BOTANY 2018

Theory

Course	Nomenclature	Number of Papers	Number of Periods per week	Maximum marks	Minimum marks
Paper I	Algae, Lichens and Bryophytes	1	2	50	
Paper II	Mycology, Microbiology and Phytopathology	1	2	50	54
Paper III	Palaeobotany, Pteridophytes and Gymnosperms	1	2	50	
PRACTICAL COURSE			6	75	27

Duration of examination of each theory papers   3 hours
Duration of examination of practicals   5 hours

PAPER I: ALGAE, LICHENS AND BRYOPHYTES

Unit I: General characters, Classification and economic importance of Algae. Important features and life history of Chlorophyceace and Charophyceae. Structure and life cycle of *Volvox,Oedogonium*, *Coleochaete* and *Chara*.

Unit II: Important features and life history of Xanthophyceae and Phaeophyceae. Structure and life cycle of Vaucheria, Ectocarpus and Sargassum.

Unit III: Important Features and life history of Rhodophyceae. Structure and life cycle of Polysiphonia. Lichens: Morphology and structure of the two components; biological, ecological and economic importance.Vegetative multiplication methods with special reference to Parmelia and Usnea.

Unit IV: Bryophytes: General characters, alternation of generations and classification.Characters and Classification of Hepaticopsida. Morphology and life history of Riccia, Marchantia and Plagiochasma.

Unit V: Characters and classification of Anthocerotopsida and Bryopsida. Morphology and life history of Anthoceros and Sphagnum.

Suggested Laboratory Exercises
Algae: Microscopic preparation and study of following algal materials: *Volvox, Oedogonium, Coleochaete, Vaucheria, Chara, Ectocarpus, Sargassum* and *Polysiphonia*
Lichens: Study of Lichens
Bryophytes: Study of external morphology and microscopic preparations of following Bryophytes: *Riccia*, Marchantia*, Plagiochasma, Anthoceros* and *Sphagnum*

Suggested Readings

Bold, H.C., Alexopoulous, C.J. and Delevoryas, T. Morphology of Plant and Fungi (4th Ed.) Harper & Foul Co., New York, 1980.

Ghemawat, M.S., Kapoor, J.N. and Narayan, H.S. A text book of Algae, Ramesh Book Depot, Jaipur, 1976.

Gilbert, M.S. Cryptogamic Botany, Vol. I & II (2nd Ed.), Tata McGraw Hill, Publishing Co. Ltd., New Delhi, 1985.

Kumar, H.D. Introductory Phycology, Affiliated East–West Press, Ltd., New York, 1988.

Pandey, S.N. and Trivedi, P.S.A Text Book of Botany 2000 Volume I, Vikas Pub. House Pvt. Ltd., New Delhi.

Puri, P.Bryophytes, Atmaram & Sons, Delhi, Lucknow, 1985.

Singh, V., Pande, P.C. and Jain, D.K.A Text Book of Botany, Rastogi & Co., Meerut, 2001.

Vashista, B.R. Botany for Degree Students (Algae, Fungi Bryophyta), S. Chand & Co. Ltd., New Delhi, 2002.

PAPER II: MYCOLOGY, MICROBIOLOGY AND PHYTOPATHOLOGY

Unit I: General characters, Classification and economic importance of fungi. Important features and life history of Mastigomycotina–*Pythium* and *Albugo*; *Zygomycotina–Rhizopus*; *Ascomycotina–Saccharomyces, Aspergillus* and *Penicillium*.

Unit II: Important features and life history of Basidiomycotina– *Puccinia, Agaricus* and wild Mushroom and *Ustilago*; Deuteromycotina–*Collectotrichum* and *Alternaria*.

Unit III: Viruses: Chemical and physical nature; Structure, multiplication and transmission of plant viruses. Tobacco mosaic virus and yellow vein mosaic virus disease. General account of Viroids, AIDS and Prions.

Unit IV: Bacteria–Structure, nutrition, cell division, reproduction and economic importance. Biofilms and Quorum sensing in microbes.Cyanobacteria–Life history of *Nostoc* and *Oscillatoria*; Nitrogen fixation – by BGA (Blue green algae).General account and biology of Mycoplasma and Phytoplasma.

Unit V: Causes and symptoms of plant diseases with special reference to green ear disease of Bajra, smut of wheat, citrus canker, little leaf of brinjal and root knot disease. A brief account of principles of plant protection.

Suggested Laboratory Exercises

Microscopic preparation and study of following fungal materials: *Albugo, Rhizopus, Saccharomyces, Aspergillus, Penicillium, Ustilago, Agaricus,* local Mushroom¸ *Colletotrichum* and *Alternaria*. Viruses: Study of disease symptoms caused by Tobacco mosaic virus and yellow vein mosaic virus.

Bacteria: Gram staining of bacteria. *Nostoc, Oscillatoria* and study of bacteriological specimens. Study of symptoms of following diseases: (specimen or photographs)

Green ear disease of bajra

Smut of wheat

Citrus canker

Rust of wheat

Little leaf of bringal

Root knot nematode.

Suggested Readings

Alexopoulos, C.J. and Mims.Introductory Mycology, John Wiley and Sons, New York, 2000.

Bilgrami, K.S. and Dube, H.C. A Text Book of Modern Plant Pathology, Vikas Publ. House, New Delhi, 1976.

Biswas, S.B. and Biswas, A.An Introduction to Viruses, Vikas Publ. House, New Delhi, 2000.

Clifton, A.Introduction to Bacteria, McGraw Hill Co., New York, 1985.

Dube, H.C. Fungi, Rastogi Publication, Meerut, 1989.

Kaushik, P. Microbiology, Emkay Publication, 2001.

Madahar, C.L. Introduction to plant viruses, S. Chand & Co. Ltd., New Delhi, 1978.

Palezer, Chan and King. Microbiology, McGraw Hill Book Co., London, 1995.

Pathak, V.N. Fundamentals of Plant Pathology, Agro Botanica. 2000.

Purohit, S.S. Microbiology, Agro. Bot. Publication, Jodhpur, 2002.

Sharma, O.P. Fungi, Today and tomorrow Publication, 2000.

Sharma, P.D. Microbiology and Plant Pathology, Rastogi Publ. Meerut, 2003.

Singh, V. and Srivastava, V.Introduction to Bacteria, Vikas Publication, 1998.

Vashista, B.R. Botany for Degree student Fungi, S. Chand & Co., New Delhi, 2001.

PAPER III: PALAEOBOTANY, PTERIDOPHYTES AND GYMNOSPERMS

Unit I: Geological time scale, Fossilization. General characters and classification and Pteridophytes.Important characteristics of Psilopsida, Lycopsida, Sphenopsida and Pteropsida.Stelar systems in Pteridophyta.Structure and reproduction in *Rhynia*.

Unit II: Occurrence, Structure and life history of *Lycopodium, Selaginella* and *Equisetum*.

Unit III: Occurrence, structure and life history of *Adiantum, Marsilea* and *Azolla*. Heterospory in Pteridophyta.

Unit IV: Characteristics of seed plants, evolution of the seed habit. General features of gymnosperms and their classification; evolution, diversity and economic importance of Gymnosperms.*Cycas*:Morphology of vegetative and reproductive parts, anatomy of root, stem and leaf; Reproduction and life cycle.

Unit V: *Pinus* and *Ephedra*: Morphology of vegetative and reproductive parts, anatomy of root, stem and leaf, reproduction and life cycle.

Suggested Laboratory Exercises

Palaeobotany: Microscopic examination of slides of *Rhynia*.

Pteridophytes: Study of external morphology of *Lycopodium, Selaginella, Equisetm, Adiantum, Marsilea,* and *Azolla*. Microscopic study of temporary double stained preparations of stem/rhizome of *Lycopodium, Selaginella, Equisetum* and *Marsilea*.

Study of temporary single stained microscopic preparations of cone of *Selaginella* and T.S. of Sporophyll of *Adiantum* and sections of sporocarp of *Marsilea*.

Gymnosperms:Study of external morphology of plant parts of *Cycas*: young and old foliage leaf, scale leaf, bulbils, male cone, microsporophyll, megasporophyll and mature seed (if material is not available show photographs).

Microscopic temporary double stained preparations of rachis and leaflet of Cycas. Study of T.S. normal and Corolloid root by permanent slides.

Study of external morphology of plant parts of *Pinus* habit, long and dwarf shoot, male cone; female cone; winged seeds.

Microscopic temporary preparation of pollen grains (W.M.) of *Pinus*. Study through permanent slides T.S. stem: young and old; male/female cone of *Pinus*.

Study of habit and structure of whole male and female cone of *Ephedra*.

Microscopic preparation of male and female flowers of *Ephedra*.

Suggested Readings

Bold, H.C., Alexopolous, C.J. and Delevoryas, T. Morphology of plant and fungi (4th ed.), Harper and Foul, Co., New York, 1980.

Gifford, E.M. and Foster, A.S. Morphology and Evolution of Vascular Plants, W.H. Freeman and Company, New York, 1988.

Pandey, S.N., Mishra, S.P., Trivedi, P.S. A Text Book of Botany Vol. II, Vikas Pub.House Pvt. Ltd., New Delhi 2000.

Raven, P.H. Evert, R.F. and Eichhom, S.C. Biology of plants, (5th ed.), W.H. Reema and Co., Worth Publication, New York, U.S.A., 1999.

Sharma, O.P. Pteridophytes, Today and tomorrow Publication, 2000.

Sporne, K.R. The Morphology of Gymnosperms, B.I. Publ. Pvt., Bombay, Calcutta, Delhi, 1991.

Vashista, P.C. Gymnosperm, S. Chand & Co. Ltd., New Delhi, 2002.

Vashista, P.C. Pteridophyta, S. Chand & Co. Ltd., New Delhi, 2002.

Wilson, N.S. and Rothewall, G.W.Palaeobotany and evolution of Plants, (2nd ed.), Cambridge University Press, U.K., 1993.

BIOTECHNOLGOY 2018

PAPER I: BIOCHEMISTRY AND BIOSTATISTICS

Max Marks: 50

Unit 1: Introduction: General Composition of living matter-A Brief account and function of biomolecules. Bioenergetics: Principles of bioenergetics. Energy Rich compounds. Biological oxidation-reduction reactions.
Water: Properties of water molecule, Hydrophilic and hydrophobic groups in biological molecules.
Carbohydrates: Classification and general structure and properties of monosaccharides.
Lipids: Classification and general structure, properties of fats and Oils.

Unit II: Amino Acids: Classification, general structure and properties
Proteins: Classification three–dimensional structure (helicity, bending, pleats, salt-bridges etc) and the basis for intermolecular interactions in enzyme– substrate and antigen-antibody recognition.
Nucleotides: Composition, General structure and properties.
Nucleic Acids: Types and general structure, Non-canonical DNA Structures (Bent DNA, cruciform triple stranded, G quartet, slipped DNA)

Unit III: Enzymes: Classification, Nature specificity & mechanism of catalysis, kinetics, inhibition, allosteric control.
Enzyme Technology: Enzyme Production, various sources of enzymes, extraction, purification & packaging.
Enzyme Applications: Therapeutic, Manipulative, Industrial and Analytical (ELISA & Biosensors)

Unit IV: Collection, classification, Tabulation and diagrammatic and graphical representation of statistical data: Histogram, pie chart, bar diagram, frequency polygon. Measurement of central tendency: Mean, Median, Mode.

Unit V: Measurement of dispersion : Mean Deviation, Standard Deviation, Standard Error, Variance, Coefficient of correlation, test for significance : t-test, (Single sample Mean and Two sample Mean), Chi-Square Test and F-Test.

PAPER II:CELL BIOLOGY AND GENETICS

Max Marks: 50

Unit I: Cell as a basic unit of living systems: The cell theory.Prokaryotic and Eukaryotic Cell, Eukaryotic Cell – Shape Size, Volume, and Number.

Broad classification of cell types: PPLOs, Bacteria, Plant and Animal cells. A detail classification of cell types within an organism.Cell, tissue, organ and organisms as different levels of organization.

Unit II: Structure and functions of cell organelles; ultra structure of cell membranes, Cytosol, Golgibodies, Endoplasmic reticulum (rough and smooth), Ribosome, Cytoskeletal structure (actins, microtubule etc), Mitochondria, Chloroplasts, Lysosomes, Peroxisomes, and Nucleus (Nuclear membrane, nucleoplasm, nucleolus and chromatin).

Cell division, cell cycle and cell growth.

Unit III: Nature of genetic material, nucleic acids, DNA replication, Mendelian laws of inheritance, gene interaction.

Sex determination in plants and animals.Sex linkage, non-disjunction as a proof of chromosomal theory of inheritance.Linkage mapping of genes, interference, coincidence in Prokaryotes and Eukaryotes.

Unit IV: Chromosome: Chemical composition: Structural organization of chromatids, centromeres, chromatin, telomeres, nucleosomes, euchromatin and heterochromatin. Special types of chromosomes (e.g. polytene and lampbrush chromosomes); Mutations; spontaneous and induced; chemical and physical mutagens.

Unit V: Basic microbial genetics; conjugation, transduction and transformation.Isolation of auxotrophs, Replica plating techniques, analysis of mutations in biochemical pathways, one-gene-one-enzyme hypothesis. Extra chromosomal inheritance, genetic systems of mitochondria and chloroplast

Max Marks: 50

Unit I: Development of microscopy (Optical, TEM and SEM).The Concept of sterilization, Methods of sterilization (Dry heat, wet heat, radiation, chemicals and filtration etc.)

Unit II: Prokaryotic and eukaryotic microbial cells. The various forms of microorganisms-PPLO'S, Cocci,Bacilli and Spirilla. Nature of microbial cell surfaces,gram (+) ve and gram (-) ve bacteria, Types of bacteria on the basis of flagella. Flagellar types in Gram (+) ve and Gram (-) ve bacteria.

Unit III: Nutritional classification of microorganisms-symbiosis and antibiosis among microbial populations.Microorganisms in extreme environments.Pathogenicity among microorganisms. Defence mechanism against microorganisms and Serotypes.

Unit IV: Microbial metabolism: Spontaneous and induced variation arising in microbial population.Recombination events in bacteria. Nitrogen-fixing microbes in Agriculture.Products from microorganisms-fermentation products, and antibiotics.

Unit V: Computers: General introduction to Computers, organization of computers, digital and analog computers, computer algorithms.
Computer in online monitoring and automation.Application of computers in co-ordination of solute concentration, pH and temperature etc. of a fermenter in operation.
Introduction to Bioinformatics. Molecular databases, application of data associates tools e.g. BLAST, FASTA, Storage, Retrieval and analysis of sequences. Application of bioinformatics.

Practical
1. Quantitative estimation of the following in biological samples:
    a. Sugar in given solution
    b. Sugar in biological sample
    c. Extraction and separation of lipids
    d. Estimation of proteins
    e. Estimation of DNA/RNA
    f. Isolation and purification of proteins
    g. Assays for enzyme activity
    h. Kinetic activities on enzymes
    i. Chromatographic methods of separation of macromolecules

2. Demonstration of computers and application.
3. Aseptic techniques:
    a. Preparation of media, cotton plugging and sterilization
    b. Personal hygiene-microbes from hands, teeth and other body parts.
    c. Isolation of microorganism from air, water and soil sample. Dilution and pour plating, colony purification
    d. Enumeration of micro organism from: Total v/s viable counts.
    e. Identification of isolated bacteria. Gram staining, other staining methods, metabolic characteristic.
    f. Growth curve of microorganisms.
    g. Antibiotic sensitivity of microbes- use of antibiotic discs.

Suggested Readings
Cox, Nelson & Lehninger- Principles of Biochemistry, CBS Publishers & Distributors

L.Stryer- Biochemistry- W.H. Freeman & Co.

Geoffrey Zubay- Biochemistry- Mac-Millan Publishing Co.

J.L. Jain – Biochemistry – S. Chand & Co.

Conn, Stumpf & Blueumming- Outlines of Biochemistry- Wiley Eastern Ltd.

G.M. Malacinski & David Freifelder – Essentials of Molecular Biology- Jonnes &Barlet , Boston

Gardner, Simmons & Snustad- Principles of Genetics, John Wiley & Sons.

P.K. Gupta- a Text book of cell & molecular biology, Rastogi Publication Meerut.

Trevor Palmer- Enzymes- biochemistry, Biotechnology & Clinical Chemistry- Horwood Publishing House.

P D Sharma- Microbiology- Rastogi Publications

Pawar & Daginawala-General Microbiology Vol I & II – Himalaya Publishing House

A J Salle- Fundamental Principles of Bacteriology- Tata McGraw Hill

Pelczar, Chan & Kreib Microbiology – Tata McGraw Hill

Brock & Madigan- Biology of microganisms.Prentice Hall, Inc.

Higgins & Taylor – Bioinformatics, Oxford University Press.

Stephen P Hunt & Rick Liveey- Functional Genomics, Oxford University Press

Rashidi- Bioinformatics basic- Application to life Sciences & Medical Science ASM

B D Singh- Genetics, Kalyani Publishers

Practical

Time: 5.00 Hrs   Max Mark: 75

                                                        Min Mark: 27

1. Perform and explain the given biotechnology experiment.
   Show the result to the examiner   15
2. Perform and explain the given microbiology experiment.   10
3. Prepare a bacterial slide by Gram's staining method and
   report result   06
4. Identify and comment upon the spots (1 to 6)   24
5. Viva-Voce   10
6. Practical Record   10

Theory

Course	Nomenclature	Number of Papers	Number of Periods per week	Maximum marks	Minimum marks
Paper I	Taxonomy and Embryology of Angiosperms	1	2	50	
Paper II	Anatomy of Angiosperms, Economic Botany and Ethnobotany	1	2	50	54
Paper III	Cell Biology, Genetics, Plant Breeding and Evoloution	1	2	50	
PRACTICAL COURSE			6	75	27

Duration of examination of each theory papers 3 hours
Duration of examination of practicals 5 hours

PAPER I: TAXONOMY AND EMBRYOLOGY OF ANGIOSPERMS

Unit I: Diversity in plant form in annuals, biennials and perennials, Canopy architecture in angiosperms: tree-origin, development, arrangement and diversity in size and shape, Flower-modified shoot, structure and development of flower, Inflorescence-types of Inflorescence.

