

Cauchy criterian for uniform convergence, Weierstrass M-test, Abel's and Dirichlet's test for uniform convergence, uniform convergence and continuity, uniform convergence and Riemann -Stieltjes integration, uniform convergence and differentiation, Weierstrass approximation theorem,

Unit 4 -

Power series, Uniqueness theorem for power series, Abel's theorem, Functions of several variables, linear transformations, Derivatives in an open subset of R^n, chain rule, partial derivatives, interchange of the order of differentiation, derivatives of higher orders. Taylor's theorem,

Unit 5 -

Inverse function theorem, Implicit function theorem, Jacobians, Lagrange's multiplier method, Differentiation of integrals, partitions of unity, Differential forms, Stoke's theorem.

Recommended Books :

[1]. Walter Rudin, Principles of Mathematical Analysis (3rd edition), McGraw-Hill, Kogakusha, 1976, International Student edition.

Reference Books :

[1] T.M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi,1985.

[2] H.L. Royden, Real Analysis, Macmillan Publishing Co. Inc., 4th Edition, New York, 1993

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Regular	Private
Theory Marks : 40 C.C.E. Marks : 10	Theory Marks : 50

M.Sc./M.A. Mathematics

SEMESTER I

Paper III Topology - I

Unit 1 -

Countable and Uncountable sets. Infinite sets and the Axiom of Choice. Cardinal numbers and its arithmetic. Schroeder-Bernstein theorem. Cantor's theorem and the continuum hypothesis. Zorn's lemma. Well - ordering theorem.

Unit 2 -

Defintion and examples of topological spaces. Closed sets, Closure. Dense subsets. Neighbourhoods. Interior, exterior and boundary. Accumulation points and derived sets.

Unit 3 -

Bases and sub bases. Subspaces and relative topology, Product Topology, Metric Topology, Continuous functions and homomorphism.

Unit **4 -**

First and Second Countable spaces. Covering and Lindelof's spaces. Separable spaces. second countability and Separability.

Unit 5-

Connected spaces, connectedness on real line, components, Path connectedness, locally connected spaces.

Recommended Books :

[1] James R. Munkres, Topology : A First Course, Prentice Hall of India Pvt. Ltd. New Delhi, 2000.

Reference Books :

[1] K.D. Joshi, Introduction to General Topology,Willey Eastern Limited, 1983.

[2] George F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill Book Company, 1963.

[3] J. Dugundji, Topology, Allyn and Bacon, 1966 (Reprinted in India by Prentice-Hall of India Pvt. Ltd.)1111444555566

[4] N. Bourbaki, General Topology part-I (Transl.) Addison Wesley Reading 1966.

[5] B. Mendelson, Introduction to Topology, Allyn & Becon, Inc., Boston, 1962.

[6] E.H. Spanier, Algebraic Topology, McGraw-Hill, New York, 1966.

[7] J.L. Kelley, General Topology, Van Nostrand, Reinhold Co., New York, 1995.

[8] M.J. Mansfield, Introduction to Topology, D.Van Nostrand Co. Inc., Princeton, N.J. 1963.

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Max. Marks 50

Regular	Private
Theory Marks : 40	**Theory Marks : 50**
C.C.E. Marks : 10	

M.Sc./M.A. Mathematics

SEMESTER I

Paper IV. Complex Analysis

Unit 1 -

Complex integration. Cauchy-Gorsat Theorem. Cauchy's integral Formula. Higher Order derivatives.

Unit 2 -

Morera's Theorem. Cauchy's inequality and Liouville's theorem. The fundamental theorem of Algebra. Taylor's theorem.

Unit 3 -

Maximum modulus principle. Schwarz lemma. Laurent's series. Isolated singularities. Meromorphic functions. The argument principle. Rouche's theorem inverse function theorem.

Unit 4 -

Mobius Transformations. Fixed Points, Cross Ratio, Bilinear transformations, their properties and classifications. Definitions and Examples of Conformal mappings.

Unit 5 -

Residues. Cauchy's residue theorem. Evaluation of integrals. Branches of many valued functions with special reference to arg z, log z and z^a.

Recommended Books :

[1] J.B. Conway, Functions of one Complex variable, Springer-Verlag, International Student Edition, Narosa Publishing House, 1980.

[2] Brijendra Singh, Varsha Karanjgaokar and R. S. Chandel, Complex Analysis, Gaura Pustak Sadan, Agra - 7.

Reference Books :

[1] S. Ponnusamy, Foundations of Complex Analysis, Narosa Publishing House, 1997.

[2] L.V. Ahlfors, Complex Analysis, McGraw-Hill, 1979.

[3] B. Singh, Varsha Karanjgoakar and R.S.Chandel, Complex analysis,Golden Valley Publications.

Max. Marks 50

Regular	Private
Theory Marks : 40 C.C.E. Marks : 10	Theory Marks : 50

M.Sc./M.A. Mathematics

SEMESTER I

Optional Paper V (i) Differential Equations - I

Unit 1 -

Initial value Problem and the equivalent integral equation, m^{th} order equation in d - dimension as a first order system, concepts of local existence, existence in the large and uniqueness of solutions with examples.

Unit 2 -

Basic Theorems- Ascoli- Arzela Theorem. A theorem on convergence of solutions of a family of initial value problems.

Unit 3 -

Picard-Lindelof theorem-Peano's existence theorem and corollary. Maximal intervals of existence. Extension theorem and corollaries. Kamke's convergence theorem. Kneser's theorem (Statement only)

Unit 4 -

Differential inequalities and Uniqueness - Gronwall's inequality. Maximal and Minimal Solutions. Differential inequalities. A theorem of Winter. Uniqueness Theorems. Nagumo's and Osgoods's criteria.

Unit 5 -

Egres points and Lyapunov functions. Successive approximations.

Linear Differential Equations - Linear systems, Variation of Constants, reduction to smaller systems. Basic inequalities, Constant coefficients. Floquet theory. Adjoint systems, Higher Order equations.

Recommended Books :

[1] P. Hartman, Ordinary Differential Equations, John Wiley (1964).

Reference Books :

[1] W.T. Reid, Ordinary Differential Equations, John Wiley & Sons, NY (1971).

[2] E.A. Coddington and N. Levinson, Theory of Ordinary Differential Equaions, Mc Graw Hill, NY (1955).

Max. Marks 50

Regular	Private
Theory Marks : 40	**Theory Marks : 50**
C.C.E. Marks : 10	

M.Sc./M.A. Mathematics

SEMESTER I

Optional Paper V (ii) Advanced Discrete Mathematics - I

Unit 1 -

Semigroups & Monoids - Definitions and examples of Semigroups and Monoids (including those pertaining to concatenation operation). Homomorphism of semigroups and Monoids. Congruence relation andQuotient Semigroups. Subsemigroup and submonoids. Direct products. Basic Homomorphism Theorem.

Unit 2 -

Lattices - Lattices as partially ordered sets. Their properties. Lattices as Algebraic systems. Sublattices, Direct products,and Homomorphisms. Some Special Lattices e.g.., Complete, Complemented and Distributive Lattices.

Unit 3 -

Boolean Algebras-Boolean Algebras as Lattices. Various Boolean Identities. The Switching Algebra example. Subalgebras, Direct products and Homomorphisms. join- irreducible elements. Atoms and Minterms. booleean forms and Teir Equivalence. Minterm Boolean forms, Sum of products Canonical forms. Minimization of Boolean Fuctions. Applications of boolean Alegebra to Switching Theory- (using AND, OR & NOT gates). the Karnaugh Map method.

Unit 4 -

Graph Theory- Definiition of (undirected) Graphs, Paths, Circuits Cycles & Subgraphs. Induced Subgraphs. Degree of a vertex. Connectivity. Planar Graphs and their properties. Trees.

Unit 5 -

Eulers Formula for connected Planar Graphs. Complete & Complete Bipartite Graphs. Kuratowskis Theorem (statement only) and its use . Spanning trees, cut-sets. Fundamental Cut- Sets, and Cycles. minimal Spanning trees and Kruskals Algorithm. Matrix Representations of Graphs.

Recommended Books :

[1] J.P.Trembly & R.Manohar, Discrete mathematical Structures with Applications to Computer Science, McGraw Hill Book Co. 1997.

[2] N. Deo, Graph Theory with applications to Engineering and Computer Sciences, Prentice Hall of India.

Reference Books :

[1] J.L.Gersting, Mathematical Structures for Computer Science, (3rd edittion), Computer Science Press, New york.

[2] Seymour Lepschutz, Finite Mathematics (International edition 1983) McGraw- Hill Book Company, Newyork.

[3] S.Wiitala,Discrete Mathematics - A Unified Approach, MC graw- Hill Book Co.

[4] J.E.Hopcroft and J,D. Ullman, Introduction to Automata Theory Languages & Compulation Narosa Publishing House.

[5] B. Singh, R.S.Chandel and Akhilesh Jain, Advanced Discrete Mathematics,Golden Valley Publications.

Max. Marks 50

Regular	Private
Theory Marks : 40	**Theory Marks : 50**
C.C.E. Marks : 10	

M.Sc./M.A. Mathematics

SEMESTER I

Optional Paper V (iii) Differential Geometry of Manifolds - I

Unit I -

Definition and examples of differentiable manifolds. Tangent spaces. Jacobian map. One parameter goup of transformations.

Unit II -

Lie derivatives. Immersions and Embeddings. Distributions. Exterior algebra. Exterior derivative.

Unit III -

Topological Groups. Lie groups and lie algebras. Product of two Liegroups.

Unit IV -

One parameter subgroup and exponential maps. Examples of Liegroups.

Unit V -

Homomorphism and Isomorphism. Lie transformation groups. General Linear groups. Principal fibre bundle. Linear frame bundle.

Recommended Books :

[1] B.B. Sinha, An Introduction to Modern differential Geometry, Kalyani Publishers, New Delhi, 1982.

[2] K. Yano and M. Kon, Structure of Manifolds, World Scientific Publishing Co. Pvt. Ltd., 1984.

References Books :

[1] R.S. Mishra, A Course in tensors with applications to Riemannian Geometry, Pothishala (Pvt.) Ltd., 1965.

[2] R.S. Mishra, Structures on a differentiable manifold and their applications, Chandrama Prakashan, Allahabad, 1984.

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Max. Marks 50

Regular	Private
Theory Marks : 25 **C.C.E. Marks : 10** **Practical Marks:15**	**Theory Marks : 35** **Practical Marks:15**

M.Sc./M.A. Mathematics

SEMESTER I

कक्षा Class : **M.Sc. (Mathematics)**

सेमेस्टर Semester : **I**

विषय समूह का शीर्षक Title of Subject : **Programming in C (Theory and Practical) I**

Group : **V (iv)**

प्रश्न पत्र कं. Paper No. : **iv**

अनिवार्य/ वैकल्पिक Compulsory/ Optional : **Optional**

Unit-1

An overview of programming languages

Unit-2

Classification. C Essentials - Programs development, Functions

Unit-3

Anatomy of a Function. Variables and Constants Expressions. Assignment Statements. Formatting Source files Continuation Character. the Preprocessor.

Unit-4

Scalar Data types - Declarations, Different Types of integers. Different kinds of Integer Constants Floating - point type Initialization

Unit-5

mixing types Explicit conversions - casts. Enumeration Types. the void data type , Typedefs. Pointers.

Reference Books:

(1) Samuel P. Harkison and Gly L Steele Jr. C; A Reference manual , 2an Edition Prentice hall 1984.

(2) Brain W Kernigham & Dennis M Ritchie the C Programmed Language 2nd Edition (ANSI features), Prentice Hall 1989.