Unit II: Angiosperms: Origin and evolution. Some examples of primitive angiosperms. Angiosperm taxonomy; (Alpha-taxonomy, Omega-taxonomy, holotaxonomy) Taxonomic literature. Botanical nomenclature; principles and rules; taxonomic ranks, type concept, principle of priority. Classification of angiosperms; salient features of the systems proposed by Bentham and Hooker and Engler and Prantl.

Unit III: Major contributions of cytology and molecular biology, phytochemistry and taximetrics to taxonomy. Diversity of flowering plants as illustrated by members of the families Ranunculaceae, Papaveraceae, Caryophyllaceae, Capparidaceae, Cucurbitaceae, Rutaceae and Apiaceae.

Unit IV: Diversity of flowering plants as illustrated by members of the families Asteraceae, Acanthaceae, Apocynaceae, Asclepiadaceae, Scrophulariaceae, Lamiaceae, Euphorbiaceae, Musaceae and Poaceae.

Unit V: Embryology: Structure of anther and pistil. Development of the male and female gametophytes; pollen-pistil interactions, self incompatibility; Double fertilization; Development of endosperm and embryo; Brief account of experimental embryology. Basics of gene imprinting.

Suggested Laboratory Exercises

Field study of diversities found in leaf shapes, size, thickness and surface properties.

The following families are for detailed taxonomic studies:

1. Ranunculaceae: *Ranunculus, Delphinium*
2. Papareraceae: *Papaver, Argemone*
3. Caryophyllaceae: *Dianthus, Gypsophylla, Saponaria*
4. Capparidaceae: *Capparis, Cleome*
5. Rutaceae: *Murraya, Citrus*
6. Apiaceae: *Coriandrum, Foeniculum, Anethum*
7. Cucurbitaceae: *Luffa* or any Cucurbit
8. Asteraceae: *Helianthus, Calandula, Sonchus*
9. Acanthaceae: *Adhatoda, Barleria*
10. Apocynaceae: *Catharanthus, Thevetia, Nerium*
11. Asclepiadaceae: *Calotropis*
12. Scrophulariaceae: *Linaria, Antirrhinum*
13. Euphorbiaceae: *Euphorbia, Phyllanthus*
14. Lamiaceae: *Ocimum, Salvia*
15. Musaceae: *Musa*
16. Poaceae: *Avena, Triticum, Hordeum, Poa, Sorghum*

Suggested Readings

Bhandari, M.M. Flora of Indian Desert.

Bhojwani, S.S. and Bhatnagar, S.P. The Embryology of Angiosperms, 4th Revised and enlarged edition, Vikas Publ., New Delhi, 2002.

Davis, P.H. and Heywood, V.H. Principles of Angiosperm Taxonomy, Oliver and Boyd, London, 1963.

Fegerig K. and Vender Pifi The Principles of Pollination Ecology, Pergamon Press, 1979.

Gifford, E.M. and Foster, A.S. Morphology and Evolution of Vascular Plants, W.H. Freemad and Company, New York, 1979.

Heywood, V.H. and Moore, D.M. (eds.) Morphology and Evolution of Vascular Plants, W.H. Freeman and Company, New York, 1984.

Jeffrey, C. An Introduction to Plant Taxonomy, Cambridge University Press, Cambridge, London, 1982.

Jones, S.D. Jr. and Suchsinger, A.E. Plant Systematic (2nd ed.) McGraw-Hill Book Co., New York, 1986.

Maheshwari, J.K. Flora of Delhi, CSIR, New Delhi, 1963.

Redford, A.E.: Fundamentals of Plant Systematics, Harper and Row, New York, 1986.

Sharma, O.P. Taxonomy: Tata McGraw Hill Pub. Company Ltd., New Delhi 2000.

Singh, G. Plant Systematics – Theory and Practices, Oxford and IBH Pvt. Ltd., New Delhi, 1999.

Singh, V., Pandey, P.C. and Jain, D.K. Angiosperms, 2005, Rastogi Pub., Meerut.

PAPER II: ANATOMY OF ANGIOSPERMS, ECONOMIC BOTANY AND ETHNOBOTANY

Unit I: Anatomy of Angiosperms: Concept of stem cell in plants. Root system; Root apical meristem; differentiation of primary and secondary tissues and their roles; structural modification for storage, respiration, reproduction and for interaction with microbes.

Unit II: Shoot system: The shoot apical meristem and its histological organization; vascularization of primary shoot in monocotyledons and dicotyledons; cambium and its functions; formation of secondary xylem, a general account of wood structure in relation to conduction of water and minerals; characteristics of growth rings, sapwood and heart wood; secondary phloem-structure, function relationship; Periderm.

Unit III: Abnormal secondary growth and Leaf: Abnormal secondary growth in stems due to abnormal origin and activity of cambium. Leaf: Internal structure in relation to photosynthesis and water loss; adaptations to water stress; senescence and abscission.

Unit IV: Economic Botany, Food plants: Rice, wheat, maize, potato, sugarcane. Fibers: Cotton and Jute. Vegetable oils: Groundnut, mustard and coconut, General account of sources of firewood, timber and bamboos. Beverages: Tea and coffee; Rubber.

Unit V: Spices and Condiments: General account. Medicinal plants with special reference to Rajasthan: *Aloe, Asparagus, Commiphora, Boswellia, Pedalium, Zyziphus, Haloxylon, Tribulus, Vitex,* and *Withania.* Ethnobotany: Introduction, Methods of Ethnobotanical studies, knowledge of aboriginals in Rajasthan.

Suggested Laboratory Exercises

ANATOMY: L.S. of Shoot tip of study Cytohistological zonation and origin in leaf primordial. Anatomy of primary and secondary growths in monocots and dicots using hand sections (or prepared slides). Structure of secondary phloem and xylem. Growth rings in wood. Microscopic study of wood in T.S., T.L.S. and R.L.S. Internal structure of leaf. Structure and development of stomata (using epidermal peels of leaf). Anatomy of root, primary and secondary structures, Abnormal secondary growth in stem.

ECONOMIC BOTANY: Food plants: Study of morphology and structure. Simple microchemicals tests of the food storing tissues in rice, wheat, maize, potato and sugarcane. Microscopic examination of starch in these plants (except sugarcane)

Fibers: Study of cotton fiber, tests for cellulose. Vegetable oils: study of hand sections of Groundnut, Mustard and Coconut and staining of oils droplets by Sudan III and Sudan Black

Field visits: To study sources of firewood (10 plants), timber-yielding trees (10 trees) and bamboos. A list to be prepared mentioning special features

Medicinal Plants & Spices: Black pepper, cloves, cardamom describe them in briefly. Study of 10 medicinal plants. Write their botanical and common names, parts used and diseases/disorders for which they are prescribed.

Beverages & Rubber: Cofee, Tea & Rubber

ETHNOBOTANY: Ethobotanically important plants of Rajasthan (Abrus, Leptidenia and Calotropis)

Suggested Readings

Cutter, E.G. Plant Anatomy: Experiment and Interpretation, Part II. Organs, Edward Arnold, London, 1971.

Esau, K. Anatomy of Seed Plants, 2nd John Wiley & Sons, New York, 1977.

Fahn, A. Plant Anatomy. 2nd ed. Pergamon Press, Oxford, 1974.

Kocchar, S.L. Economic Botany in Tropics. 2nd ed. Mac-millan India Ltd., New Delhi, 1998.

Mauseth, J.D. Plant Anatomy, The Benjamin/Cummings Publ. Company Inc., Menloc Park, California, USA, 1988.

Sambamurthy, A.V.S.S. and Subramanyam, N.S. A Text book of Economic Botany, Wiley Eastern Ltd., New York, 1989.

Sharma, O.P. Hill's Economic Botany (Late Dr. A.F. Hill, Adapted by O.P. Sharma), Tata McGraw Hill Co., Ltd., New Delhi, 1996.

Simposon, B.B. and Conner-Ororzaly, M. Economic Botany Plants in Our World, McGraw Hill, New York, 1986.

PAPER III: CELL BIOLOGY, GENETICS, PLANT BREEDING AND EVOLUTION

Unit I: History of cell biology: Concept of cell and cell theory. Cell cycle and its regulation. Mitosis and meiosis. Structural and Molecular organization of cell. Structure and function of cell wall; plasmodesmata, plasma membrane; golgi complex, plastid, mitochondria, endoplasmic reticulum, peroxisomes, vacuoles and nucleus.

Unit II: Chromatin organization: Organization and structure of chromosomes. Concept of nucleosomes, chromatin remodeling. Types of chromosomes and determination of sex in plants. Chromosome alteration: Structural alteration; deletion, duplication, translocation, inversion; Numerical variation: aneuploidy and polyploidy. Molecular basis of mutation: Spontaneous and induced, brief account of DNA damage and repair. Introduction to epigenetics.

Unit III: Nature of inheritance; Laws of Mendelian inheritance and its exceptions. Crossing-over and linkage analysis. DNA the genetic material: Structure and replication, brief account of DNA- protein interaction. Definition of a gene-modern Concept of gene (Promoter, coding sequences, terminator). RNA polymerases and general transcription. Regulation of gene expression in prokaryotes and basics of gene regulation in eukaryotes.

Unit IV: Origin of Agriculture, Centers of origin of crop plants and centers of Diversity. Concepts of Centers and Non-center (Harlan Hypothesis) Principles of plant breeding-Domestication, Introduction, Selection, Clonal propagation, Hybridization, Mutation breeding; Breeding work done on wheat; Green revolution; Assessment and Consequences; Biodiversity and Conservation of germplasm.

Unit V: Theories of Evolution: Catastrophism, The Lamark's theory, Darwin's theory, Evidences of organic evolution, mechanism of evolution. Origin of basic biomolecules evolution of prokaryotic and eukaryotic cell. and Origin of species Population genetics: Allele and genotype frequency, Hardy- Weinberg principles.

Suggested Laboratory Exercises

CYTOLOGY
1.   Study of cell structure from onion leaf peels
2.   Comparative study of cell structure in onion cells and *Hydrilla*
3.   Smear preparation of root tips for different stages in *Allium* root tip
4.   Cytological examination special types of chromosomes (Slides)
5.   Examination of electron micrographs of eukaryotic cells and cell organelles

GENETICS
1.   Working out laws of inheritance using seed mixtures
2.   Monohybrid, dihybrid and test crosses using seed samples

PLANT BREEDING
1.   Demonstration of Emasculation techniques.

Practical Exam Scheme
B.Sc. Botany Part II
Q1. Describe a given flower in semi-technical language with flower diagram
and formula mentioning special feature of identification. Cut a T.S. of anther/ovary/ovule of
the same flower and describe from embryological point of view.

                                             (10+4)   (10+6)

Q2. Cut a T.S./V.S. of given stem/root/leaf and make a double stained preparation of the
same. Draw a labeled diagram (outline and cellular), identify with special features.
(8+6)   (9+7)

Q3. Prepare a smear of onion root tip, for observation of metaphase and anaphase stage of
mitosis. Draw a labeled diagram of the same.

                                             (12+4)   (11+3)
Q4. Spots (1-9) three from each paper   (27)   (27)
Q5. Practical record   (6)   -

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                              75   75

Suggested Readings

Alberts, B., Bray, D ., Lewis, J., Raff, M., Roberts, K. and Watson, I.D. Molecular *Biology of cell*. Garland publishing Co., New York, USA

Chaudhary, H.K. Elementary principles of plant Breeding, Oxford & IBH Publishing New Delhi.

Gupta, P.K. A Textbook of cell and Molecular Biology, Rastogi Publications, Meerut,1999

Gupta, P.K. Cytology, Genetics, Evolution and plant Breeding, Rastogi, Publication, Meerut,2000.

Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell, J. Molecular Cell Biology, W.H. Freeman & Co. New York, USA

Miglani, G.S. Advanced Genetics , Narosa publishing Co., Inc., USA

Russel, P.J. Genetics. The Benjamin/ Cummings Publishing Co., Inc., USA

Shukla, R.S. and Chandel, P.S. Cytogenetics, Evolution and Plant Breeding, S.Chand & Co.Ltd., New Delhi

Singh B.D. Textbook of plant Breeding. Kalyani publishers, Ludhiana,1999

Sinha, U. and Sinha, S. Cytogenetics, Plant Breeding and Evolution, Vikas Publishing House, New Delhi, 1997

Sunstand, D.P. and Simmons, M.J. Principles of Genetics, John Wiley & Sons Inc., USA 2000

PAPER I: MOLECULAR BIOLOGY

Max Marks: 50

Unit 1: Molecular basis of life, Structure of DNA, DNA replication in prokaryotes and eukaryotes. Concepts of genomics and proteomics.

Unit 2: DNA recombination-molecular mechanism in prokaryotes and eukaryotes. Insertion elements and transposons. Structure of prokaryotic genes.

Unit 3: Prokaryotic transcription, prokaryotic translation, prokaryotic gene expression (*lac*, his, *trp*, catabolic repression).

Unit 4: Structure of eukaryotic genes- transcription, eukaryotic translation, eukaryotic gene expression and transcription factors.

Unit 5: Gene expression in yeast, post translation regulation of gene expression. Developmental and environmental regulation of gene expression.

PAPER II: BIOPHYSICS

Max Marks: 50

Unit I: Law of thermodynamics, Enthalpy, Free Energy, Heat dissipation and heat conservation.Primary events in Photosynthesis.

Unit II: Strategies of light reception in microbes, plants and animals. Electrical properties of biological components.

Unit III: Generation and reception of sonic vibrations. Hearing aids, Intra and intermolecular interactions in biological system.

Unit IV: Physical methods applied to find out molecular structure: X-ray crystallography and NMR. General Spectroscopy, Lambert-Beer Law, Spectrophotometry & Colorimetery, UV-VIS, Fluorescence, AAS, IR, Raman Spectra

Unit V: Physical methods of imaging intact structure:
Ultra sound, Optical filters, X-ray, CAT scans, ECG, EEG, NMR imaging.

PAPER III: IMMUNOLOGY AND CELL CULTURE

Max. Marks: 50

Unit I: The immune system along with historical perspectives. Non-specific & specific immune mechanism, organs and cells of immunity and their function. Concept of Acquired and innate immunity and antigen.

Unit II: Structure and function of various classes of immuno-globulins
Humoral Immunity – Mechanism involved
Cell mediated immunity role of MHC, mechanism and cells involved.
Vaccines – Dead, live attenuated, recombinant, edible and chimeric vaccines.

Unit III: History of animal cell cultures. Biology of cultured Cells-the culture environment, Cell adhesion, Cell proliferation, energy metabolism.
Culture Vessels: The substrate, choice of culture vessels.
Laboratory requirements and sterilization techniques.
Simulating natural condition for growing animal cells- Importance of growth factor is serum.

Unit IV: Primary cultures: Isolation of tissue, primary explants cell line–
Nomenclature, Subculture & Propagation, finite and continuous cell lines.
Commonly used cell lines: their origin and characteristics, growth kinetic and cell lines.

Unit V: Application of animal cell culture
Cell Separation, characterization and differentiation
Transformation–Characteristics and applications
Transfection of animal cell & selectable markers.

Practical

1.   Separation of molecules in cellular extract in aqueous buffer
(a)   Gel Filtration
(b)   Ion exchange chromatography
(c)   TLC of extracted material
(d)   Isolation of chromosomal and plasmid DNA from bacteria
(e)   Restriction digestion of DNA and assigning restriction sites (demonstrations)
(f)   Making competent cells of E-coli
(g)   Transfection cells of plasmid DNA and selection for transformants.
2.   Purification of antigens and antibodies
(a)   Raising polyclonal antibodies
(b)   Enzyme Linked Immunoassay
(c)   Radio immunoassay
(d)   Diagnosis of an infectious disease by an immunoassay

Book Recommended

Buchanan, Gruissem & Jones: Biochemistry and molecular biology of plants –American Society of Plant Physiologist, Maryland USA
Peter Paolella: Introduction to molecular biology. Tata McGraw Hill
Alberts, Bray, Lewis, Raff, Roberts & Watson: Molecular Biology of the cell. Garland Publishing Inc.
Darnell, Lodish & Baltimore: Molecular cell Biology –Scientific American Books
Roitt, Male & Brostoff: Immunology. Mobey, London
Roitt: Essential Immunology – Blackwell Scientific
Lewin: Gene VIII, Oxford University Press
Kuby J: Immunology –Understanding of immune system Wiley Liss NY

VolKenshtein: Biophysics, Russian Press
Deniel, M: Basic biophysics for biologists, Agrobios
Van HoIde: Principles of Physical biochemistry, Prentice Hall

Practical

Time: 5.00 Hr   Max Mark: 75

                                                                Min   Mark: 27

1.	Perform and explain the given Molecular Biology experiment. Show the result to the examiner	12
2.	Perform and explain the given Biophysics experiment.	12
3.	Perform and explain the given immunology and/or cell culture Experiment	12
4.	Identify and Comment upon the spots (1 to 7)	21
5.	Viva-Voce	10
6.	Practical Record	08

BOTANY 2018

Theory

Course	Nomenclature	Number of Papers	Number of Periods per week	Maximum marks	Minimum marks
Paper I	Ecology and Environmental Biology	1	2	50	
Paper II	Plant Physiology and Biochemistry	1	2	50	54
Paper III	Plant Biotechnology and Molecular Biology	1	2	50	
PRACTICAL COURSE			6	75	27

Duration of examination of each theory papers   3 hours
Duration of examination of practicals   5 hours

PAPER I: ECOLOGY AND ENVIRONMENTAL BIOLOGY

Unit I: Plants and Environment: Atmosphere (gaseous composition), water (properties of water cycle), light (global radiation, phytosynthetically active radiation), temperature, soil (development, soil profiles, physico-chemical properties) and biota.
Morphological, anatomical and physiological responses of plants to water (hydrophytes and xerophytes) temperature (thermoperiodicity and vernalization), light (photoperiodism, heliophytes and sciophytes) and salinity

Unit II: Population ecology: Concept and characters, growth curves, biotic potential, ecotypes and ecads. Seed: The significance, suspended animation; ecological adaptation and dispersal strategies

Community ecology and Succession: Community characteristics, frequency, density, cover, life forms and biological spectrum. Succession: concept, classification and examples (hydrosere & xerosere)

Unit III: Ecosystems and Productivity: Ecosystem — Structure, abiotic & biotic components, food chain, food web, ecological pyramids, energy flow, biogeochemical cycles of carbon, nitrogen, phosphorus and Sulphur.
Productivity: Primary productivity, its measurements and factors affecting primary productivity

Unit IV: Environmental Biology of Indian Desert: Climate, vegetation types, adaptive strategies of desert plants. Desertification: meanings, causes, critical issues & driving forces. Agroforestry and its impact on desert agriculture. Desert biodiversity, Geomorphology, natural resources exploitation and their impact on desert environment

Unit V: Pollution Ecology: Definitions, classification, air, water and land pollution. Concepts of Industrial Ecology in pollution management. Global warming : Concepts and Current status. Phytogeography: Vegetation types of India — Forest and Grasslands. Biogeographical regions of India, Remote sensing: The basics and applications in ecological studies

Suggested Laboratory Exercises
1. To determine minimum number of quadrats required for reliable estimation of biomass in herbaceous vegetation
2. To study the frequency of herbaceous species and to compare the frequency distribution with Raunkaier's Standard frequency diagram
3. To estimate Importance Value Index for herbaceous vegetation on the basis of relative frequency, relative density and relative biomass in protected and Gochar land
4. To measure the vegetation cover of grassland through point frame
5. To measure the above ground plant biomass in a natural field
6. To determine diversity indices (richness Simpson, Shannon-Weaver) in natural fields
7. To estimate bulk density and porosity of soil samples
8. To determine moisture contents, water holding capacity and texture of soil samples
9. To estimate qualitatively nitrate, phosphate and potassium in soil samples
10. To study the vegetation structure through profile diagram
11. To estimate transparency and pH of different water bodies
12. To measure dissolved oxygen content in polluted and unpolluted water samples
13. To estimate salinity, hardness, carbonates and bicarbonate in different water samples
14. To determine the percent leaf area injury of different leaf samples collected around polluted site
15. To estimate dust holding capacity of the leaves of different plant species
16. Plant adaptive modifications: Specimens/Slides:
    i) Succulents: *Opuntia, Euphorbia*
    ii) Salt secretion: *Atriplex, Chloris*
    iii) Salt accumulation: *Suaeda, Salsola, Zygophyllum*
    iv) Xerophytes: *Calligonum, Capparis, Leptadenia, Parkinsonia*
    v) Hydrophytes: *Eichhornia, Nymphaea, Hydrilla*

Suggested Readings

Dash, M.C. Fundamental of Ecology, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1996
Kormondy, E.J. Concepts of Ecology, Prentice – Hall of India Pvt., New Delhi, 1996
Kumar, H.D. General Ecology, Vikash Publishing House Pvt. New Delhi, 1995
Mukherjee, B. Environmental Biology, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1997
Odum, E.P. Basic Ecology, Sauders, Philadelphia, 1983
Sen, D.N. Environment and Plant Life in Indian Desert, Geobios International, Jodhpur, 1982
Sharma, P.D. Ecology and Environment, Rastogi Publications, Meerut 2002

PAPER – II
PLANT PHYSIOLOGY AND BIOCHEMISTRY

Unit 1: Plant-water relations: Importance of water to plant life; physical properties of water; diffusion and osmosis; absorption, transport of water and transpiration; physiology of stomata

Mineral nutrition: Essential macro- and micro-elements and their role, mineral uptake; deficiency and toxicity symptoms

Introduction to phloem transport; source-sink relationship; factors affecting translocation

Unit 2: Photosynthesis: Significance; historical aspects; photosynthetic pigments; action spectra and enhancement effects; concept of two photosystems; Z-scheme; photophosphorylation; Calvin cycle; C4 pathway; CAM plants; photorespiration. Rubisco enzyme.

Unit 3: Respiration: Aerobic and anaerobic respiration; Kreb's cycle; electron transport mechanism (chemi – osmotic theory); redox potential; oxidative phosphorylation pentose phosphate pathway

Basics of enzymology: Discovery and nomenclature; characteristics of enzymes; concept of holoenzyme, apoenzyme, coenzyme and cofactors; regulation of enzyme activity; mechanism of action, Protein structures

Unit 4: Nitrogen and lipid metabolism: Biological Nitrogen fixation. Importance of nitrate reductase and its regulation; ammonium assimilation. Structure and function of lipids; fatty acid biosynthesis; B-oxidation; storage and mobilization of fatty acids

Unit 5: Growth and development: Definitions; phases of growth and development. Brief account on seed dormancy, seed germination and senescence. Photoperiodism, physiology of flowering; florigen concept, biological clock, vernalization. Plant Hormones-auxins, gibberellins, cytokinins, abscisic acid and ethylene, history of their discovery, Physiological role and general mode of actions. Photomorphogenesis; Brief account on phytochromes and cryptochromes.

Suggested Laboratory Exercises
1.   To study the permeability of plasma membrane using different concentrations of organic solvents
2.   To study the effect of temperature on permeability of plasma membrane
3.   To prepare the standard curve of protein and determine the protein content in unknown samples
4.   To study the enzyme activity of catalase and peroxidase as influenced by pH and temperature
5.   Comparison of the rate of respiration of various plant parts
6.   Separation of chloroplast pigments by solvent method
7.   Determining the osmotic potential of *vacuolar sap by* plasmolytic method
8.   Determining the water potential of *any tuber*
9.   Separation of amino acids in a mixture by paper chromatography and their identification by comparison with standards

10.   Bioassay of auxin, cytokinin, GA, ABA and ethylene using appropriate plant material
11.   To study the regulation of stomatal movement using growth regulators, KCI and anti-transpirants

Suggested Readings

Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell (eds.). Plant Metabolism (2nd ed.), Longman, Essex, England, 1997

Galston, A.W. Life processes in Plants, Scientific American Library, Springer-Verlag, New York, USA, 1989

Hopkins, W.G. Introduction to plant physiology, John Wiley & Sons, Inc., New York, USA, 1995

Lea, P.J. and Leegood, R.C. Plant Biochemistry and Molecular Biology, John Wiley & Sons, Chichester, England, 1999

Mohr, H. and Schopfer, P. Plant Physiology, Springer-Verlag, Berlin, Germany, 1995

Salisbury, F.B. and Ross, C.W. Plant Physiology (4th ed.), Wadsworth Publishing Co., California, USA, 1992

Srivastava, H.S. Plant Physiology, Rastogi Publication, Meerut, 2001

Taiz, L. and Zeiger, E. Plant Physiology (2nd ed.), Sinauer Associats, Inc. Publishers, Massachusetts, USA, 1998

Suggested Readings
(for Laboratory Exercises)

Amar Singh. Practical Plant Physiology, Kalyani Publishers, New Delhi, 1977

Moore, T.C. Research Experiences in Plant Physiology: A Laboratory Manual, Springer-Verlag, Berlin, 1974

Nifa, A.J. and Ballou, D.P. Fundamental Laboratory Approaches for Biochemistry and Biotechnology, Fitzrierald Science Press, Inc., Maryland, USA, 1998

Robalts and Tucker, G.A. (Eds.) Plant Hormone Protocols, Humana Press, New Jersey¸ USA, 2000

Scot, R.P.W. Techniques and Practice of Chromatography Marcel Dekker, Inc., New York, 1995

Wilson, K. and Goulding, K.H. A Biologists Guide to principles and techniques of Practical Biochemistry, Ed-ward Arnold, London, 1986

PAPER-III
PLANT BIOTECHONOLOGY AND MOLECULAR BIOLOGY

Unit 1: Cell theory and concept of totipotency and pluripotency. History of plant tissue culture and biotechnology. Basic tools and techniques of Plant tissue culture and molecular biology: General introduction about applications of biotechnology, bioinformatics and NanoBiotechnology.

Unit 2: Introduction to Bacterial Genome organization Genetic recombination in bacteria. Introduction to vectors for gene cloning: p-BR322, Cosmids, Phagemids and BAC. c-DNA libraries. Detection and screening of recombinant DNA.

Unit 3: Concepts of organogenesis-somatic embryogenesis and androgenesis. Somaclonal variations and its applications. Protoplast isolation, fusion and somatic hybridization. Cryopreservation of germplasm. Introduction to bioreactors and production of secondary metabolites with special reference to alkaloids obtained from *Ephedra*, shikonin, diosgenin and Strategies used to optimize secondary metabolite production.

Unit-4: Genetic engineering of plants: *Agrobacterium* mediated gene transfer, t-DNA transfer mechanism integration and expression in plants. Direct method of gene transfer in plants: Chemical methods electroporation, particle gun delivery, lipofection, microinjection, macroinjection, pollen transformation, laser induced and silicon fiber mediated. Reporter (Lucifarase, GUS and GFP) and marker genes.

Unit-5: Biotechnology and society: Development of transgenic crop plants against biotic and abiotic stresses. Genetically modified crops: Golden rice, Bt cotton (as a model system). Intellectual Property Right (IPR) and Plant Breeder's Rights (PBR) in current regime of WTO. Impact of GM crops on society and environment.

SUGGESTED LABORATORY EXERCISES
1.   Demonstration of the technique of micropropagation by using different explants, e.g. auxiliary buds, shoot meristems
2.   Demonstration of the techniques of anther culture
3.   Isolation of protoplasts from different tissues using commercially available enzymes
4.   Demonstration of root and shoot formation from the apical and basal portions of stem segments in liquid medium containing different hormones
5. Demonstrations/poster on GM Crops and related issues

Suggested Readings

Bhojwani, S.S. Plant Tissue Culture: Application and Limitation, Elsevier Science Publishers, New York, USA, 1990
Old, R.W. and Primrose, S.B. Principles of Gene Manipulation, Black well Scientific Publications, Oxford, U.K., 1986
Raghavan, O. Embryogenesis in Angiosperms: A Developmental and Experimental Study, Cambridge University, Press, New York, USA, 1986
Vasil, I.K. and Thorpe, T.A. Plant Cell and Tissue Culture, Kluwer Academic Publishers, The Netherlands, 1994
SUGGESTED READINGS

(for Laboratory Exercises)

Ball, R.D. (ed.) Plant Cell Culture Protocols, Humana Press, Inc. New Jersey, USA, 1999

Dixon, R.A. (ed.) Plant Cell culture: a Practical Approach, IRL, Press Oxford, 1987

Glick, B.R. and Thompson, J.E. Methods in Plant Molecular Biology and Biotechnology, CRC Press, Boxa Raton, Florida, 1993

Roberts, J. and Tucker, G.A. (eds.) Plant Hormone Protocols Humana Press, New Jersey, USA 2000.

BIOTECHNOLOGY 2018

Max Marks: 50

PAPER I: RECOMBIANT DNA TECHNOLOGY

Unit I: What is gene cloning and why do we need to clone gene? Tools and Techniques: Plasmid and other vehicle. Genomic-DNA, handling of DNA and RNA. Restriction enzymes and reagents. Laboratory techniques and other requirements.

Unit II: Safety measures and related regulations for recombinant DNA work, choice and selection of the tools and techniques. Vehicles: Plasmids and bacteriophages, available phagemids, cosmids and viruses.

Unit III: Purification of DNA from bacteria, plant and animal cells. Manipulation of purified DNA.Introduction of DNA into living cells. Cloning vectors for *E-coli*.

Unit IV: Cloning vectors for organism other than *E-coli,* yeast, fungi, plants- agro bacteria, plants viruses and animal viruses. Applications of cloning in gene analysis- how to obtain a clone of a specific gene, studying gene location and structure, studying gene expression.

Unit V: Gene cloning and expression of foreign genes in research and biotechnology. Production of protein from cloned genes. Gene cloning in medicine: Pharmaceutical compounds, artificial insulin gene, recombinant vaccine, and diagnostic reagents.

PAPER II: PLANT BIOTECHNOLOGY

Max Marks: 50

Unit I: Introduction to in–vitro methods. Terms and definitions. Use of growth regulators. Beginning of in-vitro cultures in India (Ovary and Ovule culture), in-vitro pollination and fertilization. Embryo culture, embryo rescue after wide hybridization and its application.

Unit II: Introduction to processes of embryogenesis and organogenesis and their practical applications. Clonal multiplication of elite species (micropropagation) through axillary bud, shoot tip and meristem culture Haploids and their applications. Somaclonal variation and their applications.

Unit III: Endosperm culture and production of triploids.
Single Cell suspension culture and their application in selection of variant mutants with or without mutagen treatment (of haploid cultures preferably).

Unit IV: Testing of viability of isolated protoplasts, various steps in the isolation and regeneration of protoplasts.
Somatic hybridization – Introduction, various methods of fusion of protoplasts (chemical and electrical), use of markers for selection of hybrid cells.

Unit V: Practical application of somatic hybridization (hybrids/cybrids). Use of plant cell, protoplasts and tissue culture for genetic manipulation of plants. Introduction to *Agrobacterium tumefaciens*: Tumour formation on plants using *A. tumefaciens* (monocots v/s dicots)
Hairy Root formation using using *Agrobacterium rhizogenes*
Practical applications of genetic transformation.
Plant genomics (e.g. Rice, Arabidopsis)

PAPER III: ENVIRONMENTAL AND ANIMAL BIOTECHNOLOGY

Max Marks: 50

Unit I: General metabolism of animal cells. Special secondary metabolites/products (Insulin, growth hormone, Interferon, t- plasminogen activator, and factor VIII) Expressing cloned proteins in animal's cells. Over production and processing of chosen protein: The need to express in animal cells.

Unit II: Production of vaccines in animal cells. Production of monoclonal antibodies. Growth factors promoting proliferation of animal cells (EGF, FGF, PGDF, IL-1, IL-2, NGF, and Erythropoietin). Bioreactors for large-scale culture of cells. Transplanting cultured cells.

Unit III: Renewable and Non–Renewable resources. What is Renewable should be Bio-assimable / Biodegradable. Major consumable items: Food, Fuel and Fibers. Conventional Fuels and their Environmental impacts: Fire wood, Plant and Wastes, coal, gas, animal oils. Modern fuel and their environmental impacts: Methanogenic bacteria and biogas, microbial hydrogen production, conversion of sugars to ethanol the gasohol experiment, Solar energy converters - hopes from the photosynthetic pigments, plant based petroleum industry, cellulose degradation for combustible fuel.

Unit IV: Biotechnological inputs in producing good quality and natural fibers- transgenic animals and transgenic plants. Microbial quality of food and water .Treatment of municipal waste and industrial effluents.
Degradation of Pesticides and other toxic chemicals by micro organisms. Thuringiensis toxin as a natural pesticide, Biological control of other insects swarming the agricultural fields. Enrichment of ores by microorganisms, Biofertilizers. Nitrogen fixing microorganisms enrich the soil with assimilable nitrogen.

Unit V: Biodiversity and its conservation: Alpha- and Beta-biodiversity, steps to preserve biodiversity, in-situ and ex-situ conservation.
Intellectual property, IPR, and plant genetic resources, TRIPS and GATT
Patenting: Patenting of genetic material, obligations and complications, current issues: Ethics, Environmental safety. Risk assessment of GEOs (Genetically Engineered Organisms), Plant Breeder's right and farmer's rights.

Practical

1. Initiating Plant tissue culture: differentiation of explants.
2. Growth of plant cells into undifferentiated mass
3. Large-scale cultivation of plant cells in suspension
4. Induction of differentiation by modulating the hormonal balance
5. Culture of lymphocytes from blood samples
6. Preparation of media, filler sterilization, monitoring microbial contamination (bacteria, fungi & mycoplasma)
7. Cloning of animal cells by cell and colony purification
8. Fusion of cultured cells with myeloma cells.

Books Recommended

Old & Primrose: Principles of gene manipulation, Blackwell Scientific Publications
Sambrose & Russell: Molecular cloning CSH Press
Ausber: Current protocols in molecular biology CSH Press
Michel: Introduction to environmental microbiology
B.D. Singh Plant Breeding: Kalyani Publisher
Alexander, M: Microbial Ecology, John Wiley & sons

EC Eldowney, Hardman & Waite: Pollution Ecology biotreatment- Longman Scientific Technical

Baker &Herson - Bioremediation –Tata McGraw Hill

P.C.Debergh & R.H. Zi mmerman: Micropropagation Technique & Applications. Kluwer Academic Publishers

K. Lindsey & M.G. K. Jones: Plant Biotechnology in Agriculture

R.A. Meyers: Molecules Biology & Biotechnology VCH Publishers N.Y.