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Max. Marks 50

Regular	Private
Theory Marks : 40 C.C.E. Marks : 10	Theory Marks : 50

M.Sc./M.A. Mathematics

SEMESTER II

Paper I Advanced Abstract Algebra - II

Unit 1 -

Introduction to Modules, Examples, Sub-modules and direct sums, Examples of sub-modules, Quotient Modules, R-Homomorphism and Examples of R-Homomorphism ,

Unit 2 -

Finitely generated modules. Cyclic modules, Simple modules, Schur's Lemma, Free modules .

Unit 3 -

Noetherian and Artinian modules and rings, Hilbert basis theorem.

Unit 4 -

Uniform modules, primary modules and Noether-Lasker theorem.

Unit 5 -

Algebra of linear transformations, Characteristic roots, Similarity of linear transformations. Invariant subspaces, Reduction to triangular forms, Nilpotent transformations, Index of nilpotency, Invariants of a nilpotent transformation, The primary decomposition theorem.

Recommended Books :

[1] I. N. Herstein. Topics in algebra, Wiley Eastern Ltd..New Delhi, 1975.

[2] Vevek Sahai and Vikas Bist, Algebra, Narosa Publishing House, 1999.

Reference Books :

[1] P.B. Bhattacharya, S.K. Jain and S.R..Nagpaul, Basic Abstract Algebra (2nd Edition). Cambridge University Press, Indian Edition, 1997.

[2] S. Kumaresan, Linear Algebra - A geometric approach, Prentice Hall of India, Ltd.

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Max. Marks 50

Regular	Private
Theory Marks : 40 C.C.E. Marks : 10	Theory Marks : 50

M.Sc./M.A. SEMESTER - II

Paper II Lebesgue Measure and Integration

Unit 1 -

Lebesgue outer measure. Measurable sets. Regularity. Measurable functions. Borel and Lebesgue measurability. Non-measurable sets.

Unit 2 -

Integration of Non-negative functions. The General integral. Integration of Series. Reimann and Lebesgue integrals.

Unit 3 -

The Four derivatives. Functions of bounded variation. Lebesgue Differentiation Theorem. Differentiation and Integration.

Unit 4 -

The L^p spaces, Convex functions, Jensen's inequality, Hölder and Minkowski inequalities. Completeness of L^p.

Unit 5 -

Dual of space, Convergence in Measure, Uniform convergence and Almost uniform convergence.

Recommended Books :

[1] G.de Barra, Measure Theory and Integration, Wiley Eastern Limited, 1981.

Reference Books :

[1]. Walter Rudin, Principles of Mathematical Analysis (3rd edition), McGraw-Hill, Kogakusha, 1976, International Student edition.

[2] H.L. Royden, Real Analysis, Macmillan Publishing Co. Inc., 4th Edition, New York, 1993

[3] Inder K. Rana, An Introduction to Measure and Integration, Narosa Publishing House, 1997.

[4] P.R. Halmos, Measure Theory, Van Nostrand, Princeton, 1950.

[5] P.K. Jain and V.P. Gupta, Lebesgue Measure and Integration, New Age International (P) Limited Published New Delhi, 1986 (Reprint 2000).

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Max. Marks 50

Regular	Private
Theory Marks : 40	**Theory Marks : 50**
C.C.E. Marks : 10	

M.Sc./M.A. SEMESTER - II

Paper III Topology - II

Unit 1 -

Separation axioms T_0, T_1, T_2, $T_3^{1/2}$, T_4 their characterization and basic properties. Urysohn's lemma. Tietze extension theorem.

Unit 2 -

Compactness. Continuous functions and compact sets. Basic properties of compactness. Compactness and finite intersection property. Sequentially and countably compact sets. Local Compactness and one point compactification. Stone-Cech compactification.

Unit 3 -

Tychonoff product, Projection maps. Separation axioms and product spaces. Connectedness and product spaces. Compactness and product spaces (Tychonoff Theorem). Embedding lemma and Tychonoff embedding.

Unit 4 -

Nets and Filters. Topology and Convergence of nets. Hausdorffness and nets. Compactness and nets. Filters and their convergence. Canonical way of converting nets to filters and vice versa. Ultrafilters and compactness.

Unit 5 -

The fundamental group and covering spaces-Homotopy of paths. The fundamental group. Covering spaces. The fundamental group of the circle and the fundamental theorem of algebra.

Recommended Books :

[1] James R. Munkres, Topology : A First Course, Prentice Hall of India Pvt. Ltd. New Delhi, 2000.

[2] K.D. Joshi, Introduction to General Topology,Willey Eastern Limited, 1983.

Reference Books :

[1] George F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill Book Company, 1963.

[2] J. Dugundji, Topology, Allyn and Bacon, 1966 (Reprinted in India by Prentice-Hall of India Pvt. Ltd.)

[3] N. Bourbaki, General Topology part-I (Transl.) Addison Wesley Reading 1966.

[4] B. Mendelson, Introduction to Topology, Allyn & Becon, Inc., Boston, 1962.

[5] E.H. Spanier, Algebraic Topology, McGraw-Hill, New York, 1966.

[6] J.L. Kelley, General Topology, Van Nostrand, Reinhold Co., New York, 1995.

[7] M.J. Mansfield, Introduction to Topology, D.Van Nostrand Co. Inc., Princeton, N.J. 1963.

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Max. Marks 50

Regular	Private
Theory Marks : 40 **C.C.E. Marks : 10**	**Theory Marks : 50**

M.Sc./M.A. SEMESTER - II

Paper IV **Complex Analysis - II**

Unit 1 -

Weierstrass' factorisation theorem. Gamma function and its properties. Riemann Zeta function. Riemann's functional equation.

Unit 2 -

Runge's theorem. Mittag-Leffler's theorem. Analytic Continuation. Uniqueness of direct analytic continuation. Uniqueness of analytic continuation along a curve. Power series method of analytic continuation.

Unit 3 -

Schwarz Reflection principle. Monodromy theorem and its consequences. Harmonic functions on a disk.

Unit 4 -

Harnack's inequality and theorem. Dirichlet problem. Green's function. Canonical products. Jensen's formula. Poisson - Jensen formula. Hadamard's three circles theorem. Order of an entire function. Exponent of Convergence. Borel's theorem. Hadamard's factorization theorem.

Unit 5 -

The range of an analytic function. Bloch's theorem. The little Picard theorem. Schottky's theorem. Montel Caratheodary and great Picard theorem. Univalent function. Bieberbach conjecture and the 1/4 theorem.

Recommended Books :

[1] J.B. Conway, Functions of one Complex variable, Springer-Verlag, International Student Edition, Narosa Publishing House, 1980.

Reference Books :

[1] S. Ponnusamy, Foundations of Complex Analysis, Narosa Publishing House, 1997.

[2] H.A. Priestly, Introduction to complex analysis, Clarendon Press, Oxford, 1990.

[3] D, Sarason, Complex Function Theory, Hindustan Book Agency, Delhi, 1994.

[4] E.C. Titchmarsh, The Theory of Functions, Oxford University Press, London.

[5] L.V. Ahlfors, Complex Analysis, McGraw-Hill, 1979.

[6] Walter Rudin, Real and Complex Analysis, McGraw-Hill Book Co., 1966.

[7] S. Saks and Zygmund, Analytic Functions, Monografie matematyczne, 1952.

[8] B. Singh, Varsha Karanjgoakar and R.S.Chandel, Complex analysis,Golden Valley Publications.

Max. Marks 50

Regular	Private
Theory Marks : 40 C.C.E. Marks : 10	Theory Marks : 50

M.Sc./M.A. SEMESTER - II

Optional Paper V (i) **Differential Equations - II**

Unit 1 -

Dependence on initial conditions and parameters, preliminaries. Continuity. Differentiability. Higher Order Differentiability.

Unit 2 -

Poincare-Bendixson Theory - Autonomous Systems. Umlanfsatz. Index of a stationary point.

Poincare-Bendixson Theorem. Stability of periodic solutions, rotation points, foci, nodes and saddle points.

Unit 3 -

Linear second order equations-preliminaries. Basic facts. Theorems of Sturm. Sturm-Liouvelle Boundary Value Problems. Number of Zeros. Nonoscillatory equations and principal solutions. Nonoscillation theorems.

Unit 4 -

Use of Implicit function and fixed point theorems- periodic solutions. Linear equations. Nonlinear problems.

Unit 5 -

Second Order Boundary Value Problems- Linear Problems. Nonlinear problems. Aprori bounds.

Recommended Books :

[1] P. Hartman, Ordinary Differential Equations, John Wiley (1964).

Reference Books :

[1] W.T. Reid, Ordinary Differential Equations, John Wiley & Sons, NY (1971).

[2] E.A. Coddington and N. Levinson, Theory of Ordinary Differential Equaions, Mc Graw Hill, NY (1955).

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Max. Marks 50

Regular	Private
Theory Marks : 40	**Theory Marks : 50**
C.C.E. Marks : 10	

M.Sc./M.A. SEMESTER - II

Optional Paper V (ii) Advanced Discrete Mathematics - II

Unit 1 -

Directed Graphs. Indegree and Outdegree of a Vetex. Weighted Undirected Graphs. Dijkstra's Algorithms. Strong connectivity and Warshall's Algorithms. Directed Tress. Search Trees. Tree Traversals.

Unit 2 -

Introductry Computability Theory- Finite State Machines and their Transition Table Diagrams. Equivalence of Fintie State Machines. Reduced Machines. Homomorphism. Finite Automata. Acceptors.

Unit 3 -

Non- deterministic finite Automata and equivalence of its power to that of Deterministics Finte Automata Moore and Mealy Machines.

Unit 4 -

Turing Machine and Partial Recursive Functions.

Grammars and Languages - Phrase- Structure Grammars. Rewriting Rules. Derivations.

Unit 5 -

Sentential forms. Language generated by a Grammar . Regular , Context -Free , and Context Sensitive Grammers and Languages Regular Sets, Regular Expressions and the Pumping Lemma Kleenes Theorem.

Notions of Syntax Analysis. Polish Notations Conversion of Infix Experessions to Polish Natations. The Reverse Polish Notation.

Recommended Books :

[1] J.P.Trembly & R.Manohar, Discrete mathematical Structures with Applications to Computer Science, McGraw Hill Book Co. 1997.

[2] N. Deo, Graph Theory with applications to Engineering and Computer Sciences, Prentice Hall of India.

Reference Books :

[1] J.L.Gersting, Mathematical Structures for Computer Science, (3rd edittion), Computer Science Press, New york.

[2] Seymour Lepschutz, Finite Mathematics (International edition 1983) McGraw- Hill Book Company, Newyork.

[3] S.Wiitala,Discrete Mathematics - A Unified Approach, MC graw- Hill Book Co.

[4] J.E.Hopcroft and J,D. Ullman, Introduction to Automata Theory Languages & Compulation Narosa Publishing House.

[5] B. Singh, R.S.Chandel and Akhilesh Jain, Advanced Discrete Mathematics,Golden Valley Publications.

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Max. Marks 50

Regular	Private
Theory Marks : 40 **C.C.E. Marks : 10**	**Theory Marks : 50**

M.Sc./M.A. SEMESTER - II

Optional Paper V (iii) Differential Geometry of Manifolds - II

Unit I -

Associated fibre bundle. Vector bundle. Induced undle. Bundle homomorphisms.

Unit II -

Riemannian manifolds. Riemannian connection. Curvature tensors. Sectional Curvature. Schur's theorem.

Unit III -

Geodesics in a Riemannian manifold. Projective curvature tensor. Conformal curvature tensor.

Unit IV -

Submanifolds & Hypersurfaces. Normals. Gauss' formulae. Weingarten equations. Lines of Curvature. Generalised Gauss and Mainardi-Codazzi equations.

Unit V -

Almost Complex manifolds. Nijenhuis tensor. Contravariant and covariant almost analytic vector fields. F-connection.