B. D. Singh: Plant Biotechnology, Kalyani Publishers

Indra K Vasil & Trevar A Thorpe: Plant Cell & Tissue Culture, Kluwer Academic Publishers

S.S Bhojwani & M.K. Razdan: Plant Tissue Culture Theory & Practice, Elsevier

Practical

Time 5:00 hr
Max. Marks: 75
Min. Marks: 27

1.	Preparation of nutrient medium and its sterilization	13
2.	Preparation of explant (pretreatment), sterilization and inoculation for the given tissue culture technique	08
3.	Identification of microbial contamination in the given nutrient medium	07
4.	Identify & comment upon the Spots (1to6)	27
5.	Viva- Voce	10
6.	Practical Record	10

SYLLABUS
BACHELOR OF SCIENCE
FIRST YEAR – 2016-2017
FACULTY OF SCIENCE

<p align="center">DEPARTMENT OF BOTANY
B.Sc. FIRST YEAR-2017</p>

Theory

Course	Nomenclature	Number of Papers	Number of Periods per week	Maximum marks	Minimum marks
Paper I	Algae, Lichens and Bryophytes	1	2	50	
Paper II	Mycology, Microbiology and Phytopathology	1	2	50	54
Paper III	Palaeobotany, Pteridophytes and Gymnosperms	1	2	50	
PRACTICAL COURSE			6	75	27

Duration of examination of each theory papers   3 hours

Duration of examination of practicals   5 hours

<p align="center">PAPER I: ALGAE, LICHENS AND BRYOPHYTES</p>

Unit I: General characters, Classification and economic importance of Algae. Important features and life history of Chlorophyceace and Charophyceae. Structure and life cycle of *Volvox,Oedogonium*, *Coleochaete* and *Chara*.

Unit II: Important features and life history of Xanthophyceae and Phaeophyceae. Structure and life cycle of Vaucheria, Ectocarpus and Sargassum.

Unit III: Important Features and life history of Rhodophyceae. Structure and life cycle of Polysiphonia. Lichens: Morphology and structure of the two components; biological, ecological and economic importance.Vegetative multiplication methods with special reference to Parmelia and Usnea.

2

Unit IV: Bryophytes: General characters, alternation of generations and classification.Characters and Classification of Hepaticopsida. Morphology and life history of Riccia, Marchantia and Plagiochasma.

Unit V: Characters and classification of Anthocerotopsida and Bryopsida. Morphology and life history of Anthoceros and Sphagnum.

Suggested Laboratory Exercises

Algae: Microscopic preparation and study of following algal materials: *Volvox, Oedogonium, Coleochaete, Vaucheria, Chara, Ectocarpus, Sargassum* and *Polysiphonia*

Lichens: Study of Lichens

Bryophytes: Study of external morphology and microscopic preparations of following Bryophytes: *Riccia*, Marchantia*, Plagiochasma, Anthoceros* and *Sphagnum*

Suggested Readings

Bold, H.C., Alexopoulous, C.J. and Delevoryas, T. Morphology of Plant and Fungi (4th Ed.) Harper & Foul Co., New York, 1980.

Ghemawat, M.S., Kapoor, J.N. and Narayan, H.S. A text book of Algae, Ramesh Book Depot, Jaipur, 1976.

Gilbert, M.S. Cryptogamic Botany, Vol. I & II (2nd Ed.), Tata McGraw Hill, Publishing Co. Ltd., New Delhi, 1985.

Kumar, H.D. Introductory Phycology, Affiliated East–West Press, Ltd., New York, 1988.

Pandey, S.N. and Trivedi, P.S.A Text Book of Botany 2000 Volume I, Vikas Pub. House Pvt. Ltd., New Delhi.

Puri, P.Bryophytes, Atmaram& Sons, Delhi, Lucknow, 1985.

Singh, V., Pande, P.C. and Jain, D.K.A Text Book of Botany, Rastogi& Co., Meerut, 2001.

Vashista, B.R. Botany for Degree Students (Algae, Fungi Bryophyta), S. Chand & Co. Ltd., New Delhi, 2002.

PAPER II: MYCOLOGY, MICROBIOLOGY AND PHYTOPATHOLOGY

Unit I: General characters, Classification and economic importance of fungi. Important features and life history of Mastigomycotina–*Pythium* and *Albugo*;*Zygomycotina–Rhizopus*; *Ascomycotina–Saccharomyces, Aspergillus* and*Penicillium*.

Unit II: Important features and life history of Basidiomycotina– *Puccinia, Agaricus* and wild Mushroom and *Ustilago*; Deuteromycotina–*Collectotrichum* and *Alternaria*.

Unit III: Viruses: Chemical and physical nature; Structure, multiplication and transmission of plant viruses. Tobacco mosaic virus and yellow vein mosaic virus disease. General account of Viroids, AIDS and Prions.

Unit IV: Bacteria–Structure, nutrition, cell division, reproduction and economic importance. Biofilms and Quorum sensing in microbes.Cyanobacteria–Life history of *Nostoc* and *Oscillatoria*; Nitrogen fixation – by BGA (Blue green algae).General account and biology of Mycoplasma and Phytoplasma.

Unit V: Causes and symptoms of plant diseases with special reference to green ear disease of Bajra, smut of wheat, citrus canker, little leaf of brinjal and root knot disease. A brief account of principles of plant protection.

Suggested Laboratory Exercises

Microscopic preparation and study of following fungal materials: *Albugo, Rhizopus, Saccharomyces, Aspergillus, Penicillium, Ustilago, Agaricus,* local Mushroom¸ *Colletotrichum* and *Alternaria*. Viruses: Study of disease symptoms caused by Tobacco mosaic virus and yellow vein mosaic virus.

Bacteria: Gram staining of bacteria. *Nostoc, Oscillatoria* and study of bacteriological specimens. Study of symptoms of following diseases: (specimen or photographs)

Green ear disease of bajra

Smut of wheat

Citrus canker

Rust of wheat

Little leaf of bringal

Root knot nematode.

Suggested Readings

Alexopoulos, C.J. and Mims.Introductory Mycology, John Wiley and Sons, New York, 2000.

Bilgrami, K.S. and Dube, H.C. A Text Book of Modern Plant Pathology, Vikas Publ. House, New Delhi, 1976.

Biswas, S.B. and Biswas, A.An Introduction to Viruses, Vikas Publ. House, New Delhi, 2000.

Clifton, A.Introduction to Bacteria, McGraw Hill Co., New York, 1985.

Dube, H.C. Fungi, Rastogi Publication, Meerut, 1989.

Kaushik, P. Microbiology, Emkay Publication, 2001.

Madahar, C.L. Introduction to plant viruses, S. Chand & Co. Ltd., New Delhi, 1978.

Palezer, Chan and King. Microbiology, McGraw Hill Book Co., London, 1995.

Pathak, V.N. Fundamentals of Plant Pathology, Agro Botanica. 2000.

Purohit, S.S. Microbiology, Agro. Bot. Publication, Jodhpur, 2002.

Sharma, O.P. Fungi, Today and tomorrow Publication, 2000.

Sharma, P.D. Microbiology and Plant Pathology, Rastogi Publ. Meerut, 2003.

Singh, V. and Srivastava, V.Introduction to Bacteria, Vikas Publication, 1998.

Vashista, B.R. Botany for Degree student Fungi, S. Chand & Co., New Delhi, 2001.

PAPER III: PALAEOBOTANY, PTERIDOPHYTES AND GYMNOSPERMS

Unit I: Geological time scale, Fossilization. General characters and classification and Pteridophytes.Important characteristics of Psilopsida, Lycopsida, Sphenopsida and Pteropsida.Stelar systems in Pteridophyta.Structure and reproduction in *Rhynia*.

Unit II: Occurrence, Structure and life history of *Lycopodium, Selaginella* and *Equisetum*.

Unit III: Occurrence, structure and life history of *Adiantum, Marsilea* and *Azolla*. Heterospory in Pteridophyta.

Unit IV: Characteristics of seed plants, evolution of the seed habit. General features of gymnosperms and their classification; evolution, diversity and economic importance of Gymnosperms.*Cycas*:Morphology of vegetative and reproductive parts, anatomy of root, stem and leaf; Reproduction and life cycle.

Unit V: *Pinus* and *Ephedra*: Morphology of vegetative and reproductive parts, anatomy of root, stem and leaf, reproduction and life cycle.

Suggested Laboratory Exercises

Palaeobotany: Microscopic examination of slides of *Rhynia*.

Pteridophytes: Study of external morphology of *Lycopodium, Selaginella, Equisetm, Adiantum, Marsilea,* and *Azolla*. Microscopic study of temporary double stained preparations of stem/rhizome of *Lycopodium, Selaginella, Equisetum* and *Marsilea*.

1. Study of temporary single stained microscopic preparations of cone of *Selaginella* and T.S. of Sporophyll of *Adiantum* and sections of sporocarp of *Marsilea*.

Gymnosperms:Study of external morphology of plant parts of *Cycas*: young and old foliage leaf, scale leaf, bulbils, male cone, microsporophyll, megasporophyll and mature seed (if material is not available show photographs).

Microscopic temporary double stained preparations of rachis and leaflet of Cycas. Study of T.S. normal and Corolloid root by permanent slides.

Study of external morphology of plant parts of *Pinus* habit, long and dwarf shoot, male cone; female cone; winged seeds.

Microscopic temporary preparation of pollen grains (W.M.) of *Pinus*. Study through permanent slides T.S. stem: young and old; male/female cone of *Pinus*.

Study of habit and structure of whole male and female cone of *Ephedra*.

Microscopic preparation of male and female flowers of *Ephedra*.

Suggested Readings

Bold, H.C., Alexopolous, C.J. and Delevoryas, T. Morphology of plant and fungi (4th ed.), Harper and Foul, Co., New York, 1980.

Gifford, E.M. and Foster, A.S. Morphology and Evolution of Vascular Plants, W.H. Freeman and Company, New York, 1988.

Pandey, S.N., Mishra, S.P., Trivedi, P.S. A Text Book of Botany Vol. II, VikasPub.House Pvt. Ltd., New Delhi 2000.

Raven, P.H. Evert, R.F. and Eichhom, S.C. Biology of plants, (5th ed.), W.H. Reema and Co., Worth Publication, New York, U.S.A., 1999.

Sharma, O.P. Pteridophytes, Today and tomorrow Publication, 2000.

Sporne, K.R. The Morphology of Gymnosperms, B.I. Publ. Pvt., Bombay, Calcutta, Delhi, 1991.

Vashista, P.C. Gymnosperm, S. Chand & Co. Ltd., New Delhi, 2002.

Vashista, P.C. Pteridophyta, S. Chand & Co. Ltd., New Delhi, 2002.

Wilson, N.S. and Rothewall, G.W.Palaeobotany and evolution of Plants, (2nd ed.), Cambridge University Press, U.K., 1993.

BIOTECHNOLGOY 2017

PAPER I: BIOCHEMISTRY AND BIOSTATISTICS

Max Marks: 50

Unit 1: Introduction: General Composition of living matter-A Brief account and function of biomolecules.Bioenergetics: Principles of bioenergetics. Energy Rich compounds. Biological oxidation-reduction reactions.
Water: Properties of water molecule, Hydrophilic and hydrophobic groups in biological molecules.
Carbohydrates: Classification and general structure and properties of monosaccharides.
Lipids: Classification and general structure, properties of fats and Oils.

Unit II: Amino Acids: Classification, general structure and properties

Proteins: Classification three–dimensional structure (helicity, bending, pleats, salt-bridges etc) and the basis for intermolecular interactions in enzyme– substrate and antigen-antibody recognition.
Nucleotides: Composition, General structure and properties.
Nucleic Acids: Types and general structure, Non-canonical DNA Structures (Bent DNA, cruciform triple stranded, G quartet, slipped DNA)

Unit III: Enzymes: Classification, Nature specificity & mechanism of catalysis, kinetics, inhibition, allosteric control.

Enzyme Technology: Enzyme Production, various sources of enzymes, extraction, purification & packaging.
Enzyme Applications: Therapeutic, Manipulative, Industrial and Analytical (ELISA & Biosensors)

Unit IV: Collection, classification, Tabulation and diagrammatic and graphical representation of statistical data: Histogram, pie chart, bar diagram, frequency polygon. Measurement of central tendency: Mean, Median, Mode.

Unit V: Measurement of dispersion : Mean Deviation, Standard Deviation, Standard Error, Variance, Coefficient of correlation, test for significance : t-test, (Single sample Mean and Two sample Mean), Chi-Square Test and F-Test.

PAPER II: CELL BIOLOGY AND GENETICS

Max Marks: 50

Unit I: Cell as a basic unit of living systems: The cell theory. Prokaryotic and Eukaryotic Cell, Eukaryotic Cell – Shape Size, Volume, and Number.

Broad classification of cell types: PPLOs, Bacteria, Plant and Animal cells. A detail classification of cell types within an organism. Cell, tissue, organ and organisms as different levels of organization.

Unit II: Structure and functions of cell organelles; ultra structure of cell membranes, Cytosol, Golgibodies, Endoplasmic reticulum (rough and smooth), Ribosome, Cytoskeletal structure (actins, microtubule etc), Mitochondria, Chloroplasts, Lysosomes, Peroxisomes, and Nucleus (Nuclear membrane, nucleoplasm, nucleolus and chromatin).

Cell division, cell cycle and cell growth.

Unit III: Nature of genetic material, nucleic acids, DNA replication, Mendelian laws of inheritance, gene interaction.

Sex determination in plants and animals. Sex linkage, non-disjunction as a proof of chromosomal theory of inheritance. Linkage mapping of genes, interference, coincidence in Prokaryotes and Eukaryotes.

Unit IV: Chromosome: Chemical composition: Structural organization of chromatids, centromeres, chromatin, telomeres, nucleosomes, euchromatin and heterochromatin. Special types of chromosomes (e.g. polytene and lampbrush chromosomes); Mutations; spontaneous and induced; chemical and physical mutagens.

Unit V: Basic microbial genetics; conjugation, transduction and transformation. Isolation of auxotrophs, Replica plating techniques, analysis of mutations in biochemical pathways, one-gene-one-enzyme hypothesis. Extra chromosomal inheritance, genetic systems of mitochondria and chloroplast

PAPER III: MICROBIOLOGY AND COMPUTATIONAL BIOLOGY

Max Marks: 50

Unit I: Development of microscopy (Optical, TEM and SEM). The Concept of sterilization, Methods of sterilization (Dry heat, wet heat, radiation, chemicals and filtration etc.)

Unit II: Prokaryotic and eukaryotic microbial cells. The various forms of microorganisms-PPLO'S, Cocci, Bacilli and Spirilla. Nature of microbial cell surfaces, gram (+) ve and gram

(-) ve bacteria, Types of bacteria on the basis of flagella. Flagellar types in Gram (+) ve and Gram (-) ve bacteria.

Unit III: Nutritional classification of microorganisms-symbiosis and antibiosis among microbial populations.Microorganisms in extreme environments.Pathogenicity among microorganisms. Defence mechanism against microorganisms and Serotypes.

Unit IV: Microbial metabolism: Spontaneous and induced variation arising in microbial population.Recombination events in bacteria. Nitrogen-fixing microbes in Agriculture.Products from microorganisms-fermentation products, and antibiotics.

Unit V: Computers: General introduction to Computers, organization of computers, digital and analog computers, computer algorithms.

Computer in online monitoring and automation.Application of computers in co-ordination of solute concentration, pH and temperature etc. of a fermenter in operation.

Introduction to Bioinformatics. Molecular databases, application of data associates tools e.g. BLAST, FASTA, Storage, Retrieval and analysis of sequences. Application of bioinformatics.

Practical

1.   Quantitative estimation of the following in biological samples:

    a.   Sugar in given solution

    b.   Sugar in biological sample

    c.   Extraction and separation of lipids

    d.   Estimation of proteins

    e.   Estimation of DNA/RNA

    f.   Isolation and purification of proteins

    g.   Assays for enzyme activity

    h.   Kinetic activities on enzymes

    i.   Chromatographic methods of separation of macromolecules

2.   Demonstration of computers and application.

3.   Aseptic techniques:

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a. Preparation of media, cotton plugging and sterilization

b. Personal hygiene-microbes from hands, teeth and other body parts.

c. Isolation of microorganism from air, water and soil sample. Dilution and pour plating, colony purification

d. Enumeration of micro organism from: Total v/s viable counts.

e. Identification of isolated bacteria. Gram staining, other staining methods, metabolic characteristic.

f. Growth curve of microorganisms.

g. Antibiotic sensitivity of microbes- use of antibiotic discs.

Suggested Readings

Cox, Nelson &Lehninger- Principles of Biochemistry, CBS Publishers & Distributors

L.Stryer- Biochemistry- W.H. Freeman & Co.

Geoffrey Zubay- Biochemistry- Mac-Millan Publishing Co.

J.L. Jain – Biochemistry – S. Chand & Co.

Conn, Stumpf&Blueumming- Outlines of Biochemistry- Wiley Eastern Ltd.

G.M. Malacinski& David Freifelder – Essentials of Molecular Biology- Jonnes&Barlet , Boston

Gardner, Simmons &Snustad- Principles of Genetics, John Wiley & Sons.

P.K. Gupta- a Text book of cell & molecular biology, Rastogi Publication Meerut.

Trevor Palmer- Enzymes- biochemistry, Biotechnology & Clinical Chemistry- Horwood Publishing House.

P D Sharma- Microbiology- Rastogi Publications

Pawar&Daginawala-General Microbiology Vol I & II – Himalaya Publishing House

A J Salle- Fundamental Principles of Bacteriology- Tata McGraw Hill

Pelczar, Chan &Kreib Microbiology – Tata McGraw Hill

Brock & Madigan- Biology of microganisms.Prentice Hall, Inc.

Higgins & Taylor – Bioinformatics, Oxford University Press.

Stephen P Hunt & Rick Liveey- Functional Genomics, Oxford University Press

Rashidi- Bioinformatics basic- Application to life Sciences & Medical Science ASM

B D Singh- Genetics, Kalyani Publishers

Practical

Time: 5.00 Hrs   Max Mark: 75

                                                 Min Mark: 27

1.   Perform and explain the given biotechnology experiment.

       Show the result to the examiner   15

2.   Perform and explain the given microbiology experiment.   10

3.   Prepare a bacterial slide by Gram's staining method and

       report result   06

4.   Identify and comment upon the spots (1 to 6)   24

5.   Viva-Voce   10

6.   Practical Record   10

PAPER - I

Paper I CH-101 Inorganic Chemistry

UNIT: I

Chemical Bonding-Covalent bond

Valence bond theory and its limitation, Directional characteristics of covalent bond, Hybridizations-sp, sp^2, sp^3, dsp^2, sp^3d, dsp^3, sp^3d^2 and d^2sp^3 with suitable examples. Shapes of inorganic molecules and ions.

Valence shell election pair repulsion (VSEPR) theory and its application to study the geometry of NH_3, H_2O, H_3O^+, SF_4, ICl_2^-, ClF_3, ICl_4^-, XeF_4, XeF_6, molecules. Molecular orbital theory and molecular orbital diagrams for homo and heterodiatomic molecules-H_2, H_2^+, He_2^+, HHe^+, Li_2, Be_2, B_2, C_2, N_2, O_2, F_2, O_2^+, O_2^-, O_2^{2-}, O_2^{2+}, CO and NO.

Bonding in diborane (3c-2e bonding).

UNIT: II

Chemical Bonding- Ionic Bond

Lattice energy and Born-Haber cycle. Solvation energy, solubility of ionic solids, Fajan's rule, polarizing power and polariziblity of ions.

Structures of ionic solids, radius ratio effect and co-ordination number. Limitations of radius ratio rule.

Hydrogen bonding and vander-waal's forces of attractions.

UNIT: III

S-Block elements

Periodicity in properties of alkali and alkaline earth metals. Compexation tendency, Salvation tendency, stability and solubilities of carbonates, bicarbonates and sulphates of Magnesium and Calcium, Synthesis and applications of important hydrides: NaH, $NaBH_4$, LiH, $LiBH_4$, $LiAlH_4$ and CaH_2.

Cement: Composition and types of Cement, Manufacture of Portland cement.

Lime: Industrial preparation, Properties and Uses.

UNIT: IV

P-Block elements

Periodicity in properties of III A, IV A, V A, VI A and VII A group elements.

Silicates, oxides of nitrogen, phosphorous and sulphur- their structure and preparations.

Glass: Types and properties of glasses, coloring agents, Industrial manufacturing of glass.

Nitrogen fixation- Natural and Artificial fixation. Role of nitrogenase in biological nitrogen fixation.

UNIT: V

Qualitative Analysis

Theoretical basis of qualitative analysis, Systematic analysis of Acidic and Basic radicals (including interfering radicals). Chemical reactions involved.

 Common- ion effect, solubility product & their applications. Oxidizing and reducing agents and buffers used in analysis.

Books Recommended:

1. Inorganic Chemistry by Satya Prakash
2. Inorganic Chemistry by R.C. Agarwal
3. Inorganic Chemistry by B.R. Puri and L.R. Sharma
4. Inorganic Chemistry by P.L. Soni
5. Inorganic Chemistry by G.C. Shivhare and V.P. Lavania
6. Practical Chemistry by Giri, Bajpai and Pandey

CH-102 Organic Chemistry

UNIT: I

Mechanism of Organic Reactions

Classification of organic compounds their general characteristics. Types of reagents – electrophiles and nucleophiles. Types of organic reactions. Reactive intermediates – carbocations, carbanions, free radicals, carbenes, arynes and nitrenes (with examples). Assigning formal charges on intermediates and other ionic species. Methods of determination of reactions mechanism (product analysis, intermediates, isotope effects, kinetic and stereochemical studies).

2. UNIT: II

Stereochemistry of Organic Compounds

Concept of isomerism. types of isomerism

Optical isomerism – elements of symmetry, molecular chirality, enantiomers, stereogenic center, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centers, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature.

Geometric isomerism : Determination of configuration of geometric isomers. E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds.

Conformational isomerism :Newman projection and Sawhorse formulae, Fischer and flying wedge formulae. Difference between configuration and conformation.

conformational analysis of ethane and n-butane; conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives.

3. UNIT: III

Alkanes , Cycloalkanes, Alkenes, Dienes and Alkynes

Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity Cycloalkanes – nomenclature, methods of formation, chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings. The case of cyclopropane ring: banana bonds.

Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions – 1, 2-and 1, 4-additions, Diels-Alder reaction.

Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidic nature of 1-alkynes. Mechamism of electrophilic and nucleophilic addition reactions, hydroboration-oxidation, oxidation and polymerization.

UNIT: IV

Arenes and Aromaticity

Nomenclature of benzene derivatives. Aryl group. Aromatic nucleus and side chain. Structure of benzene: molecular formula and Kekule structure. Stability and carbon-carbon bond lengths of benzene, resonance structure, MO picture.

Aromaticity: the Huckel rule, aromatic ions.

Aromatic electrophilic substitution – general pattern of the mechanism, role of α- and π-complexes. Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Birch reduction.

Methods of formation and chemical reactions of alkylbenzenes, Structure, preparation and properties of naphthalene.

4. UNIT: V

Alkyl and Aryl Halides

Nomenclature and classes of alkyl halides, methods of formation, chemical reactions. Mechanisms of nucleophilic substitution reactions of alkyl halides, S_N2 and S_N1 reactions with energy profile diagrams. Mechanism of elimination reactions of alkyl halides, regioselectivity in dehydrohalogenation, Saytzeff rule.

Methods of formation of aryl halides, nuclear and side chain reactions. The addition-elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions.

.Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides towards nucleophilic-substitution reactions. Synthesis and uses of DDT and BHC.

Books Recommended:

1. Advanced Organic Chemistry by Mukheri and Kapoor Vol. I & II
2. A Text Book of Organic Chemistry by M.K. Jain
3. A Text Book of Organic Chemistry by R.K. Bansal
4. Organic Chemistry, R.T. Morrison and R.N.Boyd, Prentice-Hall

PAPER – III

CH-103 Physical Chemistry

UNIT: I

Mathematical Concepts

Logarithmic relations, curve sketching, linear graphs and calculation of slopes, differentiation of functions like a^x, e^x, x^n, sin x, cos x, tan x, log x; maxima and minima, partial differentiation. Integration of some useful functions; like x^n, $1/x$, e^x, constant, sin x, cos x, integration by parts. Permutations and combinations. Probability.

UNIT: II

Gaseous State

Deviation from ideal behavior, Vander Waals equation of state and its discussion.

Critical Phenomena: PV isotherms of real gases, continuity of states, relationship between critical constants and Vander Waals constants, the law of corresponding states, reduced equation of state.

Molecular velocities: Root mean square, average and most probable velocities(No derivation). Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Liquification of gases (based on Joule-Thomson effect). Numericals.

UNIT: III

Liquid and Colloidal State

Liquid State: Intermolecular forces, structure of liquids (a qualitative description).

Structural differences between solids, liquids and gases.

Liquid crystals: Classification-nematic, smectic and cholestric phases. Theory of liquid crystal (Swarm theory).

Colloidal State: Definition of colloids, classification of colloids.

Solids in liquids (sols): properties – kinetic, optical and electrical; stability of colloids, Hardy-Schulze law, protective action, Gold number.

Liquids in liquids (emulsions): types of emulsions, preparation, Emulsifier, Theory of Emuloion.

Liquids in solids (gels): classification, preparation and properties, imbitions and syncresis. General applications of colloids.

Solutions

Types of liquid mixtures, ideal and non-ideal mixtures, vapour pressure of liquid mixtures, distillation of immiscible liquid mixtures.

Partially miscible liquids-phenol-water, triethylamine-water, nicotine-water-systems, consolute temperature-lower and upper, Effect of impurity on consolute temperature-Phenol-water system, immiscible liquids, Principal and Methodology of steam distillation. Numericals

UNIT V

Chemical Kinetics

Rate, order, molecularity and stoichiometry of a reaction, Derivation of Integrated rate law and characteristics of zero, first and second order reactions, Pseudo-first order reaction, Determination of the order of reaction-differential method, method of integration(hit and trial method), half-life method and isolation method.

Theories of Reaction Rate: Simple collision theory and its limitations, transition state theory (equilibrium hypothesis) and derivation of the rate constant, Thermodynamical formulation of rate constant, Comparison of collision theory and transition state theory, Numericals.

Books Suggested:

1. The Eelements of Physical Chemistry, P.W. Atkins, Oxford.
2. Physical Chemistry Through problems, S.K. Dogra and S. Dogra, Wile   Eastern Ltd.
3. Principles of Physical Chemistry, B.R. Puri, L.R. Sharma and M.S. Pathania, Shobhan Lal Naginchand & Co.
4. Physical Chemistry, Bahl and Tuli, S. Chand & Co.(P) Ltd.
5. Physical Chemistry, Vol. I & II, S. Pahari, New Central Book Agency (P) Ltd.
6. Bhotic Rasayan, K.R. Genwa, RBD Jaipur

CH – 104 Laboratory Course I

1. Inorganic Chemistry: **[20]**

Qualitative analysis of inorganic mixture, containing 5-radicals. Cation analysis, separation and identification of ions (group 0, I, II, III, IV, V and VI). Interfering radicals mixtures and special combination of acidic radicals (CO_3^{2-} , SO_3^{2-}; NO_3^-,NO_2^-; NO_3^- , Br^-; Cl^- , Br^- , I^-; SO_3^{2-},S^{2-} , SO_4^{2-})

2. Physical Chemistry: **[15]**

(a) Viscosity:

(I) To determine the viscosity of the given organic liquid by Ostwald Viscometer

(II) To determine the % composition of a binary solution by Viscosity measurement.

(b) Surface Tension:

(I) To determine the surface tension of a given organic liquid by Stalagmometer.

(II) To determine the % composition of a binary solution by surface tension measurement.

3. Volumetric analysis   **[15]**

Redox Titrations:

 (i) To determine the strength of given unknown copper sulphate solution iodometrically using starch as indicator.

 (ii) To determine the strength of given unknown potassium dichromate solution iodometrically using starch as indicator.

4. Organic Models: **[5]**

   R and S configuration of optical isomers

   E/Z configuration of geometrical isomers

   Conformation isomerism of ethane and n-butane

Viva-Voce   **[5]**

Sessional/Record   **[15]**

Books Suggested (Laboratory Courses):

   1. Practical Chemistry by S.Giri, D.N.Bajpai and O.P.Pandey Publ. S. Chand

2. …………………………………

Examination & Marking Scheme

Time: 5 hours	Max. Marks: 75	Min. Pass Marks: 27
	Regular Student	Ex- Student
Inorganic Mixture	20	20
Volumetric Exercise	15	15
Physical Experiment	15	15
Organic Models	05	05
Viva- Voice	05	05
Sessional and Record	15	----
Total	75	60*

*To be converted out of 75

    Inorganic qualitative mixture for 5 radicals: Correct Identification of group- 1 mark each, correct radical reporting- 2 marks each and proper reporting of observations- 1 marks.

1. **Volumetric Exercise:** An error up to 0.1% carries full marks. For each subsequent 0.1% error deduct 1 mark, 8 marks reserved for procedure.

2. **Physical Experiment:** Correct Observations- 6 mark, Calculation and Formula-5, Correct Result-4 marks.

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Theory

Paper I	Physical Geology	50 Marks
Paper I I	Mineralogy	50 Marks
Paper I II	Palaeobiology	50 Marks
Practicals :	Practical Examination	75 Marks

Total   225 Marks

Duration of each theory paper Examination	3 Hrs.
Duration of Practical Examination	3 Hrs.

PAPER I   :   PHYSICAL GEOLOGY

Unit I

Geology and its perspectives. Earth in the Solar System: origin, size, shape, mass, density, rotational and revolution parameters. Age of the Earth. Chemical composition of the Earth. Internal structure of the Earth. Formation of hydrosphere, atmosphere and biosphere. Internal heat and Radioactivity of the Earth; Convection in the earth's core and its magnetic field. Introduction to basic tenets of origin of the Universe, the solar system.

Unit II

Elementary ideas of continental drift, Sea floor spreading and the theory of plate tectonics. Types of plates. Causes and rate of plate movement. Application of theory of plate tectonics in Geology to explain origin of mineral deposits Mountains, Earthquake belts, Island arcs and various Petrogenesis.

Unit III

Rock Weathering. Difference between Weathering and Erosion. Types of weathering, Soil formation, soil profile and soil types.

Geological work of rivers, glaciers, wind and groundwater.

Unit IV

Earthquakes: Their causes, effects and distribution. Earthquake waves. Measurement of Earthquakes.

Volcanoes: Types, Products and distribution.

Unit V

Oceanography : Geological work of Ocean; Physical features of Oceans, Coasts, Deep Sea trench, Midoceanic Ridges and Abyssal plain. Generation of oceanic currents, surface currents and global ocean Conveyor system; wave erosion and beach processes; ocean as a thermostat for the earth's surface heat balance.

Climatology : Atmospheric circulation, weather and climate changes. Land-air-sea interaction, Earth's heat budget and global climatic changes. Glacial, interglacial periods and ice ages.

PAPER II: MINERALOGY

Unit I

 Fundamental laws of crystallography, elements of crystal symmetry, Millers, Weiss and Millarian system of notation and parameters. Crystal forms and their classification into crystal system, Introduction to space lattice.

Study of the normal classes of following crystal systems – Cubic system, Tetragonal system, Hexagonal system, Trigonal system, Orthorhombic system, monoclinic system, Triclinic system. Introduction to Symmetry classes (32). Twinning.

Unit II

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Physical properties of minerals. Physical properties of Important Silicate and economic minerals. Concept of Isomorphism, Polymorphism, Solid solution, Exsolution. Elementary idea about structure and classification of silicate minerals. Physical properties of the following minerals.

Quartz, jasper, Orthoclase, Plagioclase, Microcline, Muscovite, Biotite, Garnet, Olivine, Augite, Hornblende, tourmaline, Talc, Gypsum, Fluorite, Calcite, Apatite, Barite, Asbestos, Corundum. Phosphorite, Beryl, Kyanite, Galena, Sphalerite, Chalcopyrite, Pyrite, Magnetite, Hematite,Chromite, Pyrolusite and Psilomelane, Bauxite, Coal, Lignite.

Unit III

Petrological microscope and its construction; principles of optics as applied to orthoscopic and conoscopic study of minerals : color, form, birefringes, pleochroism, uniaxial and biaxial characters of minerals. Study of optical properties of Muscovite, Biotite, Quartz, Orthoclase, Microcline, Plagioclase, Olivine, Augite and Hornblende.

Unit IV

Mineralogical study of the following families.

    (i)   Olivine   (ii) Pyroxene   (iii) Amphiboles

Unit V

Mineralogical study of the following families.

    (i)   Quartz   (ii) Feldspar   (iii) Mica   (iv) Garnet

PAPER III: PALAEOBIOLOGY

Unit I

Fossils, their preservation and uses. Elementary idea of organic evolution. Morphology of hard parts and geological distribution of foraminifera. Introduction to Nummulites.

Unit II

Study of morphology and geological distribution of Graptoloidea, Echinoidea and Corals. Introduction to Monograptus, Diplograptus, Cidaris, Hemiaster, Micraster, Calceola and Zaphrentis.

Unit III

Study of morphology of hard parts and geological distribution of Gastropoda, Lamellibranchia and Trilobita. Introduction toTrochus, Murex, Physa, Turritella, Natica, Conus, Cyprea, Calymene, Paradoxides, Trinucleus and Phacops, Lima, Pecten, Ostrea, Graphea, Exogyra, Mytilus, Trigonia and Hippurites.

Unit IV

Study of morphology and geological distribution of Brachiopoda and Cephalopoda. Introduction to Productus, Spirifer, Terebratulla, Rhynchonella. Nautilus, Beleminites, Phylloceras, Orthoceras, Goniatites, Ceratites and Perisphinctes.

Unit V

Elementary knowledge of Gondwana flora and vertebrates of Siwaliks. Evolutionary history of Man, Horse and Elephant. Introduction to Glosopteris, Gangmopteris, Vertibraria and Ptilophyllum.

PRACTICALS

(1) Identification and Description of fossils in hand specimens.
(2) Identification and Physical Properties of Minerals in hand specimens.
(3) Identification and Description of Minerals under Petrological microscope
(4) Physical Geology Experiments.
(5) Sessional Marks.