Recommended Books :

[1] B.B. Sinha, An Introduction to Modern differential Geometry, Kalyani Publishers, New Delhi, 1982.

[2] K. Yano and M. Kon, Structure of Manifolds, World Scientific Publishing Co. Pvt. Ltd., 1984.

References Books :

[1] R.S. Mishra, A Course in tensors with applications to Riemannian Geometry, Pothishala (Pvt.) Ltd., 1965.

[2] R.S. Mishra, Structures on a differentiable manifold and their applications, Chandrama Prakashan, Allahabad, 1984.

Max. Marks 50

Regular	Private
Theory Marks : 25 C.C.E. Marks : 10 Practical Marks: 15	Theory Marks : 35 Practical Marks: 15

M.Sc./M.A. SEMESTER - II

Optional Paper V (iv) **Programming in C (Theory & Practical) -II**

Unit-1

Control Flow - Conditional Branching, the Switch Statement. looping. nested loops

Unit-2

The Break and Continue statement . the goto statement infinite loops.

Unit-3

Operators and Expressions - Precedence and associatively. Unary plus and Minus operators. Binary Arithmetic operators arithmetic assignment operators. Increment and decrement operators. Comma Operator Relational operators logical operators bit- Manipulation operators Bitwise assignment operators. Cast operators size of Operators , Conditional Operators , memory operator.

Unit-4

Arrays and multidimensional Arrays. Storage Classes - fixed vs. Automatic Duration Scope, global variable

Unit-5

The Register Specifier Structures and Unions.

Recommended Books:

(1) Peter A Darnell and Philip E. Margolis, C; A Software Engineering Approched narosa Publishing House (Springer International Student Edition) 1993.

Reference Books:

(1) Samuel P. Harkison and Gly L Steele Jr. C; A Reference manual , 2an Edition Prentice hall 1984.

(2) Brain W Kernigham & Dennis M Ritchie the C Programmed Language 2nd Edition (ANSI features), Prentice Hall 1989.

COURSE STRUCTURE FOR

M.Sc./M.A. Mathematics
III & IV Semester
2012-2013

COURSE STRUCTURE
M.Sc./M.A. SEMESTER - III 2012-2013
MATHEMATICS

Name of the Papers	Theory (M.M.)	Mini. Pass. M.	C.C.E.	Mini. Pass. M.	Practical M.M.	Mini. Pass. M.	Total
Compulsory Paper 1. **Inregration Theory & Functional Analysis-I**	40	13	10	04	----	----	50
Optional Paper's Four papers out of the following have to be chosen, opting not more than one from each group.							
Group I (1) **Advanced Functional Analysis-I** (2) **Partial Differential Equations** (3) Differentiable Structures on manifolds-I (4) General Theory of Relativity and Cosmology-I	40	13	10	04	----	----	50
Group II (1) Algebraic Topology-I (2) **Abstract Harmonic Analysis-I** (3) Advanced Graph Theory-I (4) **Advanced Special Function-I**	40	13	10	04	----	----	50
Group III (1) **Theory of Linear Operators-I** (2) Advanced Numerical Analysis -I (3) Fuzzy Sets and their Applications-I	40	13	10	04	----	----	50
Group IV (1) **Operations Research -I** (2) Computational Biology -I (3) Jacobi Polynomial & H-Function-I (4) Fluid Mechanics -I	40	13	10	04	----	----	50
Group V (1) Wavelets-I (2) Bio- Mechanics -I (3) Analytic Number Theory-I (4) **Integral Transform-I**	40	13	10	04	----	----	50
Group VI (1) **Fundamentals of Computer Science(Theory & Practical) - I** (2) Mathematics of Finance & Insurance -I (3) Spherical Trigonometry and astronomy-I	25 40	09 13	10 10	04 04	15 ----	06 ----	50
Paper VI Comprehensive Viva- Voce							50
Grand Total							**300**

13.06.12 13-6-2012 13/6/2012 13.6.12

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अधिकतम अंक/Max. Marks 50

कक्षा Class : **M.Sc. (Mathematics)**

सेमेस्टर Semester : **III**

विषय समूह का शीर्षक Title of Subject : **Advanced Functional Analysis-I**

Group : **I(1)**

प्रश्न पत्र कं. Paper No. : **1**

अनिवार्य/ वैकल्पिक Compulsory/ Optional : **Optional**

Unit-1

Definition and examples of topological vector Spaces Convex, Balanced and absorbing sets and their properties.

Unit-2

Minkowski's functionals, Subspace product space and quotient space of a topological Vector space. Chapter 1 of R. Larsen.

Unit-3

Locally convex topological Vector Spaces. Normable and metrizable topological vector spaces .

Unit-4

Complete topological vector spaces and Frechet space.Chapter 2 and 3 of R. Larsen.

Unit-5

Linear transformations and linear functionals and their continuity. Chapter 2 and 3 of R. Larsen.

Text Books:-

1- Functional Analysis with Applications by A.H. Siddiqi, Tala Mc. Graw Hill Publishing Company.

2- Linear Topological Spaces by Kelley J.L. , Van Nostrand East West Press, New Delhi.

Reference Books:-

1- Toposigical Vector spaces and Distributions by John Horvath, Addison-Wesley Publishing Company, 1966.

2- Modern methods in Topological vecotr spaces by albert Wilansky, Mcgraw-Hill, 1978.

3- Functional Analysis by K. Chandra Sekhar Rao, Narosa 2002.

13.6.12 13.6.12

अधिकतम अंक/Max. Marks 50

कक्षा Class : **M.Sc. (Mathematics)**

सेमेस्टर Semester : **III**

विषय समूह का शीर्षक Title of Subject : **Partial Differential Equations**

Group : **I (2)**

प्रश्न पत्र कं. Paper No. : **2**

अनिवार्य/ वैकल्पिक Compulsory/ Optional : **Optional**

Unit-1

Transport Equation-Intial value Problem Non-homogeneous Equation.Laplace's Equations - Fundamental Solution, Mean Value Formula, Properties of Harmonic functions, Green's Functions, Energy Methods.

Unit-2

Heat Equation - Fundamental Solution, Mean Value Formula, Properties of Solutions, Energy Methods. Wave Equation- Solution by Spherical Means, Non-homogeneous Equations, Energy Methods.

Unit-3

Nonlinear First Order PDE. Complete integrals , Envelopes, Characteristics, Hamil ton-Jacobi Equations (Calculus of Variations, Hamiltons ODE, Legendre Transform, Hopf-Lax formulae)

Unit-4

Conservation Laws (Shocks, Entropy Condition Lax-Oleinic formula, Riemanns Problem, Long Time behaviour).
Represenation of Solutions- Separation of Variables , Similarity Solutions (Plane and Travelling Waves, Soluitions, Similarity under Scalling)

Unit-5

Fourier and Laplace Transform, Hopf- Cole Transform, Hodographand, legendre Transforms, Potential Functions, Power Series (non - charcateristic surface, Real Analytic Functions, Cauchy - Kovalevskaya Theorem).

Recommended Books :- (1) L.C. Evans, Partial Differential Equations, 1998.

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अधिकतम अंक/Max. Marks 50

कक्षा Class : **M.Sc. (Mathematics)**

सेमेस्टर Semester : **III**

विषय समूह का शीर्षक Title of Subject : **Differentiable Structures on manifolds-I**

Group : **I (3)**

प्रश्न पत्र कं. Paper No. : **3**

अनिवार्य/ वैकल्पिक Compulsory/ Optional : **Optional**

Unit-1

Submanifolds & Hyper surfaces. Normals. Gauss's formulde, Weingarten equations.

Unit-2

Lines of Curvature. Generalized Gauss and Mainrdi - Codazzi equations .

Unit-3

almost complex manifolds, Njenhuis tensors. Contravariant and covariant almost analytic vector fields.

Unit-4

F-connection, almost Hermit manifolds.

Unit-5

almost analytic vector fields. cUrvature tensor, Linera connection.

Recommended Books.

1. B.B. Sinha, An Introduction to modern Differential Geometry, Kalyani Publishers, new Delhi, 1982
2. K. Yano and M. Kon structure of Manifolds. world scientific Publishing C. Pvt. Ltd. 1984
3. A. Behaneu, Geomatry of CR- sub manifolds, D. Reidel Publishing company, Dordrecht, 1986

Reference Books:

(i) R.S. Mishra, A course in tensor with application to Riemannian geometry

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अधिकतम अंक/Max. Marks 50

कक्षा Class : **M.Sc. (Mathematics)**

सेमेस्टर Semester : **III**

विषय समूह का शीर्षक Title of Subject : **General Theory of Relativity and Cosmology-I**

Group : **I (4)**

प्रश्न पत्र कं. Paper No. : **4**

अनिवार्य/ वैकल्पिक Compulsory/ Optional : **Optional**

Unit-1 Transformation of coordinates. Tensors. Algebra of Tensors. Symmetric and skew symmetric Tensors.

Unit-2 Contraction of tensors and quotient law. Riemannian metric. Christoffel Symbols.

Unit-3 Covariant derivatives. Gradient, Divergence and Curl.

Unit-4 Intrinsic derivatives and geodesics, Riemann Christoffel curvature tensor and its symmetry properties.

Unit-5 Intrinsic derivatives and geodesics, Riemann Christoffel curvature tensor and its symmetry properties.

Recommended Books:

[1] S.R.Roy and Raj Bali: Theory of Relativity Jaipur Publishing House,Jaipur, 1987.
[2] S. K. Shrivastva: General Relativity and Cosmology, PHI, New Delhi.
[3] J.V. Narlikar, General Relativity and Cosmology: The Macmillan Company of India Limited, 1978.

References:

[1] C.E. Weatherburn, An Introduction to Riemannian Geometry and the tensor Calculus, Cambridge University, Press 1950.
[2] H. Stephani, General Relativity: An Introduction to the theory of the gravitational field, Cambridge University Press 1982.
[3] A.S. Eddington, The Mathematical Theory of Relativity. Cambridge University Press, 1965.
[4] R. Adler, M. Bazin, M. Schiffer, Introduction to general relativity, McGraw Hill Inc.,1975.

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अधिकतम अंक/Max. Marks

कक्षा Class : **M.Sc. (Mathematics)**

सेमेस्टर Semester : **III**

विषय समूह का शीर्षक Title of Subject : **Algebraic Topology-I**

Group : **II (1)**

प्रश्न पत्र कं. Paper No. : 1

अनिवार्य/ वैकल्पिक Compulsory/ Optional : **Optional**

Unit-1

Deformation retracts and homotopy type

Unit-2

Fundamental group of Sn for n > 1, and some surfaces.

Unit-3

The Jordan seperation theorem,

Unit-4

The Jordan curve theorem ,

Unit-5

Imbedding graphs in plane.

Book recommended :

[1] J.R. Munkres, Topology, Second edition, Prentice - Hall of India, 2000.

[2] J.R. Munkres, Elements of Algebraic topolgy, Addison - Wesley Pubshing company, 1984

13.6.12 13.6.12

Signature Not Verified

ARPANA BHARDWAJ
E=ARPANABHARDWAJ1@GMAIL.COM,

अधिकतम अंक/Max. Marks 50

कक्षा Class : **M.Sc. (Mathematics)**

सेमेस्टर Semester : **III**

विषय समूह का शीर्षक Title of Subject : **Abstract Harmonic Analysis I**

Group : **II(2)**

प्रश्न पत्र कं. Paper No. : **2**

अनिवार्य/ वैकल्पिक Compulsory/ Optional : **Optional**

Unit-1

Topological groups, Examples of topological groups and its basic Properties. Subgroups and quotient groups.

Unit-2

Product groups and projective limits. (See G. Bachman[1]) Continuity, homeomorphism. left translate, right translate, inversion mapping, inner automorphism,

Unit-3

Homogenous topological group . Properties of topological groups involving connectedness. Invariant pseudo-metrics and separation axioms.

Unit-4

Symmetric neighbourhood of identity, compact sets, Structure theory for compact and locally compact Abelian groups. (See Hewitt and Ross [3]), Locally compact topological groups

Unit-5

Compact support subgroups and quotient groups of topological groups, topology for quotient group, open sets, Open mapping, Hausdorff quotient group compact quotient group.

Recommended Books.

1- George Bachman Elements of Abstract Harmonic Analysis Acadmic Press, New Your. 1964

2- Taqdir Hussain Introduction to Topological Group W.D. Saudss Company 1966 to ok W.O.

3- Walter Rudin, Fourier Analysis On Group Intersceince publisher , John wiley, New York,1967

Reference Books.

1- Edwin Hewit and Kenneth A. Ross. Abstract Harmonic Analysis -1, Springer - Verlag, Berlin, 1963.

2- lynn H. Loomis : An Introduction to Abstract Harmonic Analysis, D, Van Nostrand Co. Princet

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अधिकतम अंक/Max. Marks 50

कक्षा Class : **M.Sc. (Mathematics)**

सेमेस्टर Semester : **III**

विषय समूह का शीर्षक Title of Subject : **Inregration Theory & Functional Analysis-I**

Group :

प्रश्न पत्र कं. Paper No. : **1**

अनिवार्य/ वैकल्पिक Compulsory/ Optional : **Compulsory**

Unit-1

Signed measure. Hahn decomposition theorem, mutually singular measures. Radon-Nikodim theorem. Lebesgue decomposition. Riesz representation theorem.

Unit-2

Extension theorem (Caratheodory), Lebesgue -Stieltjes integral, product measures, Fubini's theorem.Differentiation and Integration.

Unit-3

Normed linear spaces. Banach spaces and examples. Quotient space of normed linear spaces and its completeness,

Unit-4

Equivalent norms. Riesz lemma, basic properties of finite dimentional linear spaces and compactness.

Unit-5

Weak convergence and bounded linear transformations, normed linear spaces of bounded linear transformations, dual spaces with examples.

Text Books :

[1] E. Kreyszig, Introductory Functional Analysis with applications, John Wiley & Sons New York.

[2] G.F. Simmons, Introduction to Topology & Modern Analysis Mc Graw Hill, New York.

Reference :

[1] B. Choudhary and Sudarshan Nanda. Functional Analysis with applications, Wiley Eastern Ltd.

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अधिकतम अंक/Max. Marks 50

कक्षा Class :	**M.Sc. (Mathematics)**
सेमेस्टर Semester :	**III**
विषय समूह का शीर्षक Title of Subject :	**Advanced Graph Theory- I**
Group :	**II(3)**
प्रश्न पत्र कं. Paper No. :	**3**
अनिवार्य/ वैकल्पिक Compulsory/ Optional :	**Optional**

Unit-1 Revision of graph theoretic preliminaries, Operations on graphs. Graph Isomorphism Disconnected graph and their Components. Traveling salesman problem, round table problem,

Unit-2 Eulerian and Hamiltonian Paths and circuits.

Unit-3 Properties of trees, Distance centre, radius, diameter eccentricity and related theorems, Graph as Metric space Rooted and binary trees,

Unit-4 Labelled graph and trees spanning tree, weighted spanning tree, Shortest path,

Unit-5 fundamental cutsets. Rank and nullity, cutsets and cut vertices, fundamental cutsets,

Text Book :-

1- Graph Theory with Application to Engineering and Computer Science by Narsingh Deo.

Reference Book :-

1- Graph Theory by Harary.

13.6.12 13.6.12

Signature Not Verified
ARPANA BHARDWAJ
E=ARPANA.BHARDWAJ1@GMAIL.COM,

अधिकतम अंक/Max. Marks 50

कक्षा Class : **M.Sc. (Mathematics)**

सेमेस्टर Semester : **III**

विषय समूह का शीर्षक Title of Subject : **Advanced Special Function I**

Group : **II(4)**

प्रश्न पत्र कं. Paper No. : **4**

अनिवार्य/ वैकल्पिक Compulsory/ Optional : **Optional**

Unit-1

Gamma and Beta Functions : The Euler or Mascheroni Constant ? , Gamma Function, A series for ' (z) / Γ (z) , Difference equation ?(z+1) = z?(z),

Unit-2

Beta function, value of ?(z) ?(1-z), Factorial Function, Legendre's duplication formula, Gauss multiplication theorem.

Unit-3 Hypergoemetric and Generalized Hypergeometric functions: Function 2F1 (a,b;c;z) A simple integral form evaluation of 2F1 (a,b;c;z)

Unit-4 Contiguous function relations, Hyper geometrical differential equation and its solutions, F (a,b;c;z) as function of its parameters.

Unit-5 Elementary series manipulations, Simple transformation, Relations between functions of z and 1 -z

:Books Recommended ;

1- Rainville, E.D, ; Special Functions, The Macmillan co., New york 1971,

2- Srivastava, H.M. Gupta, K.C. and Goyal, S.P.; The H-functions of One and Two Variables with applications, South Asian Publication, New Delhi.

3- Saran, N., Sharma S.D. and Trivedi, - Special Functions with application, Pragati prakashan, 1986.

Reference Books.

1- Lebdev, N.N, Special Functions and Their Applications, Prentice Hall, Englewood Cliffs, New jersey, USA 1995.

2- Whittaker, E.T. and Watson, G.N., A Course of Modern Anal

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अधिकतम अंक/Max. 50

कक्षा Class :	M.Sc. (Mathematics)
सेमेस्टर Semester :	III
विषय समूह का शीर्षक Title of Subject :	Theory of Linear Operators I
Group :	III(1)
प्रश्न पत्र कं. Paper No. :	I
अनिवार्य/ वैकल्पिक Compulsory/ Optional :	Optional

Unit-I

Spectral theory in normed linear spaces, resolvent set and spectrum, Spectral properties of bounded linear operators. Properites of resolvent and spectrum, Spectral maping theorem for polynomials.

Unit-2

Spectral radius of a bounded linear operator on a complex Banach space. Elementary theory of Banach alegbras. General properties of compact linear operators. Spectral properties of compact linear operators on normed spaces. Chapter 7,8 (E. Kreyszig).

Unit-3

Behaviours of Compact linear operators with respect to solvability of operators equations. Fredholm type theorems. Fredholm alternative theorem. Fredholm alternative for integral equations

Unit-4

Spectral properties of bounded self -adjoint linear operators on a complex Hilbert space. Positive operators. Monotone sequence theorem for bounded self -adjoint operators on a complex Hilbert space.

Unit-5

Square roots of a positive operator. projection operators. Spectral family of a bounded self -adjoint linear operator and its properties.

Recommended Books:

(1) E. Kreyszig Introductory functional analysis with applications, Jhon wiley & Sons, Nwe York, 1978.

Referance Books:

(1) P. R. Halmos Introduction to Hilbert space and the theory of Spectral Multiplicity, Second edition, Chelsea publishing co. N.Y. 1957.

(2) N. Dundford and J.T. Schwartz, linear operator -3 part, Interscience / Wiley, New York 1958-71.

(3) G.Bachman and L. Narci, Functuional analysis, Academic press New York, 1966.

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अधिकतम अंक/Max. Marks 50

कक्षा Class : **M.Sc. (Mathematics)**

सेमेस्टर Semester : **III**

विषय समूह का शीर्षक Title of Subject : **Advanced Numerical Analysis I**

Group : **III(2)**

प्रश्न पत्र कं. Paper No. : **3**

अनिवार्य/ वैकल्पिक Compulsory/ Optional : **Optional**

Unit-1

Piece wise and spline interpolation

Unit-2

Bivariate inter polation Approximation,

Unit-3

Least squares approximation

Unit-4

Uniform approximation Rational approximation, choice of method

Unit-5

Numerical differentiation optimum choice of step length

Text book -

(1) Numerical Methods for scientific and Engineering computation by M.K. Jain, S.R.K. Iyenger, R.K. Jain south Edition (2003) New Age.

13.6.12 12.6.12

Signature Not Verified

ARPANA BHARDWAJ
E=ARPANABHARDWAJ1@GMAIL.COM,

अधिकतम अंक/Max. M

कक्षा Class : M.Sc. (Mathematics)

सेमेस्टर Semester : III

विषय समूह का शीर्षक Title of Subject : Fuzzy Sets and Their Applications I

Group : III(3)

प्रश्न पत्र कं. Paper No. : 4

अनिवार्य/ वैकल्पिक Compulsory/ Optional : Optional

Unit-1

Fuzzy Sets-Basic definitions. A-level sets, convex fuzzy sets.

Unit-2

Basic operations on fuzzy sets Types of fuzzy sets, Cartesian, Product, Algebraic products.

Unit-3

Bounded sum and difference, t-norms and T - co norms.

Unit-4

The Extension Principle - The Zadeh's extension principle.

Unit-5

Image and inverse image of fuzzy sets, fuzzy numbers. Elements of fuzzy arithmetic.

Text Books:

(1) Fuzzy set theory and its Applications by H.J. Zimmermann. Allied Publishers Ltd., New Delhi. 1991.

(2) Fuzzy sets and Fuzzy logic by G.J. Klir and B. Yuan Prentice - Hall of India, New Delhi 1995

Reference Books:-

(1) Fuzzy sets and Uncertainty and Information by G.J. Kalia Tina A. Foljer - Prentice - Hall of India.

13.6.12 13.6.12

Signature Not Verified
ARPANA BHARDWAJ
E=ARPANABHARDWAJ1@GMAIL.COM,

अधिकतम अंक/Max. Marks 50

कक्षा Class : **M.Sc. (Mathematics)**

सेमेस्टर Semester : **III**

विषय समूह का शीर्षक Title of Subject : **Operations Research I**

Group : **IV(1)**

प्रश्न पत्र कं. Paper No. : **1**

अनिवार्य/ वैकल्पिक Compulsory/ Optional : **Optional**

Unit-i

Operations Research and its scope, Origin and Development of Operations Research, Necessity of Operations Research in Industry, Characteristics of Operations Research. Model in Operations Research, Phase of Operations Research, Uses and Limitations of Operation Research,

Unit-2

Linear Programming Problems, Graphical Solution Method,General Linear Programming Problems, Mathematical Formulation, Graphical Solution Method.

Unit-3

Simplex Method exceptional cases, artificial variable techniques ; Big M method, two phase Method , Problem of degeneracy.

Unit-4 Duality: Fundamental Properties of duality and theorem of duality.

Unit-5

Transportation problems, Assignments problems.

Recommended Books :-

1- Kanti Swarup, P.K. Gupta and Manmohan, Operations Research, Sultan Chand & Sons, New Delhi.

Reference Books:-

1- S.D, Sharma, Operation Research,

2- F.S, Hiller and G.J. Lieberman, Industrial Engineering Series, 1995 (This book comes with a CD containing software)

3- G. Hadley , Linear Programming, Narosa Publishing House. 1995.

4- G. Hadley, Linear and Dynamic programming, Addison - Wesley Reading Mass.

5- H.A. Taha, Operations Research - An introduction, Macmillan Publishing co. Inc. New york.

6- Prem Kumar Gupta and D.S. Hira, Operation Reasearch, an Introdution, S. Chand & Company Ltd. New Delhi.

7- N.S. Kambo, Mathematical Programming Techniques, Affilated East - West Pvt. Lt

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अधिकतम अंक/Max. Marks 50

कक्षा Class :	**M.Sc. (Mathematics)**
सेमेस्टर Semester :	**III**
विषय समूह का शीर्षक Title of Subject :	**Computational Biology- I**
Group :	**IV(2)**
प्रश्न पत्र कं. Paper No. :	**2**
अनिवार्य/ वैकल्पिक Compulsory/ Optional :	**Optional**

Unit-1 Basic concepts of Molecular biology

Unit-2 DNA and Proteins, The Central Dogma, Gene and Genome Sequences.