SUGGESTED READING

1. Dutta A. K. 'Physical Geology.'

2. Gosh Mukul   'Bhautic Bhu Vigyan.' Madhya Pradesh Hindi Granth Academy., Bhopal.

3. Aurther Homes.   'Principles of Physical Geology'

4. Savinder Singh   'Bhu Akrati Vigyan'

5. Read H.H   'Rutley's Elements of Mineralogy. 26th Ed CBS Pub. New Delhi

6. Jain BC 'Khaniz tatha Crystal Vigyan,. Madhya Pradesh Hindi Granth Academy., Bhopal.

7. Tiwari D. R. 'Khaniz Vigyan'. Madhya Pradesh Hindi Granth Academy., Bhopal.

8. Deer WA, Howie RA and Zussman J. 1996: ' The Rock forming minerals' Longman publishers.

9. Woods, H., 1985: 'Invertebrate Palaeontology' CBS Publishers and Distributions. New Delhi.

10. Mishra R P 'Jeevashm Vigyan'. Madhya Pradesh Hindi Granth Academy., Bhopal.

11. Moore R. C., Lalicher CG and Fisher AC : 'Invertebrate fossils'. Mc Graw Hill.

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TEACHING AND EXAMINATION SCHEME

Subject/Paper	Period/Week		Exam. Hours	Max Marks	Min.Pass Marks
	L	**P**			
MATHEMATICS					
Paper I	3	-	3	75	
Paper II	3	-	3	75	81
Paper III	3	-	3	75	
STATISTICS					
Paper I	2	-	3	50	
Paper II	2	-	3	50	54
Paper III	2	-	3	50	
PRACTICALS	6	-	4	75	27

B.A. / B.Sc. Part I Examination 2017
Mathematics

Paper   **I : Algebra and Co-ordinate Geometry of Two Dimensions.**
Paper   **II : Calculus**
Paper   **III: Co-ordinate Geometry of three Dimensions and Vector Calculus.**

Note: Each theory paper is divided in three parts i.e. Section – A, Section – B and Section – C

Section A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited up to 30 words. Each question will carry 2 marks.

Section B: Will consist of 10 questions. Each unit will be having two question; students will answer one question from each Unit. Answer of each question shall be limited up to 250 words. Each question will carry 5 marks.

Section – C: Will consist of 05 questions one from each unit. Students will answer any 03 questions and answer of each question shall be limited up to 500 words. Each

question will carry 10 marks.
Total Marks: 75
Paper I

Algebra and Co-ordinate Geometry of Two Dimensions

Unit1: The characteristic equation of a matrix, Eigen values and Eigen vectors, Cayley- Hamilton theorem and its use in finding the inverse of a matrix. Inequalities. Continued fractions.

Unit 2: Relations between the roots and coefficients of general polynomial equations in one variable, Symmetric functions of roots Transformation of equations. Descarte's rule of signs. Solution of cubic equations (Cardon method). Biquadratic equations (Ferrari Method).

Unit 3: Infinite series. Convergent series, tests for convergence of a series, comparison test, D'Alembert's Ratio test, Cauchy's root test, Logarithmic Ratio Test. Raabe's test, De Morgen and Bertrand's test, Cauchy's condensation test, Gauss's test. Alternating series, Leibnit'z test (Derivation of above tests not required).

Unit 4 : Polar equation of a conic, polar equations of tangent, normal, asymptotes, chord of contact, auxiliary circle, director circle of a conic and related problems.
Unit 5 : General equation of second degree. Tracing of conics (Cartesian coordinates).

SUGGESTED BOOKS
M. Ray : A Text Book of Higher Algebra, S.Chand & Co., New Delhi
Bansal, Bhargva, Agarwal : Algebra (Hindi Ed.), Jaipur Publishing House, Jaipur. Bansal, Bhargava : 2-D Coordinate Geometry (HindiEd) Jaipur Publishing House, Jaipur. Sharma, Varshney : Coordinate Geometry, Pragati Prakashan, Meerut.
Gokhroo, Saini, Oza : 2-D Geometry (Hindi Ed.), Navkar Publication, Ajmer.
Paper – II
Calculus

Unit 1: Polar Co-ordinates. Angle between radius rector and the tangent. Angle between curves in polar form. Length of polar substangent and polar subnormal, Pedal equation of a curve, Derivatives of an arc, curvature, various formulae, Centre of curvature and chord of curvature and related problems.

Unit2:Partial differentiation, Euler's theorem on homogeneous functions, chain rule of partial differentiation, Maxima and Minima of functions of two independent variables and of three variables connected by a relation Lagrange's Method of undetermined multipliers.
Unit 3: Asymptotes, double points, curve tracing, Envelopes and evolutes.

Unit 4: Theory of Beta and Gamma functions. Rectification. Volume and Surfaces of solids of revolution. Differentiation and integration under the sign of integration.

Unit 5: Evaluation of double and triple integrals and their applications in finding areas and volumes. Dirichlet's integral. Change of order of integration and changing into polar co-ordinates.

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SUGGESTED BOOKS

Gorakh Prasad: A Text Book of Differential Calculus; Pothishala Pvt.Ltd.Allahabad Bansal, Bhargava and Agarwal : A Text Book of Differential Calculus II (Hindi Ed.) and Integral Calculus, Vol. II (Hindi Ed.); Jaipur Publishing House, Jaipur

Gokharoo, Saini : Differential Calculus (Hindi Ed.); Navkar Prakashan, Ajmer. Tandon, O.P. and Sharma, K.C. : Integral Calculus; Jaipur Publishing House, Jaipur Gupta, Juneja and Tandon : Differential Calculus (English Ed.);Ramesh Book Depot, Jaipur.

Gorakh Prasad : Integral Calculus; Pothishala Pvt.Ltd.Allahabad

Paper – III

Co-ordinate Geometry of 3-Dimensions and Vector Calculus.

Unit 1 : Sphere, Cone and Cylinder (Rectangular Coordinates only)

Unit 2 : The Central Conicoids (referred to principal axes). Tangents and tangent planes, Polar planes and polar lines, Section with a given centre, Enveloping cone, Enveloping cylinder and related problems.

Unit 3 : Equations of the normal to an ellipsoid, number of normals from a given point to an ellipsoid, Cone through six normals, Conjugate diameter and diametrical planes and their properties. Cone as a Central surface. Paraboloids.

Unit 4 : Plane Sections of Conicoids, Umbilics, Generating lines of hyperboloid of one sheet and its properties.

Unit 5 : Vector Calculus : Curl, Gradient and Divergence & Identities involving these operators. Theorems of Store's, Green and Gauss (Statement, application and verification only).

SUGGESTED BOOKS

Gupta, Juneja : Vector Analysis; Ramesh Book Depot, Jaipur.

Gokhroo, Saini, Bhati : Vector Calculus (Hindi Ed.); Navkar Prakashan, Ajmer Bhargava, Banwari Lal : Vector Calculus (Hindi Ed.); Jaipur Publishing House, Jaipur Bell, R.J.T.: Coordinate Geometry of Three dimensions;Macmillan India Ltd., New Delhi Vasistha, Agarwal : Analytical Solid Geometry; Pragati Prakashn, Meerut

Gokhroo, Saini & Rathi : Analytical 3-D Geometry (HindiEd);Jaipur Pub. House, Jaipur Bansal, Bhargva, Agarwal : 3-D Coordinate Geometry II; Jaipur Pub. House, Jaipur

B.A. / B.Sc. Part I Examination 2017
Statistics

Paper   **I : Statistical Methods**
Paper   **II : Elements of Probability**
Paper   **III: Applied Statistics**
Practical

Note: Each theory paper is divided in three parts i.e. Section – A, Section – B and Section – C.

Section A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited up to 30 words. Each question will carry 1 mark.

Section B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited up to 250 words. Each question will carry 3.5 marks.

Section – C: Will consist of total 05 questions one from each unit. The paper setter will set one question from each Unit and Students will answer any 03 questions and answer of each question shall be limited up to 500 words. Each question will carry 7.5 marks.

Total Marks: 50

Paper I
Statistical Methods

Unit 1: Definition, Importance, Scope, Limitations, distrust and functions of statistics, Planning of a statistical enquiry, sources of data, classification and tabulation of statistical data.

Unit 2: Diagrammatic and graphical representation of statistical data, graphs of frequency distribution, histogram, frequency polygon and ogives.

Unit 3: Measures of central tendency: Mean, Median and Mode, requisites of an ideal average, their merits and demerits, dispersion and its various measures.

Unit 4: Moments, raw moments, central moments and interrelationship between them, skewness and its various measures. Kurtosis and its measures.

Unit 5: Theory of attributes, class frequency, their order, consistency of data, incomplete data, association and independence of attributes, coefficient of association.

SUGGESTED BOOKS

Gupta, S.C. and Kapoor, V.K.: Fundamentals of Mathematical Statistics, Sultan Chand & Sons, Delhi.
Gupta, S.P.: Statistical Methods, Sultan Chand & Sons, Delhi.

Paper II

Elements of Probability

Unit 1: Random experiment. Sample space, events. Union and interaction of events, mutually exclusive, exhaustive, independent and equally likely events. Classical and Statistical definitions of probability and simple problems. Axiomatic approach to probability. Addition law of probability for two or more events.

Unit 2: Conditional probability. Multiplication law of probability, Statistical independence of events. Bayes theorem and its simple applications.

Unit 3: Random Variable: Discrete and continuous random variables. Probability mass and density functions, joint, marginal and conditional probability function. Distribution functions.

Unit 4: Mathematical Expectation: Definition of expectation, Addition and Multiplication laws of expectation. Moments and product moments in terms of expectation, variance and covariance for the linear combination of random variables Elementary idea of conditional expectation. Schwartz's inequality.

Unit 5: Moments generating and Cumulant generating functions with properties. Joint Moment generating function. Characteristic function with properties (without proof).

SUGGESTED BOOKS

Gupta, S.C. and Kapoor, V.K. Fundamentals of Mathematical Statistics, Sultan Chand & Sons, Delhi.
Kapoor, J.N. and Saxena, H.C.: Mathematical Statistics, S.Chand & Co., Delhi
Goon, A.M., Gupta M.K., Dass Gupta.: Fundamentals of Statistics, Vol. 1, World Press, Calcutta, 1991.
Gokharoo, D.C. and Saini, S.R.: Mathematical Statistics (Hindi ed.), Navkar Prakashan, Ajmer.
Bhargava, S.L. and Agarwal, S.M., Mathematical Statistics (Hindi Ed.), Jaipur Publishing House, Jaipur.
David, R.: Elementary Probability, Oxford Press
Bhat, B.R., Srivenkatramana, T. and Rao, Madhava K.S. (1977): A Beginner's Text, Vol, II, New Age International (P) Ltd., 1996.

Paper III

Applied Statistics

Unit 1: Statistical Organizations in India: C.S.O., N.S.S.O., their functions and publications, agricultural Statistics, area and yield statistics, trade statistics.

Unit 2: Index Number: Various types of index numbers, construction of index number of prices, fixed base and chain base methods, uses and limitations of these methods.

Unit 3: Essential requisites of an ideal index number, cost of living index number and its construction, the notions of splicing, base shifting and deflating.

Unit 4: Population Statistics, its nature, vital statistics, measures of mortality and fertility.

Unit 5: The growth of population and its measurements, life table, its construction and uses. Indian census, its organization and features.

SUGGESTED BOOKS

Gupta, S.C. and Kapoor, V.K.: Fundamentals of Applied Statistics

Goon, A.M. and others: Fundamentals of Statistics, Vol. II, World Press, Calcutta. Gupta, B.N.:

Statistics: Theory and Practice, Sahitya Bhawan, Agra (The Chapter on Indian Statistics)

Agarwal, B.L. Basic Statistics, Wiley Eastern Ltd.,

PRACTICAL

The students will be asked to attempt three exercises out of five exercises. The

distribution of marks will be as follows:

	Regular Students	Ex-Students
(a) Three Practical exercise	45 Marks	45 Marks
(b) Practical record work	10 Marks	-
(c) Viva-Voce	20 Marks	20 Marks
Total	75 Marks	65 Marks*

*To be converted out of 75 marks.

The following topics are prescribed for practical works:

1.Presentation of raw data.

2.Graphical representation by (i) Histogram (ii) Frequency Polygon (iii) Frequency curve and (iv) Ogives.

3.Diagrammatic representation by (i) Bars (ii) Pie-diagram.

4.Measures of central tendency: Mean, Median and Mode.

5.Measures of dispersion: (i) Range (ii) Inter-quartile range (iii) Mean deviation (iv) Variance and Standard deviation (v) Coefficient of variation.

6.Moments and various measures of skewness and kurtosis.

7.Exercises on determination of class frequencies, consistency of data and association of attributes.

8.Computations of death rates, birth rates, reproduction rates and construction of life tables.

9.Exercises on various types of index numbers.

TEACHING & EXAMINATION SCHEME

For the Examination -2016-17

COMPUTER SCIENCE

B.Sc. Part-I

THEORY

			Pd/W (45mts.)	Exam. Hours	Max. Marks
					150
CS.101	Paper I	Computer Oriented Numerical Methods and FORTRAN	2	3	50
CS.102	Paper II	Database Management System	2	3	50
CS.103	Paper III	5. Digital Electronics and Computer Organisation	2	3	50

PRACTICAL

	Pd/W	Exam. Hours	Max. Marks
			75
(a) Digital Electronics Lab.	3(1 day)	}5	37
(b) Software Lab.	3(1day)		38
		Total	**225**

B.Sc. Part-I

Paper – 1

COMPUTER ORIENTED NUMERICAL METHODS AND FORTRAN

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

Section – A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.

Section – B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.

Section – C: Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

6. Unit 1:

7. Language FORTRAN: Numerical constants, Variable names, Type statements, Arithmetic operations, Arithmetic expressions, Mixed Mode, Builtin mathematical functions, unformatted input output, Formatted input output, Field specifications, output field specifications, literal field, records, Repetition factors.

Unit 2:

Transfer of control: Unconditional and conditional transfer, relational expressions, Logical IF statement and computed GOTO statement, Do Loops: Use of Do Statements, Exit from Do loop, Continue statement, and Nested Do loops. Arrays: Declaration of arrays, Linear and multidimensional arrays, Input /Output Statement for arrays and Implied Do loops.

Unit 3:

Function and Subroutine: Subprogram, declaration and calling a function subprogram, Arithmetic statement functions, subroutines, difference between function and subroutine. Logical constants and Logical variables, Logical operators and Logical expressions, Type statement, IMPLICIT Statements, Double precision, Unlabelled Common Statement, Labeled Common Statement, Equivalence Statements.

U~NIT~ 4:

Computer Arithmetic: Floating point representation of numbers, arithmetic operations with normalized floating point numbers and their consequences, Errors in number representations.

Iterative Methods for solving Equations: Successive approximation, Bisection, false position and Newton Raphson methods; Convergence of iterative methods.

U~NIT~ 5:

Solution of simultaneous and ordinary differential equations: Taylor's series and Euler's method, Runge-Kutta methods and predictor –corrector method. Newton's and Lagrange's interpolation formula. Numerical differentiation, Numerical Integration: Newton cote's quadrature formula, Trapezoidal rule and Simpson's rule, Curve fitting by the method of least squares.

P~APER~ II

DATA BASE MANAGEMENT SYSTEM

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

Section – A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.

Section – B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.

Section – C: Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

U~NIT~ 1:

Data: Definition, uses, need, purpose of data base system, data abstraction, data models, data independence, data definition language, data manipulation language, data base manager, data base administrator, data base users, over all system structure, implementation and trade-offs of files.

UNIT 2:

Entity-Relationship Model: Entities and entities sets, relationships and relationship sets, attributes, mapping constraints, keys, E-R diagrams, reducing E-R diagrams to tables, generation, aggregation design of an E-R data base scheme.

UNIT 3:

Structure of relational databases, relational algebra, the tuple relational calculus, the domain relational calculus, modifying the database, relational commercial languages: SQL, Query-by-example.

UNIT 4:

RDBMS: Database file creation, updating, indexes, constants and functions and operators, logical functions, relational operators, logical operators, FOR and WHILE clauses.

UNIT 5 :

Report generation, design of report form, page layout, grouping, use of RQBE, understanding relational data bases, one to many relations, many to many and one to one relations, the RQBE window, the Select command.

PAPER III

8. DIGITAL ELECTRONICS AND COMPUTER ORGANISATION

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

Section – A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.

Section – B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.

Section – C: Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

UNIT 1:

Logic fundamentals and Boolean algebra: Binary, Octal, Decimal and Hexadecimal numbers and their inter conversion, BCD, ASCII and Gray codes, logic gates: DTL and TTL circuits. Boolean algebra, De Morgan's theorems and their applications to logic circuit analysis and synthesis, formulation of minimization problem prime implicants, Karnaugh map.

UNIT 2:

Arithmetic and logic elements: logical construction and analysis of half adder, full adder, adder-subtractor, multiplexers, demultiplexer, Flip Flops: RS latches; level clocking, D-latches, edge triggered D-Flip Flop, JK Flip Flop, JK master slave Flip Flop,

UNIT 3:

Registers and Counters: Buffer register, Shift register: Shift-Left, Shift-Right and ring counter, Counters: Asynchronous & synchronous counter, Mod counters, Divide by N counters, sequential counters and BCD counters.

UNIT 4:

Data Representation: Sign magnitude representation, Fixed-point representation, Floating point representation. Comparison and subtraction of unsigned binary numbers: 4-bit magnitude comparator using logic gates, 4-bit adder-subtractor. Error detection and correction: Parity generator-checker, Hamming codes (1-bit detection-correction).