Unit-3 Restriction Maps - Graphs, Interval graphs. Measuring Fragment sizes.

Unit-4 Algorithms for double digest problem (DDP) - Algorithms and complexity.

Unit-5 Approaches to DDP.

Text Books:-

1- Introduction to Computational Biology by M.S, Waterman Chapman & Hall, 1995

2- Bio informatics - A practical Guide to the analysis of Genes and Proteins by A. Baxevanis and B. Ouelette, WileyInterscience (1998).

Reference Books:-

1- Introduction to Bio informatics by Attwood.

2- Bioinformatics-Sequence and Genome analysis by David W.Mount.

13.6.12 13.6.12

अधिकतम अंक/Max. Marks 50

कक्षा Class : **M.Sc. (Mathematics)**

सेमेस्टर Semester : **III**

विषय समूह का शीर्षक Title of Subject : **Jacobi Polynomial and H-Function I**

Group : **IV(3)**

प्रश्न पत्र कं. Paper No. : **3**

अनिवार्य/ वैकल्पिक Compulsory/ Optional : **Optional**

Unit-1

Jocobi Polynomials. Bateman's Generating functions.

Unit-2

Rodrigues formula Orthogonality.

Unit-3

Differential recurrence relations. Pure recurrence relations. Mixed relations.

Unit-4

The H Functions of one variable. Definition. Asymptotic expansion.

Unit-5

Simple transformation and elementary properties. Mellin and Laplace transforms. Special cases.

Books Recommended :

1- Rainville. E.D. : Special Functions. The Macmillan Co.. New. York. 1971.

2- Shrivastava. H.M. , Gupta K.C. and Goyal. S.P. : The H- Functions of One and Two Variables with applications. South Asian Publication New Delhi.

Reference Books :

1- Lebdev. N.N. Special functions and Their Applications. Prentice Hall. Englewood Hall phase new jersy USA, 1965.

2- Whittaker. E.T, and Watson G.N. A Course of Modern analysis. Cambridge University Press. London 1963

13.6.12 13.6.12

अधिकतम अंक/Max. M

कक्षा Class : M.Sc. (Mathematics)

सेमेस्टर Semester : III

विषय समूह का शीर्षक Title of Subject : Fluid Mechanics- I

Group : IV(4)

प्रश्न पत्र कं. Paper No. : 4

अनिवार्य/ वैकल्पिक Compulsory/ Optional : Optional

Unit-1 Lagrangian and Eulerian Methods

Unit-2 equation of continuity, types of flow lines, velocity potential,

Unit-3 stream function irrigational and rotational motions, vortex lines.

Unit-4 Lagrange's and Euler's equation of motion, burnoulli's theorem.

Unit-5 irrotational motion in two dimensions,

Text Books.

1- A text book of Fluid Mechanics in SI units by R.K. Rajput.

2- An introduction to Fluid Dynamics by R.K. Rathy, Oxford and IBH Published Co.

Reference Books:

1- Fluid Mechanics (Springer) By Joseph H. Spurk.

2- Fluid Mechanics by Irfan A Khan (H.R.W.)

3- An Introduction to Fluid Mechanics by G.K. Batchelor, Foundation Books, New Delhi, 1994.

अधिकतम अंक/Max. Marks 50

कक्षा Class :	**M.Sc. (Mathematics)**
सेमेस्टर Semester :	**III**
विषय समूह का शीर्षक Title of Subject :	**Wavelets- I**
Group :	**V(1)**
प्रश्न पत्र कं. Paper No. :	**1**
अनिवार्य/ वैकल्पिक Compulsory/ Optional :	**Optional**

Unit-1 Haar's simple wavelets

Unit-2 Haar Wavelet transforms, Inverse Haar Wavelet transforms,

Unit-3 Multi dimensional wavelets, Two - dimensional Haar Wavelets.

Unit-4 Application of wavelets, Noise reduction Data compression, Edge detection, Daubechies wavelet (DW),

Unit-5 approximation of samples with D wavelets, Fast DW transform and its inverse.

Text Books:-

1- Wavelets made easy by Y. Nieveregelt

2- A first Course on Wavelets by E. Hernandez and G. Weiss.

Reference Books.

1- An Introduction to Wavelets by Chui, Academic Press.

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अधिकतम अंक/Max. Marks 50

कक्षा Class : **M.Sc. (Mathematics)**

सेमेस्टर Semester : **III**

विषय समूह का शीर्षक Title of Subject : **Bio-Mechanics- I**

Group : **V(2)**

प्रश्न पत्र कं. Paper No. : **2**

अनिवार्य/ वैकल्पिक Compulsory/ Optional : **Optional**

Unit-1 Bio-physics of Human Cardio - vascular system: Types of Blood Vessels, Properties of Blood

Unit-2 Flow in Tubes, Poiseuibles law, Erythrocyte Sedimentation Rate . Stroke's law , Palatial flow in elastic vessels.

Unit-3 Bio - physics of Human Thermo- Regulation Head Flow in Human Dermal and Subdermal parts

Unit-4 Derivation of Governing partial differential equations Incorporating

Unit-5 Microcirculation and perspiration.

Text books:

1- Introduction to Mathematical Biology by S.I. Rubinow, J. Wiley & Sons.

2- Biomechanics by Y.C, Fung, Springer - Verlag.

3- Introduction to Biomathematics by V.P. Saxena, Vishwa Prakashan (Wiley eastern)

Reference Book :-

1- Biofluid Dynamics by Mazumdar.

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Signature Not Verified

ARPANA BHARDWAJ
E=ARPANABHARDWAJ1@GMAIL.COM,

अधिकतम अंक/Max. Marks 50

कक्षा Class : **M.Sc. (Mathematics)**

सेमेस्टर Semester : **III**

विषय समूह का शीर्षक Title of Subject : **Analytic Number Theory- I**

Group : **V(3)**

प्रश्न पत्र कं. Paper No. : 3

अनिवार्य/ वैकल्पिक Compulsory/ Optional : **Optional**

Unit-1 Characters of finite abelian groups

Unit-2 The Character Group, Dirichlet characters

Unit-3 Sums involving Dirichilet characters.

Unit-4 Dirichlet Theorem on primes in arithmetic progressions.

Unit-5 Dirichlet series and Euler products,

Book Rocommneded :

1- T.M. Apostol, Introduction to Analytic Number Theory, Narosa Pub, House, 1989.

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अधिकतम अंक/Max. Marks 50

कक्षा Class : M.Sc. (Mathematics)

सेमेस्टर Semester : III

विषय समूह का शीर्षक Title of Subject : Integral Transform I

Group : V(4)

प्रश्न पत्र कं. Paper No. : 4

अनिवार्य/ वैकल्पिक Compulsory/ Optional : Optional

Unit-1

Application of Laplace Transforms

Unit-2

Laplace's equations.

Unit-3

Laplace's wave equation

Unit-4

Application of Laplace Transforms

Unit-5

Heat conduction equation.

Books recommended :-

[1] Integral Transforms by Goyal & Gupta.

[2] Integral Transforms by Sneddon

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अधिकतम अंक/Max. Marks 50

कक्षा Class : **M.Sc. (Mathematics)**

सेमेस्टर Semester : **III**

विषय समूह का शीर्षक Title of Subject : **Fundamentals of Computer Science - I (Theory and Practical)**

Group : **VI(1)**

प्रश्न पत्र कं. Paper No. : **1**

अनिवार्य/ वैकल्पिक Compulsory/ Optional : **Optional**

Unit 1 -

Object Oriented Programming Paradigm, Basic Concepts, Benefits and Applications of Object Oriented Programming.

Unit 2 -

C++ - Introduction, Tokens, Keywords, Identifiers and Constants, Basic Data Types, User-Defined Data Types, Derived Data Types, Variables, Operators in C++, Expressions, Implicit Conversions.

Unit 3 -

Operator Overloading, Operator Precedence, Control Structure - The if Statement, The switch Statement, The do...while Statement, The while Statement, The for statement.

Unit 4 -

Functions in C++, The main Function, Function Prototyping, Call by Reference, Inline Function, Function Overloading, Friend and Virtual Functions.

Unit 5 -

Classes and Objects : Specifying a Class, Defining Member Function, Nesting of Member Function, Private Member Functions, Arrays within a Class, Static Data Members, Static Member Functions, Pointers to Members.

Reference Books :

[1] E. Balagurusamy, Object Oriented Programming with C++, III Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi.

[2] B. Stroustrup, The C++ programming Language, Addition Wesley.

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अधिकतम अंक/Max. Marks 50

कक्षा Class :	M.Sc. (Mathematics)
सेमेस्टर Semester :	III
विषय समूह का शीर्षक Title of Subject :	Mathematics of Finance and Insurance- I
Group :	VI(2)
प्रश्न पत्र कं. Paper No. :	2
अनिवार्य/ वैकल्पिक Compulsory/ Optional :	Optional

Unit-1 Elements of Theory of Interest

Unit-2 Flow Valuation Annuities

Unit-3 Amortization and Sinking Funds, brief review of probability theory.

Unit-4 Survival Distributions , Life Tables, Valuing Contingent Payment Life insurance,

Unit-5 life annuities, Net Premiums Insurance Models including Expenses .

Text Books:

1 Options, Futures and other Drivatives by Jhon C. Hull Prentice -Hall of India Pvt. Ltd.

2 An introduction to Mathematic Finance by Cheldon M. Ross. Cambridge University Press

Reference Books:

1 An Introduction to Mathematics of Financial Derivatives by Salih N.Neftci, Academic Press. Inc.

2 Mathematics of Financial markets by Ribert J. Elliot & P.E. Kopp Springer Verlag, New Yorlk Inc

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ARPANA SHARMA

अधिकतम अंक/Max. Marks 50

कक्षा Class : **M.Sc. (Mathematics)**

सेमेस्टर Semester : **III**

विषय समूह का शीर्षक Title of Subject : **Spherical Trigonometry an Astronomy- I**

Group : **VI(3)**

प्रश्न पत्र कं. Paper No. : **4**

अनिवार्य/ वैकल्पिक Compulsory/ Optional : **Optional**

Unit-1 Fundamental of Spherical Trigonometry

Unit-2 solution of right angled triangle

Unit-3 Properties of Right angle triangle

Unit-4 Relation between Sides & angles of a Spherical triangle

Unit-5 Application of Spherical triangle & Examples.

Text Books:-

1- A text book of spherical trigonometry : Gorakh Prasad.

2- A text book of spherical Astronomy : Gorakh Prasad.

Reference Book.

1- Spherical Astronomy - Smarat

2- spherical Astronomy - Bell

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M.Sc./M.A. SEMESTER - IV 2012 -2013 **(Regular Students)**

MATHEMATICS

Name of the Papers	Theory (M.M.)	Mini. Pass. M.	C.C.E.	Mini. Pass. M.	Practical M.M.	Mini. Pass. M.	Total
Compulsory							
Paper 1. **Functional Analysis-II**	40	13	10	04	----	----	50
Optional Paper's							
Four papers out of the following have to be chosen, opting not more than one from each group.							
Group I							
(1) **Advanced Functional Analysis-II**	40	13	10	04	----	----	50
(2) **Mechanics**							
(3) Differentiable Structures on manifolds-II							
(4) General Theory of Relativity and Cosmology-II							
Group II							
(1) Algebraic Topology-II	40	13	10	04	----	----	50
(2) **Abstract Harmonic Analysis-II**							
(3) Advanced Graph Theory-II							
(4) **Advanced Special Function-II**							
Group III							
(1) **Theory of Linear Operators-II**	40	13	10	04	----	----	50
(2) Advanced Numerical Analysis -II							
(3) Fuzzy Sets and their Applications-II							
Group IV							
(1) **Operations Research -II**	40	13	10	04	----	----	50
(2) Computational Biology -II							
(3) Jacobi Polynomial & H-Function-II							
(4) Fluid Mechanics -II							
Group V							
(1) Wavelets-II	40	13	10	04	----	----	50
(2) Bio- Mechanics -II							
(3) Analytic Number Theory-II							
(4) **Integral Transform-II**							
Group VI							
(1) **Fundamentals of Computer Science (Theory & Practical) -II**	25	09	10	04	15	06	50
(2) Mathematics of Finance & Insurance -II	40	13	10	04	----	----	
(3) Spherical Trigonometry and astronomy-II							
Paper VI							
Comprehensive Viva-Voce							50
Paper VII							
Job Oriented Project Work							50
Grand Total							**350**

Note: Above Mentioned bold Optional Papers are teaching in the University and Colleges. If any College wants to change their optional Papers. Kindly inform to the Dy. Registrar (Examination), Vikram University, Ujjain.

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Signature Not Verified

ARPANA BHARDWAJ
E=ARPANA.BHARDWAJ1@GMAIL.COM,

अधिकतम अंक/Max. Marks 50

कक्षा Class :	**M.Sc. (Mathematics)**	**Theory Marks : 40**
सेमेस्टर Semester :	**IV**	**C.C.E. Marks : 10**
विषय समूह का शीर्षक Title of Subject :	**Functional Analysis II**	
Group :		
प्रश्न पत्र कं. Paper No. :	**1**	
अनिवार्य/ वैकल्पिक Compulsory/ Optional :	**Compulsory**	

Unit-1

Uniform boundedness theorem and some of its consequences. Open mapping and closed graph theorems. Hahn-Banach theorem for real linear spaces.

Unit-2

Complex linear spaces and normed linear spaces. Reflexive spaces. Weak Sequential compactness, Compact operators, Solvability of linear equations in Banach spaces.

Unit-3

The Closed range theorem, Inner product spaces, Hilbert spaces, orthonormal sets, Bessels inequality.

Unit-4

Complete Orthonormal sets and Parseval's identity, Structure of Hilbert spaces. projection theorem. Riesz representation theorem.

Unit-5

Adjoint of an operator on a Hilbert space. Reflexivity of Hilbert spaces. Self-adjoint operators, Positive operators, Projection, and Unitary operators.

Text Books :

[1] E. Kreyszig, Introductory Functional Analysis with applications, John Wiley & Sons.
[2] G.F. Simmons, Introduction to Topology & Modern Analysis Mc Graw Hill, New

Reference :

[1] B. Choudhary and Sudarshan Nanda. Functional Analysis with applications, Wiley Eastem Ltd. .

अधिकतम अंक/Max. Marks 50

कक्षा Class :	**M.Sc. (Mathematics)**	**Theory Marks : 40**
सेमेस्टर Semester :	**IV**	**C.C.E. Marks : 10**

विषय समूह का शीर्षक Title of Subject : Advanced Functional Analysis-II

Group : I(1)

प्रश्न पत्र कं. Paper No. : 1

अनिवार्य/ वैकल्पिक Compulsory/ Optional : Optional

Unit-1

Finite - dimensional topological vector spaces. Linear Varieties and Hyperplanes. Geometric form of Hahn -Banch theorem. . Chapter 2(2.2), 5(5.1, 5.2) 6(6.2), 7 and 9 (9.4) of R. Larsen.

Unit-2

Uniform - Boundedness principle. Open Mapping theorem and closed graph theorem for Frehet spaces, Banach - Alaouglu theorem. Chapter 6(6.2), 7 and 9 (9.4) of R. Larsen.

Unit-3

Extreme points and Extremal sets. Krein- Milman's theorem. Duality polar. Bipolar theorem. Baralled and Bornological spaces.

Unit-4

Macekey Spaces. Sami-reflexive and Reflexive topological vector spaces. Montel Spaces and Schwarz spaces. Quasi-completeness. Chapter 11(11.1, 11.2) of R. Larsen

Unit-5

Inverse Limit and inductive limit of locally convex spaces. Distributions. [Walter Rudin and L.V. Kantorovich and G.P. Akilov].

Recommended Books :

[1] R.Larsen, Functional Analysis, Marcel Dekker, Inc. New york, 1973.

[2] Walter Rudin, Functional Analysis, TMH Edition,1974.

[3] L.V.Kantorovich and G.P. Akilov, Functional Analysis, Pergamon Press 1982.

Reference Books :

1. Laurent Schwartz, Functional Analysis Courant Institute of Mathematical Sciences, New York University, 1964.

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अधिकतम अंक/Max. Marks 50

कक्षा Class :	**M.Sc. (Mathematics)**	**Theory Marks : 40**
सेमेस्टर Semester :	**IV**	**C.C.E. Marks : 10**
विषय समूह का शीर्षक Title of Subject :	Mechanics	
Group :	I(2)	
प्रश्न पत्र कं. Paper No. :	2	
अनिवार्य/ वैकल्पिक Compulsory/ Optional :	**Optional**	

Unit-1

Generalized cordinates. Holonomic and Non-holonomic systems. Scleronomic and Rheonomic System Generalized Potential. Lagrange's equations of first kind. Lagrange's equations of second Kind. Uniqueness of solution. Energy equation for conservative fields.

Unit-2

Hamilton's variables, Hamilton's canonical equations, Donkin's theorem, Matovating probelms of calculus of variations, Shortest distance. Minimum surface of revolution. Brachistochrone problem. Fundamental lemma of calculus of variations. Euler's equation for one dependent function and its generalization to (i) n dependent functions. (ii)higher order derivatives.

Unit-3

Hamilton's Principle. Principle of least action, Hamilton-Jacobi equation (time-dependent and time-independent), Whittaker's equations, Statement of Lee HWA Chung's theorem, Poincare Carten Integal invariant.

Unit 4-

Poisson's Bracket. Poisson's Identity. Jacobi-Poisson theorem, Lagrange Brackets. Condition of canonical character of a transformation in terms of Lagrange brackets and Poisson brackets, Invariance of Lagrange brackets and Poisson brackets under canonical transformations.

Unit-5

Hamilton-Jacobi Theory: Solution of Hamilton-Jacobi equation, Jacobi theorem. Method of saperation of variables.

Attraction and Potential of rod, disc, Spherical shells and sphere.

Reference Books:

(1) Narayanan Chandra Rana & Pramod Sharad Chandra Joag, Classical Mechanics, Tata Mcgraw Hill 1991.

(2) F. Gantmacher, Lectures in Analytic Mechanics MIR Publishers.

(3) M. Ray, Attraction and Potential, Student's Friends and Company, Agra.

(4) H. Goldstein Classical Machanics (2nd Edition), Narosa Publishing House , .

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अधिकतम अंक/Max. Marks 50

कक्षा Class :	**M.Sc. (Mathematics)**	**Theory Marks : 40**
सेमेस्टर Semester :	**IV**	**C.C.E. Marks : 10**
विषय समूह का शीर्षक Title of Subject :	Differentiable Structures on manifolds-II	
Group :	I(3)	
प्रश्न पत्र कं. Paper No. :	3	
अनिवार्य/ वैकल्पिक Compulsory/ Optional :	**Optional**	

Unit-1

Kahler manifolds. Affine conncetion

Unit-2

Holomorphic sectional curvature. Curvature tensor. Almost analytic vector fields.

Unit-3

Nearly Kahler manifolds, Curvature identities. Constant Holomorphic sectional curvature

Unit-4

Almost analytic vector fields Almost Kahler Manifold Anilities vector fields, Almost Contact manifolds : Lie derivative normal contact structure

Unit-5

Affinely almost almost cosymplectic manifold, Almost Grayn manifolds: D-conformal transformation, Perticular affined connection K- Contact Rumanian manifolds.

Reference Books.

1- B.B, Sinha, An Introduction to Modern Differential Geometry, Kalyani Publishers, New Delhi. 1982.

2- K. Yano and M. Kon, Structure of Manifolds, World Scientific Publishing co-Pvt. Ltd. 1984.

3- A. Bejaneu, Geometry of Cr- Submanifolds, D. Reidel Publishing Company, , 1986

Reference Books:

1- R.S, Mishra, A course in tensons with application to Riemannian geometry pothishala Pvt. Ltd. 1965.

2- R.S. Mishra, Structures on Differentiable manifold and theire applications, Chandrema Prakashan , 1984.

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अधिकतम अंक/Max. Marks 50

	M.Sc. (Mathematics)	**Theory Marks : 40**
सेमेस्टर Semester :	**IV**	**C.C.E. Marks : 10**

विषय समूह का शीर्षक Title of Subject : General Theory of Relativity and Cosmology-II

Group : I(4)

प्रश्न पत्र कं. Paper No. : 4

अनिवार्य/ वैकल्पिक Compulsory/ Optional : **Optional**

Unit-1

Review of the special theory of relativity and the Newtonian Theory of gravitation. Principle of equivalence and general covariance, geodesic principle.

Unit-2

Newtonian approximation of relativistic equations of motion. Einstein's field equations and its Newtonian approximation.

Unit-3

Schwarzschild external solution and its isotropic form. Planetary orbits and anologues of Kepler's Laws in general relativity. Advance of perihelion of a planet

Unit-4

Bending of light rays in a gravitational field. Gravitational redshift of spectral lines. Radar echo delay.

Unit-5

Energy-momentum tensor of a perfect fluid. Schwarzschild internal solution. Boundary conditions.

Recommended Books:

[1] S.R.Roy and Raj : Theory of Relativity Jaipur Publishing House,Jaipur, 1987.

[2] S. K. Shrivastva: General Relativity and Cosmology, PHI, .

[3] J.V. Narlikar, General Relativity and Cosmology: The Macmillan Company of Limited, 1978.

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अधिकतम अंक/Max. Marks 50

कक्षा Class :	**M.Sc. (Mathematics)**	**Theory Marks : 40**
सेमेस्टर Semester :	**IV**	**C.C.E. Marks : 10**
विषय समूह का शीर्षक Title of Subject :	Algebraic Topology-II	
Group :	II(1)	
प्रश्न पत्र कं. Paper No. :	1	
अनिवार्य/ वैकल्पिक Compulsory/ Optional :	**Optional**	

Unit-1

Free product of groups, Free groups, the Siefert - van Kampen theorem and its applications

Unit-2

Classfication of Surfaces : Fundamental groups of surfacees,

Unit-3

Homology of surfaces, Cutting and pasting Construction of Compact surfaces,

Unit-4

Cutting and pasting Construction of Compact surfaces, Equivalence The classification theorem.

Unit-5

Equivalence of covering space, Covering transformations, The universal covering space and its existence. :

Book recommended :

[1] J.R. Munkres, Topology, Second edition, Prentice - Hall of India, 2000.

[2] J.R. Munkres, Elements of Algebraic topolgy, Addison -

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अधिकतम अंक/Max. Marks 50

कक्षा Class :	**M.Sc. (Mathematics)**	**Theory Marks : 40**
सेमेस्टर Semester :	**IV**	**C.C.E. Marks : 10**
विषय समूह का शीर्षक Title of Subject :	Abstract Harmonic Analysis-II	
Group :	II(2)	
प्रश्न पत्र कं. Paper No. :	2	
अनिवार्य/ वैकल्पिक Compulsory/ Optional :	**Optional**	

Unit-1

The Haar covering function Existence and properties of Haar covering function Definition and properties of the function Ig (f) . Existence and Uniqueness of the Haar integral ,

Unit-2

Translation in Lp(G), uniform continuity of translation character, Characters, Characters group, properties of characters

Unit-3

Character group or dual group Locally compact abelian group non - trivial complex homomorphism.