IC Fabrication: Basic monolithic IC, epitaxial growth, photo masking, etching, diffusion of impurities, isolation techniques. Fabrication of: resistance, capacitance, diodes, transistors and FET devices. Advantages of IC technology.

Books Suggested:

Lipschutz, S And Poe, A.: Programming With FORTRAN, Schaum's Outline Series, Mcgraw Hill

Rajaraman, V. : Computer Oriented Numerical Methods, Prentice Hall Of India.

Rajaraman, V. : Computer Programming In FORTRAN, Prentice Hall Of India.

Malvino : Digital Computer Electronics – Introduction To Micro-Computers, Tata Mcgraw Hill.

Malvino : Digital Principles and Application, Tata Mcgraw Hill.

Mottershed : Electronic Devices and Circuits, PHI

Korth, H.P. and Silberschatz, A: Data Base System Concepts, McGraw Hill

Martin, J.: An Introduction to Database System, Vol. I, Narosa Publishing House.

Ulman, J.D.: Principles of Database Management System, (Second Edition), Galgotia Publishers Pvt. Ltd.

Sze S.M. Physics of Semiconductor Devices: Physics & Technology. Wiley Eastern.

EXPERIMENTS FOR PRACTICAL WORK

DIGITAL ELECTRONICS

1. To study the function of Basic Logic Gates and verify their truth table. AND, OR, NOT, NAND, NOR, X-OR.

2. To study the application of AND, OR, NAND, X-OR gates for gating digital signals.

3. (a) To study the different Logical Expression and their simplifications.

   (b) To familiarize and verify the Boolean algebraic theorems.

4. To study the different arithmetic circuits using logic gates:

   (a) Half adder and Half subtractor.

   (b) Full adder.

5. To study the BCD to Binary and Binary to BCD code converter.

6. To study the Binary to Gray and Gray to Binary code converter.

7. Study of Encoder circuits:

   (a) Decimal to BCD encoder.

   (b) Octal to Binary encoder.

8. Study of Decoder circuits:

   (a) BCD to Decimal decoder.

   (b) BCD to 7 segments decoder.

9. To study the Flip-Flop circuits using gates:

   (a) R-S Flip-Flop.

   (b) J-K Flip-Flop.

   (c) Master slave J-K Flip-Flop.

   (d) D Flip-Flop.

10. To study the R-S, J-K and D Flip-Flop ICs.

11. Study the Registers and Counters:

   (a) Study of Shift Registers.

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(b) Study of Ring Counter.

12. To study the Asynchronous counter using Flip-Flop ICs

13. To study the Asynchronous counter ICs

14. To study the Synchronous counter using Flip-Flops ICs

15. To study the Synchronous counter ICs

SOFTWARE LABORATORY

1. To write the program to show use of arithmetic operations with different data types.

2. To write the program to show use of Input and Output statements.

3. To write the program to show use of arithmetic expression using build-in functions.

3. To write the program using arithmetic IF statement.

4. To write the program using logical IF statement.

5. To write the program using DO loops.

7. To write the program using Arrays.

8. To write the program using function sub program.

9. To write the program using subroutine sub program.

10. To write the program using COMMON Statements.

11. Write a program to find solution of quadratic equation.

12Write a program to find root of an equation by Bisection method.

13. Write a program to find root of an equation by Secant method.

14. Write a program to find transpose of matrix.

   15. Write a program to solve the set of simultaneous equations by Gauss elimination method.

16. Write a program to evaluate a polynomial by nested multiplication method.

17. Write a program to solve the set of simultaneous equations by Gauss-Seidal elimination

method.

18. Solution of a differential equation by Euler's method.

19. Solution of a differential equation by Predictor-Corrector's method.

20. Numerical integration using Trapezoidal Rule.

TEACHING & EXAMINATION SCHEME
For the Examination – 2016-17
ELECTRONICS

B.Sc. Part - I

THEORY

			Pd/W (45mts.)	Exam. Hours	Max. Marks
					150
Elec. 101	Paper I	Circuit Elements and Networks	2	3	50
Elec. 102	Paper II	Semiconductor Devices	2	3	50
Elec. 103	Paper III	Thermionic Devices and measuring Instruments	2	3	50
PRACTICAL			6	5	**75**
	Total				**225**

B.Sc. Part -I

PAPER I
CIRCUIT ELEMENTS AND NETWORKS

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

Section – A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.

Section – B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.

Section – C: Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

UNIT 1:

Circuit elements: Types of resistors and their rating, inductance, types of inductors, mutual – inductance, transformer principle, types of transformers, capacitance, types of capacitors, LR, RC and RLC circuits, phasor diagrams, series and parallel resonance circuits, Quality factor.

UNIT 2:

Networks analysis I: Kirchhoff's Laws, superposition theorem, Thevenin's theorem, voltage source equivalent circuit, Norton's theorem, current source equivalent circuit, maximum power transfer theorem.

Unit 3:

Network analysis II: Network definitions, mesh and node circuit analysis, reduction of a complicated circuit into T and π equivalents, conversion between T and π configurations.

UNIT 4:

Coupled circuits: Coupled circuits and impedance transformation, inductive coupled circuits, equivalent circuits for transformer, tuned coupled circuits, two terminal pair networks, ladder network and characteristics impedance.

UNIT 5:

Filters: Characteristics impedance of symmetrical T and π networks, constant – k type low, high, band pass and band elimination filters, cascading of filters, attenuators.

PAPERS II

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Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

Section – A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.

Section – B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.

Section – C: Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

UNIT 1:
Semiconductors: Energy bands in metals, insulators and semiconductors , intrinsic semiconductors, mobility and conductivity, extrinsic semiconductors - n type and p type, carrier concentration, conductivity, Fermi levels, Hall effect, generation and recombination of carriers, life time, photoconductivity, diffusion, continuity equation.

UNIT 2:
Semiconductor diodes :Space charge region and potential barrier, Current - voltage equation, forward and reverse bias characteristics, d.c. and a.c resistance, Space Charge and diffusion capacitances, varactor diode, Zener diode, tunnel diode and their characteristics, metal-semiconductor contact

UNIT 3:
Transistor characteristics: Bipolar junction transistors, NPN and PNP transistors and their characteristics in CB, CE and CC configurations, α, β and hybrid parameters, simple CE amplifier and its graphical analysis, fabrication of IC components.

UNIT 4:

Field effect transistors: Junction field effect transistors (JFET) and MOSFET and their characteristics, comparison between p channel and n channel MOSFET, Comparison between BJT and FETs, Silicon controlled rectifier (SCR), Diac, Triac and UJT and their characteristics.

UNIT 5:

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Optoelectronics devices : Photoconductivity cells, PN photodiodes, PIN photodiodes, Avalanche photodiode, simple applications of photodiodes, optocoupler, photovoltaic effect, solar cell, LED and Phototransistors, basic concept of laser, semiconductor lasers and LCD.

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PAPERS III

THERMIONIC DEVICES AND MEASURING INSTRUMENTS

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Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

Section – A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.

Section – B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.

Section – C: Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

UNIT 1:

Thermionic emissions: types of cathode materials, vacuum diode and its characteristics, space charge, triode and its characteristics and parameters, tetrode, pentode and their characteristics, V-R tubes and thyratron.

UNIT 2:

Cathode ray oscilloscope: Construction of CRT, deflection sensitivity of tube, block diagram of CRO, various controls and their operation, details of X and Y sections, horizontal sweep section, synchronization of sweep, triggered sweep, measurement of voltage, current, frequency and phase angle using CRO, basic idea about dual trace CRO.

UNIT 3:

Power supplies: Half wave and full wave rectification, voltage regulation. Ripple factor, use of inductor, capacitor, L and π type filters, voltage regulation circuit using zener diode

UNIT 4:

Measuring instruments I: D' Arsonval galvanometer, galvanometer sensitivity, D.C. ammeter, voltmeter, voltmeter sensitivity, d.c. multimeter rectifier type instruments, electrodynamometer, wattmeter, transducers: variable resistance, piezoelectric and pyroelectric transducers

UNIT 5:

Measuring instruments II: A.C. bridge, balance conditions, Comparison bridges, Maxwell bridge, Hay bridge, Schering bridge, Wien bridge, impedance bridges, Q- meter

Books Suggested :

Millman & Halkias: Integrated Electronics (TMH)

Grob: Basic Electronics Mcgraw Hill 1985

Mottershead: Electronics, Devices and Circuits PHI, 1984

Ryder: Networks, Lines and Fields PHI 1983

Helfrick & Cooper: Modern Electronic Instrumentation & Measurement Techniques, PHI.

1.   Design and study of constant voltage source
2.   Design and study of constant current source
3.   Measurement of ac and dc voltage, frequency and phase of the waves   using CRO
4.   Measurement of impedance by impedance bridge
5.   Frequency response of Series LCR resonance circuits
6.   Frequency response of parallel resonance circuits
7.   Semiconductor Diode Characteristics
8.   Zener Diode Characteristics
9.   Transistor characteristics in CB mode
10. Transistor characteristics in CE mode
11. FET Characteristics
12. Single Stage BJT amplifier
13. Photocell characteristics
14. Verify Maximum power transfer theorem using reactive (resistive) circuit
15. Single Stage Troide amplifier
16. Voltage regulation by Zener Diode
17. Single stage FET amplifier.
18. DIAC characteristics.
19. Verify the Thevenin theorem using a resistive circuit.
20. Verify the Norton theorem using a resistive circuit.
21. To measure the characteristic impedance of symmetrical two-port resistive Network.

22. To measure Z-parameters for a two port network.

Note: - New experiments may be added on availability of equipments.

TEACHING & EXAMINATION SCHEME
For the Examination – 2016-17

PHYSICS

B.Sc. Part – I

THEORY

			Pd/W (45mts.)	Exam. Hours	Max. Marks
					150
Phy.101	Paper I	Mechanics	2	3	50
Phy.102	Paper II	Optics	2	3	50
Phy.103	Paper III	Electromagnetics	2	3	50
PRACTICAL			6	5	75
				Total :	225

B. Sc. Part I

Paper I: Mechanics

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

Section – A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.

Section – B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.

Section – C: Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

UNIT-1

Frames of Reference: Inertial frames, Galilean transformations, Non-inertial frames, fictitious forces, Displacement, Velocity and acceleration in rotating coordinate systems and their transformations, Coriolis force, Focault's pendulum, Motion relative to earth. Centre of Mass, collision of particles in laboratory and C.M. frame.

UNIT-2

Special Theory of Relativity: Invariance of c, Michelson-Morley Experiment, Lorentz transformations, addition of velocities, time dilation and length contraction, conservation of momentum in collision at relativistic speeds and variation of mass with velocity, relativistic energy, mass-energy equivalence, work and energy, transformation equations for momentum, energy and rate of change of momentum.

UNIT-3

Oscillations: Qualitative idea of oscillations in an arbitrary potential well, General differential equation for the harmonic motion, mass on a spring, oscillation of two masses connected by a spring, reduced mass, coupled oscillations, normal modes, normal coordinates of two linear coupled oscillators, damped harmonic motion, Forced oscillations and resonances, Resonance width and quality factor.

UNIT-4

Waves: General differential equation of one dimensional wave motion and its solution, plane progressive harmonic wave, differential calculus methods for speed of transverse waves on a uniform string and for that of longitudinal waves in a fluid, energy density and energy transmission in waves, superposition of waves, group and phase velocity.

Fourier series, Fourier analysis of square and saw-tooth waves.

UNIT-5

Rigid Body Dynamics: Equation of motion of a rotating body, angular momentum of a rigid body, inertial coefficient and idea of principal axes, case of j not parallel to ω, kinetic energy of rotation.

Elasticity : Young modulus, Bulk modulus and modulus of rigidity, Poisson ratio, relation between elastic constants, Theory of bending of a beam and torsion of a cylinder, experimental determination of Y by loading a beam in the middle and of η by static and dynamic methods, Searle's two bar experiment.

Books suggested:

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9. Berkeley: Physics Course, Vol. I, Mechanics, Tata McGraw Hill, New Delhi.

10. Berkeley: Physics Course, Vol. III, Waves and Oscillations, McGraw Hill, New Delhi.

11. A. P. French: Physics of Vibration and Waves.

12. Alonso and Finn: Fundamental University Physics, Vol. I, Mechanics.

13. R. S. Gambhir: Mechanics, CBS Publishers.

14. J.C. Upadhyaya: Mechanics, Ram Prasad & Sons, Agra.

PAPER II: OPTICS

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

Section – A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.

Section – B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.

Section – C: Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

UNIT-1

Geometrical Optics: Axial, Lateral and angular magnifications and their inter-relationship, Abbe's Sine condition for spherical surfaces, Aplanatic points for a spherical refracting surface.

Focal length of two thin lenses separated by a distance, Cardinal points of a co-axial lens system, properties of cardinal points, construction of image using cardinal points, Newton's formula and other relations for a lens system using cardinal points, Ramsden's and Huygen's eye pieces, their cardinal points, and relative merits.

UNIT-2

Interference: Division of Amplitude-Interference exhibited by thin film, Production of colours in thin films, Wedge-shaped film, Newton's rings and determination of wavelength and refractive index of a liquid by Newton's rings.

Michelson Interferometer: Measurement of wavelength and difference between two close wavelengths.

Fabry-Perot interferometer: Intensity Distribution, Co-efficient of sharpness and half width, measurement of wavelength.

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UNIT-3

Lasers: Population inversion, laser as source of coherent radiation, Basic principles of He-Ne Laser and Ruby Laser.

Diffraction: Fresnel's class of diffractions, Zone Plate, Phase reversal Plate, Cylindrical wave front and its effect at an external point and geometrical construction, diffraction at a straight edge; thin wire, rectangular slit and circular aperture.

UNIT-4

Fraunhofer class of diffraction: Amplitude and phase due to a number of SH Motions acting on a particle simultaneously, Diffraction at two slits and intensity distribution, Diffraction at N slits.

Plane Transmission Grating: Theory and formation of spectra, width of principal maxima, absent spectra, overlapping of spectral lines, number of spectra, measurement of wave-length of light, Rayleigh's criterion, Resolving Power of a Prism, Telescope, Microscope and plane transmission grating.

UNIT-5

Polarization: Double refraction, production of plane polarized light by double refraction, Nicol Prism, Double refraction in uniaxial crystals, Huygen's explanation of Double Refraction, Plane, circular and elliptically polarized light, Half-wave and quarter-wave plates, production and detection of plane, circularly and elliptically polarized light by Nicol Prism and Quarter-wave plate.

Rotatory Polarization, Fresnel's explanation, specific rotation, half shade and Biquartz Polarimeter, determination of specific rotation and strength of sugar solution.

Books suggested:

1. Jenkins and White: Optics, McGraw Hill.
2. Ghatak A.K.: Optics, Tata McGraw Hill.
3. Khandelwal D.P.: Optics and Atomic Physics, Shivlal Agarwal & Co.
4. Subramanayam and Brijlal: A text book of Optics, S. Chand, New Delhi.

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

Section – A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.

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Section – C: Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

UNIT-1

Vector Analysis: Scalar and Vector fields, partial differentiation of vector, gradient of a scalar field, line and surface integral of vector field, flux of a vector field, divergence of vector field and its physical significance, curl of vector field and its physical significance. Gauss law in integral and differential form, Gauss divergence theorem, Stokes theorem and Green's theorem, Laplace equation in Cartesian, cylindrical and spherical polar coordinates (without derivation).

Unit II:

Electrostatics: Potential and field due to a quadrupole and an arbitrary charge distribution, concept of multipoles, Electrostatic energy of a uniformly charged sphere. Classical radius of an electron.

Conductors in an electric field, uniqueness theorem, method of electric images and its application for system of point charge near a grounded conducting plane, Poisson's and Laplace equation in Cartesian coordinate Solution of Laplace equation in Cartesian coordinates, potential at a point inside a rectangular box.

Unit III:

Electric field in matter : Atomic and molecular dipoles, polarizability, permanent dipole moment, Dielectrics, boundary condition for electrostatic field at dielectric surface, polarization Vector, electric displacement vector, electrostatic energy of a charge distribution in dielectrics. Lorentz local field and Clausius-Mossotti equation.

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Magnetic field in matter : Magnetization Vector, uniform magnetization and surface current, non-uniform magnetization, B,M,H Vectors and their inter-relations, Bohr magneton, orbital magnetic moment and angular momentum, Gyromagnetic ratio, Magnetic Susceptibility.

Unit IV:

Electromagnetic Induction, Faraday's laws of Electromagnetic induction, integral and differential form, Relation between self and mutual inductance, measurement of self-inductance by (a) Rayleigh method (b) Anderson Bridg, Energy stored in magnetic field.

Transient response: Charge and discharge of condenser through resistance, determination of high resistance by method of leakage, growth and decay of current in LR circuit; significance of operator j and its uses in A.C. circuits. series and parallel LCR circuit, phasor diagram, Resonance and Quality factor, Sharpness of resonance.

Unit V:

Charge particle in electromagnetic field: equation of motion for charged particle, moving charge in electric field, in uniform magnetic field, charged particles in parallel electric and magnetic field, charged particles in cross electric and magnetic field.

Principle construction and working of ballistic galvanometer, determination of constant of ballistic galvanometer using steady deflection method, determination of mutual inductance using B.G., determination of magnetic field using search coil and B.G.

Books suggested:

Berkeley: Physics Course, Vol. II: Electricity and Magnetism, Tata McGraw Hill.

Laud, B.B.: Electro-magnetics, Wiley Eastern.

Ahmed and Lal: Electricity, Magnetism and Electronics.

D.C. Tayal: Electricity and Magnetism, Himalaya Publishing House

A.S. Mahajan A.A. Rangwala: Electricity and Magnetism, Tata McGraw Hill.