Unit-4

The Fourier transform, Convolution, convolution of function set A (Γ) of all Fourier transforms invariance, of A (Γ),

Unit-5

Fourier Stieltjes transform set B(Γ) of all Fourier Stieltjes transform, invariance of B (Γ), Duality Theorem.

Recommended Books.

1- George Bachman Elements of Abstract Harmonic Analysis Acadmic Press, New Your. 1964

2- Taqdir Hussain Introduction to Topological Group W.D. Saudss Company 1966 to ok W.O.

3- Walter Rudin, Fourier Analysis On Group Intersceince publisher , John wiley, New York , 1967

Reference Books.

1- Edwin Hewit and Kenneth A. Ross. Abstract Harmonic Analysis -1, Springer - Verlag, Berlin, 1963.

2- lynn H. Loomis : An Introduction to Abstract Harmonic Analysis, D, Van Nostrand Co. Princeton.

अधिकतम अंक/Max. Marks 50

कक्षा Class : **M.Sc. (Mathematics)** **Theory Marks : 40**

सेमेस्टर Semester : **IV** **C.C.E. Marks : 10**

विषय समूह का शीर्षक Title of Subject : Advanced Graph Theory-II

Group : II(3)

प्रश्न पत्र कं. Paper No. : 3

अनिवार्य/ वैकल्पिक Compulsory/ Optional : **Optional**

Unit-1

Connectivity and separability in graphs Abstract graphs geometric graphs planar graphs Kurtowski two graphs embedding and regions of a planar graphs Detection of planarity

Unit-2

Geometric dual and combinationa dual.

Unit-3

Coloring and covering of graphs, Chromatic, Polynomial chromatic partitioning Dimmer problem Domination sets independent sets, Four colour conjecture.

Unit-4

Digraph and types of digraphs, Digraph and binary relation Equivalence relation in a graph Directed path walk circuit and connectedness Eulerian digraph, arborscence matrices A, B and C of digraphs.

Unit-5

Adjacency metric of a digraph, Alogorithms, Kruskal algorithm, Prism algorithm, Dijkastra Algorithm.

Text Book :-

1- Graph Theory with Application to Engineering and Computer Science by Narsingh Deo.

Reference Book :-

1- Graph Theory by Harary.

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अधिकतम अंक/Max. Marks 50

कक्षा Class : **M.Sc. (Mathematics)** **Theory Marks : 40**

सेमेस्टर Semester : **IV** **C.C.E. Marks : 10**

विषय समूह का शीर्षक Title of Subject : Advanced Special Function-II

Group : II(4)

प्रश्न पत्र कं. Paper No. : 4

अनिवार्य/ वैकल्पिक Compulsory/ Optional : **Optional**

Unit-1

Bessel function and Legendre polynomials : Definition of Jn (z), Bessel's differential equation ,Generating function, Bessel's integral with index half and an odd integer,

Unit-2

Generating function for Legendre polynomials Rodrigues formula, Bateman's generating function, Additional generating funtions, Hypergeometric forms of Pn (X) , Special properties of PnX), Some more generating functions, Laplace's first integral form, Othergonality.

Unit-3

Special properties of PnX), Some more generating functions, Laplace's first integral form, Othergonality.

Unit-4

Definition of Hermite polynomials Hn(x), Pure recurrence relations, Differential recurrence relations, Rodrigue's formula, Other generating functions, Othogonality, Expansion of polynomials, more generating functions.

Unit-5

Laguerre Polynomials : The Laguerre Polynomials Ln(X), Generating functions, Pure recurrence relations, Differential recurrence relation, Rodrigo's formula, Orthogonal, Expansion of polynomials, Special properties, Other generating functions.

Books Recommended ;

1- Rainville, E.D, ; Special Functions, The Macmillan co., New york 1971,

2- Srivastava, H.M. Gupta, K.C. and Goyal, S.P.; The H-functions of One and Two Variables with applications, South Asian Publication, New Delhi.

3- Saran, N., Sharma S.D. and Trivedi, - Special Functions with application, Pragati prakashan, 1986.

Reference Books.

1- Lebdev, N.N, Special Functions and Their Applications, Prentice Hall, Englewood Cliffs, New jersey, USA 1995.

2- Whittaker, E.T. and Watson, G.N., A Course of Modern Analysis Cambridge University Press, London, 1963

अधिकतम अंक/Max. Marks 50

कक्षा Class :	**M.Sc. (Mathematics)**	**Theory Marks : 40**
सेमेस्टर Semester :	**IV**	**C.C.E. Marks : 10**
विषय समूह का शीर्षक Title of Subject :	Theory of Linear Operators-II	
Group :	III(1)	
प्रश्न पत्र कं. Paper No. :	1	
अनिवार्य/ वैकल्पिक Compulsory/ Optional :	**Optional**	

Unit-1

Spectral representation of bounded self- adjoint linear operators. Spectral theorem. Spectral measures. Spectral Integral.

Unit-2

Regular Spectral Measure. Real and Complex Spectral Measure. Complex Spectral Integral Description of the Spectral Subspaces. Characterization of the Spectral Subspaces.

Unit-3

The Spectral theorem for bounded Normal Operators. Unbounded linear operators in Hilbert spece. Hellinger- Toeplitz theorem. Hilbert adjoint operators.

Unit-4

Symmetric and self -adjoint linear operators. Closed linear operators and closures. Spectrum of an unbounded self-adjoint linear operators.

Unit-5

Spectral theorem for unitary and self- adjoint linear operators. Multiplication operator and Differentiation Operator. Chapter 10, E. Kreyszig.

Recommended Books:

(1) E. Kreyszig Introductory functional analysis with applications, Jhon wiley & Sons, Nwe York, 1978.

Referance Books:

(1) P. R. Halmos Introduction to Hilbert space and the theory of Spectral Multiplicity, Second edition, Chelsea publishing co. N.Y. 1957.

(2) N. Dundford and J.T. Schwartz, linear operator -3 part, Interscience / Wiley, New York 1958-71.

(3) G.Bachman and L. Narci, Functuional analysis, Academic press , 1966

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Signature Not Verified

ARPANA SHARDWAJ
E=ARPANASHARDW
AJ1@GMAIL.COM,

अधिकतम अंक/Max. Marks 50

कक्षा Class : **M.Sc. (Mathematics)** **Theory Marks : 40**

सेमेस्टर Semester : **IV** **C.C.E. Marks : 10**

विषय समूह का शीर्षक Title of Subject : Advanced Numerical Analysis -II

Group : III(2)

प्रश्न पत्र कं. Paper No. : 2

अनिवार्य/ वैकल्पिक Compulsory/ Optional : **Optional**

Unit-1

Extrapolation methods ordinary differential equations. multi step methods Predicator and corrector method

Unit-2

stability analysis of multistep methods. Ordinary differential equation

Unit-3

boundary value problems shooting method.

Unit-4

Finte difference methods

Unit-5

finite element method

Text book -

(1) Numerical Mmethod for scientific and Engineering computation by M.K. Jain, S.R.K. Iyenger, R.K. Jain south Edition (2003) New Age.

BSJ Jain 7.1.13

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अधिकतम अंक/Max. Marks 50

कक्षा Class :	**M.Sc. (Mathematics)**	**Theory Marks : 40**
सेमेस्टर Semester :	**IV**	**C.C.E. Marks : 10**
विषय समूह का शीर्षक Title of Subject :	Fuzzy Sets and their Applications-II	
Group :	III(3)	
प्रश्न पत्र कं. Paper No. :	3	
अनिवार्य/ वैकल्पिक Compulsory/ Optional :	**Optional**	

Unit-1

Fuzzy Relation and fuzzy graphs - Fuzzy relation on Fuzzy sets, Composition of Fuzzy relation,

Unit-2

Min-Max composition and its properties, Fuzzy equivalence relation Fuzzy compatibility relation Fuzzy relation equation Fuzzy graphs, Similarity relation.

Unit-3

Possibility Theory-Fuzzy measures, Evidence theory, Necessity Measure, possibility measure,

Unit-4

possibility distribution, possibility theory and fuzzy sets possibility theory versus probability theory.

Unit-5

Fuzzy Logic-An overview of classical logic, multivalued logics, Fuzzy proposition Fuzzy quantifiers Linguistic variables and hedges, Inference from conditional fuzzy proposition, the compositional rule of inference.

Text Books:

(1) Fuzzy set theory and its Applications by H.J. Zimmermann, Allied Publishers Ltd., , 1991.

(2) Fuzzy sets and Fuzzy logic by G.J. Klir and B. Yuan Prentice - Hall of India, ,1995

Reference Books:-

(1) Fuzzy sets and Uncertainty and Information by G.J. Kalia Tina A. Foljer - Prentice - Hall of India.

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अधिकतम अंक/Max. Marks 50

कक्षा Class :	**M.Sc. (Mathematics)**	**Theory Marks : 40**
सेमेस्टर Semester :	**IV**	**C.C.E. Marks : 10**
विषय समूह का शीर्षक Title of Subject :	Operations Research -II	
Group :	**IV**(1)	
प्रश्न पत्र कं. Paper No. :	**1**	
अनिवार्य/ वैकल्पिक Compulsory/ Optional :	**Optional**	

Unit-1

Network analysis, constraints in Network, Construction of network, Critical Path Method (CPM) PERT, PERT Calculation, Resource Levelling by Network Techniques and advances of network (PERT/CPM).

Unit-2

Dynamic Programming - recursive equation approach, Characteristic of Dynamic Program ming, Computational procedure, Integer programming Gomory's all I.P.P. method, Branch and Bound Technique.

Unit-3

Game theory - Two person Zero-sum games, Maximix-Minimax principle, games with out saddle points - Mixed strategies, Graphical solution of 2Xn and Mx2 Games, Solution by Linear Programming,

Unit-4

Non-linear programming: Mathematical Formulation, General Non-linear Programming Problems, Problems of Constrained Maxima and Minima (Kuhn-Tucker Condition), Non-negative Constraints,

Unit-5

Quadratic programming: Wolfe's Modified Simplex method, Beale's Method, Separable programming, Convex programming, Separable programming algorithms.

Recommended Books :-

1- Kanti Swarup, P.K. Gupta and Manmohan, Operations Research, Sultan Chand & Sons, New Delhi.

Reference Books:-

1- S.D, Sharma, Operation Research,

2- F.S. Hiller and G.J. Lieberman, Industrial Engineering Series, 1995 (This book comes with a CD containing software)

3- G. Hadley , Linear Programming, Narosa Publishing House. 1995.

4- G. Hadley, Linear and Dynamic programming, Addison - Wesley

5- H.A. Taha, Operations Research - An introduction, Macmillan Publishing co. Inc. .

6- Prem Kumar Gupta and D.S. Hira, Operation Reasearch, an Introdution, S. Chand & Company Ltd.

7- B.Singh, Varsha Karanjgaokar and R. S. Chandel, Operations Research, Golden Valley

Signature Not Verified
ARPANA BHARADWAJ
E=ARPANABHARADW
AJ1@GMAIL.COM,

अधिकतम अंक/Max. Marks 50

कक्षा Class :	**M.Sc. (Mathematics)**	**Theory Marks : 40**
सेमेस्टर Semester :	**IV**	**C.C.E. Marks : 10**
विषय समूह का शीर्षक Title of Subject :	Computational Biology -II	
Group :	**IV**(2)	
प्रश्न पत्र कं. Paper No. :	**2**	
अनिवार्य/ वैकल्पिक Compulsory/ Optional :	**Optional**	

Unit-1

Integer programming, Partition Problems, Traveling Salesman Problem (TSP) simulated annealing Sequence.

Unit-2

Assembly - Sequencing strategies,

Unit-3

Traveling Salesman Problem (TSP) simulated annealing Sequence.

Unit-4

Fragment alignment, Sequence accuracy,

Unit-5

sequence comparisons Methods - Local and global alignment, Dynamic programming method.

Text Books:-

1-Introduction to Computational Biology by M.S, Waterman Chapman & Hall, 1995.

2-Bio informatics - A practical Guide to the analysis of Genes and Proteins by A. Baxevanis and B. Ouelette, WileyInterscience (1998).

Reference Books:-

1- Introduction to Bio informatics by Attwood.

2- Bioinformatics-Sequence and Genome analysis by David W.Mount.

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अधिकतम अंक/Max. Marks 50

कक्षा Class : **M.Sc. (Mathematics)** **Theory Marks : 40**

सेमेस्टर Semester : **IV** **C.C.E. Marks : 10**

विषय समूह का शीर्षक Title of Subject : Jacobi Polynomial & H-Function-II

Group : **IV**(3)

प्रश्न पत्र कं. Paper No. : **3**

अनिवार्य/ वैकल्पिक Compulsory/ Optional : **Optional**

Unit-1

Differentiation formulas of H Function one Variable, Partial derivatives with respect to parameters. Contiguous relation and simple. expansion formula.

Unit-2

The H Functions of two variables, Definition and notation. Asymptotic behavior elementary properties special cases.

Unit-3

Derivatives. Contiguous relations Total Count of recurrences.

Unit-4

Finite Summation formulas for the H Functions of two variables,

Unit-5

Method and schemes for obtaining sum of finite or infinite series. Double Summation formulas.

Books Recommended :

1- Rainville. E.D. : Special Functions. The Macmillan Co.. New. . 1971.

2- Shrivastava. H.M. , Gupta K.C. and Goyal. S.P. : The H- Functions of One and Two Variables with applications. South Asian Publication New .

Reference Books :

1- Lebdev. N.N. Special functions and Their Applications. Prentice Hall. Englewood Hall phase new jersy USA, 1965.

2- Whittaker. E.T, and Watson G.N. A Course of Modern analysis. Press. 1963

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अधिकतम अंक/Max. Marks 50

कक्षा Class : **M.Sc. (Mathematics)** **Theory Marks : 40**

सेमेस्टर Semester : **IV** **C.C.E. Marks : 10**

विषय समूह का शीर्षक Title of Subject : **Fluid Mechanics-II**

Group : **IV**(4)

प्रश्न पत्र कं. Paper No. : **4**

अनिवार्य/ वैकल्पिक Compulsory/ Optional : **Optional**

Unit-1

Motion of a sphere through agapsquid at rest as infinity. equation of motion of a sphere, stress components in a real fluid.

Unit-2

Relations between rectangular components of stress convection between streses and gradients of velocity,

Unit-3

plane Poiseuille and coquette flows between two parallel plate, flow through tubes of uniform, cross - section in the former of circle, annulus under constant pressure gradient.

Unit-4

Dynamical similarity, Reynolds number, Prandt's boundary layer, boundary layer equations in two dimension, blasius solution

Unit-5

boundary layer thickness, displacement thickness, Karman itegral conditions, separation of boundary layer flow.

Text Books.

1- A text book of Fluid Mechanics in SI units by R.K, Rajput.

2- An introduction to Fluid Dynamics by R.K. Rathy, Oxford and IBH Published Co.

Reference Books:

1- Fluid Mechanics (Springer) By Joseph H. Spurk.

2- Fluid Mechanics by Irfan A Khan (H.R.W.)

3- An Introduction to Fluid Mechanics by G.K. Batchelor, Foundation Books, , 1994.

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अधिकतम अंक/Max. Marks 50

कक्षा Class : **M.Sc. (Mathematics)** **Theory Marks : 40**

सेमेस्टर Semester : **IV** **C.C.E. Marks : 10**

विषय समूह का शीर्षक Title of Subject : Wavelets II

Group : **V**(1)

प्रश्न पत्र कं. Paper No. : **1**

अनिवार्य/ वैकल्पिक Compulsory/ Optional : **Optional**

Unit-1

Inner products and orthogonal projection,

Unit-2

Applications of orthogonal projection to computer graphics, Computation of functions and wavelets, Discrete and fast Fourier transform with inverse and applications.

Unit-3

Fourier series for periodic functions its convergence and inversion, Unit-4 uniform convergence of Fourier series, Bessel's inequality, Parseval's inequality

Unit-5

The Fourier transform Convolution and inversion of Fourier transform Weight functions, approximate identities.

Text Books:-

1- Wavelets made easy by Y. Nieveregelt

2- A first Course on Wavelets by E. Hernandez and G. Weiss.

Reference Books.

1- An Introduction to Wavelets by Chui, Academic Press.

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अधिकतम अंक/Max. Marks 50

कक्षा Class : **M.Sc. (Mathematics)** **Theory Marks : 40**

सेमेस्टर Semester : **IV** **C.C.E. Marks : 10**

विषय समूह का शीर्षक Title of Subject : **Bio-Mechanics-II**

Group : **V**(2)

प्रश्न पत्र कं. Paper No. : **2**

अनिवार्य/ वैकल्पिक Compulsory/ Optional : **Optional**

Unit-1

Solution of steady state and Unsteady - state flow problems in one dimesion, application of finite element method and exact solutions.

Unit-2

Diffusion processes in biology ; diffusion in Tissue Fick's principle,

Unit-3

One, two and three Dimensional diffusion problems and their solution, Water Transport, Diffusion through membranes.

Unit-4

Respiratory Gas Flows, flow in Airways, Interaction Between convection and diffusion Exchange between Alvoelar Gas and Erythrocytes,

Unit-5

Pulmonary function Test, Dynamics of Ventilation system.

Text books:

1- Introduction to Mathematical Biology by S.I. Rubinow, J. Wiley & Sons.

2- Biomechanics by Y.C, Fung, Springer - Verlag.

3- Introduction to Biomathematics by V.P. Saxena, Vishwa Prakashan (Wiley eastern)

Reference Book :-

1- Biofluid Dynamics by Mazumdar.

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अधिकतम अंक/Max. Marks 50

कक्षा Class :	**M.Sc. (Mathematics)**	**Theory Marks : 40**
सेमेस्टर Semester :	**IV**	**C.C.E. Marks : 10**
विषय समूह का शीर्षक Title of Subject :	Analytic Number Theory-II	
Group :	V(3)	
प्रश्न पत्र कं. Paper No. :	**3**	
अनिवार्य/ वैकल्पिक Compulsory/ Optional :	**Optional**	

Unit-1

Dirichlet series and Euler products,

Unit-2

the function defined by Dirichlet series, the halfplane of convergence of a Dirichlet series.

Unit-3

Integral formula for the coefficients of Dirichlet series

Unit-4

Analytic properties of Dirichilet series, Mean value formula for Dirichilet series.

Unit-5

Properties of the gamma function, Integral representations of Hurwitz zeta functions, Analytic continuation of Hurwitz zeta function.

Book Rocommneded :

1- T.M. Apostol, Introduction to Analytic Number Theory, Narosa Pub, House, 1989.

अधिकतम अंक/Max. Marks 50

कक्षा Class : **M.Sc. (Mathematics)** **Theory Marks : 40**

सेमेस्टर Semester : **V** **C.C.E. Marks : 10**

विषय समूह का शीर्षक Title of Subject : Integral Transform-II

Group : V(4)

प्रश्न पत्र कं. Paper No. : 4

अनिवार्य/ वैकल्पिक Compulsory/ Optional : **Optional**

Unit-1

Application of Laplace Transform to Boundary Value Problems.

Unit-2

Electric Circuits. Application to Beams.

Unit-3

The complex Fourier Transform, Inversion Formula, Fourier cosine and sine transform,

Unit-4

properties of Fourier Transoforms, Convolution & Parseval's identity

Unit-5

Fourier Transform of the derivatives, Finite Fourier Sine & Cosine Transform, Inversion Operational and combined properties Fourier transform.

Books recommended :-

[1] Integral Transforms by Goyal & Gupta.

[2] Integral Transforms by Sneddon

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अधिकतम अंक/Max. Marks 50

Theory Marks : 25

C.C.E. Marks : 10

Practical Marks : 15

कक्षा Class : **M.Sc. (Mathematics)**

सेमेस्टर Semester : **IV**

विषय समूह का शीर्षक Title of Subject : **Fundamentals of Computer Science - II (Theory and Practical)**

Group : **VI(1)**

प्रश्न पत्र कं. Paper No. : **1**

अनिवार्य/ वैकल्पिक Compulsory/ Optional : **Optional**

Unit 1 -

Inheritance, Single Inheritance, Multilevel Inheritance, Multiple Inheritance, Hierarchical Inheritance, Hybrid Inheritance, Templates including Class Templates.

Unit 2 -

C++ Streams, C++ Stream Classes, put() and get() Functions, getline() and write() Functions.

Unit 3 -

Database Systems - Role of Database Systems, Database Systems Architecture.

Unit 4 -

SQL -Basic Features including views, Integrity Constraints, Key, Functional Depedency, Multivalued Functional Dependency, Database Design- Normalization up to BCNF.

Unit 5 -

Operating Systems - User Interface, Processor Mangement, Memory management , Network and Distributed Systems.

Reference Books :

[1] E. Balagurusamy, Object Oriented Programming with C++, III Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi.

[1] S.B.Lipman , J Lajoi; C++ Primer Addison Wesley.

[2] C.J. Date ; Introduction to Database systems, Addition Wesley.

[3] C. Ritchie; Operating Systems, Incorporating UNIX and Windows, BPB Publications.

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अधिकतम अंक/Max. Marks 50

कक्षा Class : **M.Sc. (Mathematics)** **Theory Marks : 40**

सेमेस्टर Semester : **IV** **C.C.E. Marks : 10**

विषय समूह का शीर्षक Title of Subject : Mathematics of Finance & Insurance -II

Group : **VI**(2)

प्रश्न पत्र कं. Paper No. : **2**

अनिवार्य/ वैकल्पिक Compulsory/ Optional : **Optional**

Unit-1

A Brief introduction to financial Markets,

Unit-2

basics of Securities, Stocks Bonds and financial derivatives,

Unit-3

Viz forwards, Futures, Options and Swaps.

Unit-4

An Introduction to stochastic Calculus stochastic process, geometric Brownian motion stochastic integration andI ito's lemma

Unit-5

Option Pricing models- Binamial Models and Black Scholes Option Pricing Model for European Options, Black Scholes formula and computation of greeks.

Text Books:

Options, Futures and other Drivatives by Jhon C. Hull Prentice -Hall of India Pvt. Ltd. An introduction to Mathematic Finance by Cheldon M. Ross, Cambridge University Press.

Reference Books:

An Introduction to Mathematics of Financial Derivatives by Salih N.Neftci, Academic Press, Inc.

mathematics of Financial markets by Ribert J. Elliot & P.E. Kopp Springer Verlag, New Yorlk Inc.

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अधिकतम अंक/Max. Marks 50

कक्षा Class :	**M.Sc. (Mathematics)**	**Theory Marks : 40**
सेमेस्टर Semester :	**IV**	**C.C.E. Marks : 10**
विषय समूह का शीर्षक Title of Subject :	Spherical Trigonometry and astronomy-II	
Group :	**VI**(3)	
प्रश्न पत्र कं. Paper No. :	**3**	
अनिवार्य/ वैकल्पिक Compulsory/ Optional :	**Optional**	

Unit-1

Spherical Astronomy - Various system of references and related topics.

Unit-2

Celestial sphere,

Unit-3

Transit instrument. Atmospheric Retraction. Time planetary phenomena.

Unit-4

Atmospheric Retraction.

Unit-5

Time planetary phenomena.

Text Books:-

1- A text book of spherical trigonometry : Gorakh Prasad.
2- A text book of spherical Astronomy : Gorakh Prasad.

Reference Book.

1- Spherical Astronomy - Smarat
2- spherical Astronomy - Bell

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