Griffiths: Introduction to Electrodynamics, PHI.

Experiments for Practical Work

1. Study of bending of a beam and determination of Young's modulus.

5. Modulus of rigidity by statical method using horizontal apparatus.

6. Modulus of rigidity by statical method using vertical apparatus.

7. Modulus of rigidity by dynamical method using Hollow Maxwell needle.

8. Modulus of rigidity by dynamical method using Solid Maxwell needle.

9. Elastic constants by Searle's method.

10. Verification formula for focal length of combination of two lenses separated by a distance d.

11. Formation of spectrum, prism spectrometer and determination of dispersive power of the material of a prism.

12. Wavelength of light by Newton's rings.

13. Wavelength of light by plane transmission grating.

14. Wavelength of light by biprism.

15. Specific rotation by polarimeter.

16. Resolving power of telescope.

17. To determine the Poisson's ratio of a rubber tube.

18. Study of temperature variation of surface tension by Jagger's method.

19. Resolving power of a plane transmission grating.

20. To determine the polarizing angle for the glass prism surface and to determine the refractive index of material of prism using Brewster's law.

21. Low resistance by Carey Foster Bridge.

22. Variation of magnetic field along the axis of circular Coil.

23. Study of an RL Circuit for Phase relations.

24. Study of rise and decay in CR Circuit.

25. Study of electro-magnetic induction and verification of Faraday's Laws.

26. Verification of Malus law.

27. Determine the thermodynamic constant using Clement and Desormes method.

28. Verification of Rutherford and Soddy's law of radioactive disintegration using dices and statistical Board.

Note: - New experiments may be added on availability of equipments.

THEORY

			Max. Marks (Min. Pass Marks: 54)
Paper I	:	Animal Diversity and Evolution	50
Paper II	:	Biology of Non chordates	50
Paper III	:	Cell Biology and Genetics	50

PRACTICALS :   Max. Marks: 75
                                                         (Min Pass Marks: 27)

Duration of each theory paper   3 hours
Duration of practical examination   5 hours

Note: Each theory paper is divided in three parts i.e. Section-A, Section –B and Section –C.

Section-A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited up to 30 words. Each question will carry of 1 mark.

Section –B: Will consist of 10 questions. Each unit will be having two questions; students will answer one question from each Unit. Answer of each question shall be limited up to 250 words. Each question carries 3.5 Marks.

Section-C: will consist of total 05 questions. Students will answer any 03 questions and answer of each question shall be limited up to 500 words. Each question carries 7.5 Marks.

PAPER I
Animal Diversity and Evolution

Functional morphology of the types included with special emphasis on the adaptations to their modes of life and environment. General characters and classifications of all invertebrate phyla up to class with examples emphasizing their biodiversity, economic importance and conservation measures where required.

Unit 1: General principles of taxonomy, concept of the five-kingdom, Concept of Protozoa, Metazoa and Levels of organization. Basis of classification of non-chordata: Symmetry, coelom, segmentation and embryogeny, Characters and Classification of Protozoa and Porifera upto classes with examples.

Unit 2: Salient features and classification of Coelenterata, Ctenophora, Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Mollusca and Echinodermata with their suitable examples.

Unit 3: Origin of Life, Miller's experiment, Lamarckism and Darwinism, Natural Selection, genetic basis of evolution, speciation, Evidences of organic evolution.

Unit 4: Variations, Isolation and Adaptations, Geological time scale and animal distribution in different era.

Unit 5: Principal zoogeographical regions of the world with special reference to their mammalian fauna, Factors affecting the large scale animal distribution, Origin and evolution of man.

PAPER II
Biology of Nonchordates

Unit 1: *Euglena:* Ultrastructure of flagellum and flagellar movement, osmoregulation and behaviour, reproduction.

Paramecium: Locomotion, nutrition, osmoregulation and reproduction. *Sycon*: Cellular organization, canal system, reproduction and development.

Unit 2: *Obelia:* Structure of polyp and medusa, sense organs and reproductive systems, life cycle.

Fasciola: Digestive, excretory and reproductive systems, developmental stages and life cycle.

Taenia: Structure of body wall, excretory and nervous systems, reproduction and developmental stages in life cycle.

Unit 3: *Nereis:* Parapodial locomotion, digestive, blood vascular, excretory, nervous and reproductive systems, development and metamorphosis.

Hirudinaria: Digestive, haemocoelomic, excretory, nervous and reproductive systems, sense organs.

Unit 4: *Palaemon:* Appendages, Digestive, respiratory, blood – vascular, excretory, nervous, sense organs and reproductive systems.

Pila: Digestive, respiratory, blood vascular, nervous and reproductive systems, sense organs

Unit 5: *Lamellidens*: Digestive, respiratory, blood–vascular, excretory and nervous systems, sense organs, reproduction and development.

Asterias: Water – vascular system, digestive, circulating and nervous systems, sense organs, reproduction, life history and regeneration.

PAPER III
Cell Biology and Genetics

Unit 1: Characteristics of prokaryotic and eukaryotic cells, Characteristics of cell membrane molecules, fluid-mosaic models of Singer and Nicolson, passive and active transport, Structures and functions of endoplasmic reticulum, ribosome, Golgi complex, lysosome, mitochondria, centriole, microtubules and nucleus.

Unit 2: Structure of Chromatin and Chromosomes, semiconservative mechanism of replication,

elementary idea about topoisomerases, replication forks, leading and lagging strands, RNA primers and Okazaki fragments, RNA structure and types, mechanism of transcription, Genetic Code and protein synthesis.

Unit 3: Interphase nucleus and cell-cycle including regulation.

Mitosis: Phases and process of mitosis, structure and function of spindle apparatus, Theories of cytokinese.

Meiosis: Phases and process of meiosis, synaptonemal complex, formation and fate of chiasmata recombination and significance of crossing over.

Unit 4: Mendelism: Brief history of genetics and Mendel's work: Mendelian laws, their significance and current status, linked gene inheritance.

Chromosomal aberration: Structural - translocation, inversion, deletion and duplication; Numerical - haploidy, diploidy, polyploidy, aneuploidy, euploidy, polysomy and genetic implications.

Unit 5: Genetic interaction: supplementary genes, complementary genes, duplicate genes, multiple gene interaction, ABO blood groups and their genotypes, Multiple alleles.

PRACTICALS

1. Dissections [Major]:

    Palaemon: Study of appendages, general anatomy, digestive and nervous systems *Pila*: General anatomy and nervous system
    Lamellidens / *Unio*: General anatomy and nervous system

2. Permanent preparations / Minor dissections of the following: Protozoa: *Paramecium*

    Porifera: Sponge spicules, fibres and gemmules Coelenterata: *Obelia* colony, *Obelia* medusa Annelida: *Nereis* parapodia
    Arthropoda: *Palaemon*: Statocyst and hastate plate along with comb plates,
    Cyclops and *Daphnia*
    Mollusca: *Pila*: Gill lamella, radula and L. S. Osphradium, *Lamellidens*: Gill-lamella

3. Identification, systematic position up to order and general study of the following animal forms, microscopic slides / museum specimens:

    Protozoa: *Amoeba, Entamoeba, Euglena, Noctiluca, Trypanosoma, Trichomonas, Foraminifera* (Oozes)*, Opalina, Balantidium, Nyctotherus, Paramecium, Paramecium* binary fission and conjugation and, *Vorticella* [Whole mounts].

    Porifera: *Leucosolenia, Grantia, Scypha, Hyalonema, Euplectella, Spongilla* and *Euspongia*

    Coelenterata: *Obelia* (colony and medusa), *Physalia, Porpita, Aurelia, Rhizostoma, Alcyonium, Corallium, Gorgonia, Tubipora, Pennatulla* and *Madrepora*
    Ctenophora: *Beroe*
    Platyhelminthes: *Dugesia, Fasciola* and *Taenia*

    Nematoda: *Ascaris, Ancylostoma, Dracunculus, Wuchereria, Trichinella, Schistosoma* and *Enterobius*

    Annelida: *Nereis*, Phase Heteronereis, *Aphrodite, Arenicola, Pheretima, Pontobdella, Branchellion* and *Hirudinaria*
    Onychophora: *Peripatus*

Arthropoda : *Limulus, Araneus, Palamnaeus, Apus, Lepas, Balanus, Sacculina, Palaemon, Lobster, Eupagurus, Carcinus, Lepisma, Odontotermes, Pediculus, Schistocerca, Papilio, Bombyx, Xenopsylla, Apis, Julus* and *Scolopendra*

Mollusca: *Chiton, Dentalium, Patella, Pila, Turbinella, Aplysia,* Slug, Snail, *Mytilus, Ostrea* (pearl oyster), *Lamellidens, Teredo, Nautilus, Sepia, Octopus* Enchinodermata: *Pentaceros, Asterias, Ophiothrix, Echinus, Holothuria* and *Antedon*

4. Study of sections, developmental stages and isolated structures from microscopic slides

Maximum Marks: 75
Minimum Pass Marks: 27

Porifera: L. S. and T. S. of *Scypha* / *Grantia*

Coelenterata: *Hydra,* Sections of *Hydra,* Developmental stages of *Aurelia*

Platyhelminthes: Transverse sections of *Dugesia, Fasciola* and *Taenia*, mature and gravid proglottids of *Taenia*, developmental stages of *Fasciola* and *Taenia* Annelida: Transverse sections of *Nereis* and *Hirudinaria*, Trochophore larva of Nereis, Parapodium of *Nereis* and *Heteronereis*

Arthropoda: Crustacean larvae (*Nauplius, Zoea, Megalopa* and *Mysis*), mosquito larva & pupa

Mollusca: Transverse sections of *Lamellidens* and Glochidium larva Echinodermata: Pedicellariae of Star fish

5. Experimental Zoology:

(i) Test for Protein : Biuret
(ii) Test for Lipids : Sudan IV
(iii) Test for Carbohydrates : Benedict's
(iv) Demonstration of catalase enzyme activity in animal tissue
(v) Living study of *Paramecium*
(vi) Temporary acetocarmine squash preparations and study of chromosomes

Each regular student is required to keep a record of practical work done by him/her duly checked by the teachers which will be submitted at the time of practical examinations.

Distribution of Marks:

	Regular	Ex.
Dissection [Major]	20	20
Permanent preparation / Minor Dissection (one)	08	10
Spots (seven)	21	21
Experimental Zoology	06	09
Viva-voce	10	15
Practical Record	10	---
Total	75	75

Recommended Books (All latest editions)

1.   Prasad, Beni: *Pila*, Lucknow Publishing House, Lucknow.
2.   Bhatia, M. L.: *Hirudinaria*, Lucknow Publishing House, Lucknow.
3.   De Robertis, E. D. P. and De Robertis, E. M. F.: *Cell and Molecular Biology*, Halt Saunder, Tokyo, Japan.
4.   Gardner, E. J.: *Principles of Genetics*, John Wiley & Sons, New York.
5.   Kotpal, R. L. : *Invertebrates*, Rastogi Publications, Meerut.
6.   Nigam, H. C. : *A University Course in Invertebrate Zoology*, Vol. I, Mc Milan, London.
7.   Prasad, S. N. : *Text Book of Invertebrate Zoology*, Kitab Mahal, Allahabad.
8.   Patwardhan, S. S. : *Palaemon*, Lucknow Publishing House, Lucknow.
9.   Reese, A. M. : *Outlines of Economic Zoology*, Blackiston Co., Philadelphia, U.S.A.
10. Vishwa Nath : *A Text Book of Zoology*, Vol. I, Invertebrate, S. Chand & Co., New Delhi.
11. Rastogi, Veerbala : *Invertebrate Zoology*, Kedar Nath Ram Nath, Delhi.
12. Jordan, E. L. and P. S. Verma: *Invertebrate Zoology*, S. Chand & Co. Ltd., Ram Nagar, New Delhi.
13. Alberts, B. *et.al*. *The Cell* (Garland).
14. Lodish, H., *et.al*. *Molecular Cell Biology* (Freeman).
15. Gupta, P. K., Genetics, Rastogi Publications, Meerut.
16. Rastogi, Veer Bala, Cell Biology, Kedar Nath Ram Nath, Delhi.

B.Sc. Part I Examination, 2017

Foundation Course: General English

Duration: 2 Hrs.
Max Marks: 100
No. of Questions: 100 Multiple Choice Questions

Unit 1:   **Texts Prescribed:**   (20 questions)

1. R.K. Narayan: *A Vendor of Sweets*
   (Ten questions from this text)
2. *Remedial Course in English Book II*
   (Ten questions from this text)

Unit II: Phrasal Verbs, Antonyms, Synonyms, Prefixes and Suffixes.
                                                    (20 questions)

Unit III: Compound and Complex Sentences, Transformation of simple,
                Compound and Complex sentences.   (20 questions)

Unit IV: Modal auxiliaries, Common Errors involving the use of articles,
                prepositions and tenses.   (20 questions)

Unit V: Active and Passive Voice, Direct and Indirect Speech, Formal and
                Informal Letters, Sequential Sentences.   (20 questions)

NOTE:

Division Of Questions and Marks :

Each Unit will be of 20 marks (20x5=100 Marks)

From Each Unit 20 multiple choice questions of one mark each will be given.

(20x5 = 100 questions)

RECOMMENDED READINGS:

Close, R.A. *A Reference Grammar of English.*

Corder, S. Pit.*An Intermediate English Practical Book*. Orient Longman.

Seely, John. *Writing with a Purpose.* Oxford University Press.

Thomson & Martinet. *A Practical English Grammar*. Oxford University Press.

B.Sc.

Ist Year 2017

General Hindi

बी.एससी. प्रथम वर्ष परीक्षा 2017
आधार पाठ्यक्रम : सामान्य हिन्दी

नोट : यह प्रश्न–पत्र दो घण्टे की अवधि और 100 अंकों का होगा।

इकाई 1 – पाठ्य पुस्तक–प्रकीर्णिका : सम्पादक–बालकृष्ण राव एवं श्रीराम शर्मा, राजकमल प्रकाशन, नई दिल्ली

इकाई 2 – (क) वर्णों का वर्गीकरण – भेद प्रभेद, (ख) सन्धि (ग) समास
(घ) उपसर्ग – प्रत्यय (ङ) तत्सम– तद्भव (च) शब्द शुद्धि, वाक्य शुद्धि

इकाई 3 – (क) संज्ञा और संज्ञा के विकारी तत्व–लिंग, वचन, कारक (ख) सर्वनाम (ग) विशेषण (घ) क्रिया और सहायक क्रिया–क्रिया, काल वृत्ति , पक्ष, वाच्य (ङ) अविकारी तत्व–क्रिया विशेषण, संबंध बोधक, समुच्चय बोधक, विस्मयादि बोधक, निपात (च) विराम–चिह्न

इकाई 4 – (क) अनेकार्थी शब्द (ख) युग्म शब्द (ग) वाक्यांश के लिए एक शब्द (घ) पर्यायवाची शब्द (ङ) विलोम शब्द (च) मुहावरे–लोकोक्तियाँ

इकाई 5 – (क) देवनागरी लिपि की विशेषताएँ (ख) मानक हिन्दी वर्णमाला तथा अंक, (ग) हिन्दी वर्तनी का मानक रूप (घ) कार्यालयी पत्र लेखन (ङ) कार्यालयी टिप्पणी (च) पारिभाषिक शब्दावली (कार्यालयी)

प्रश्न एवं अंक–विभाजन

- प्रत्येक इकाई 20 अंक की होगी – 20X 5= 100 अंक
- प्रत्येक इकाई से एक–एक अंक के बीस बहुविकल्पात्मक प्रश्न पूछे जाएँगे–

20X 5= 100 प्रश्न

सहायक पुस्तकें–

हिन्दी शब्दानुशासन : किशोरीदास वाजपेयी
हिन्दी व्याकरण : कामताप्रसाद गुरु
हिन्दी का सामान्य ज्ञान : हरदेव बाहरी
आलेख –प्रारूप : शिवनारायण चतुर्वेदी
टिप्पणी– प्रारूप : शिवनारायण चतुर्वेदी
मानक हिन्दी वर्तनी तथा नागरी लिपि : वैज्ञानिक तथा तकनीकी शब्दावली आयोग, नई दिल्ली।

SYLLABUS
BACHELOR OF SCIENCE
THIRD YEAR – 2016-2017
FACULTY OF SCIENCE

DEPARTMENT OF BOTANY
B.Sc. THIRD YEAR-2017

Theory

Course	Nomenclature	Number of Papers	Number of Periods per week	Maximum marks	Minimum marks
Paper I	Ecology and Environmental Biology	1	2	50	
Paper II	PlantPhysiology and Biochemistry	1	2	50	54
Paper III	Plant Biotechnology and Molecular Biology	1	2	50	
PRACTICAL COURSE			6	75	27

Duration of examination of each theory papers   3 hours

Duration of examination of practicals   5 hours

PAPER I : ECOLOGY AND ENVIRONMENTAL

BIOLOGY

Unit I: Plants and Environment: Atmosphere (gaseous composition), water (properties of water cycle), light (global radiation, phytosynthetically active radiation), temperature, soil (development, soil profiles, physico-chemical properties) and biota.

Morphological, anatomical and physiological responses of plants to water (hydrophytes and xerophytes) temperature (thermoperiodicity and vernalization), light (photoperiodism, heliophytes and sciophytes) and salinity

Unit II: Population ecology: Concept and characters, growth curves, biotic potential, ecotypes and ecads. Seed: The significance, suspended animation; ecological adaptation and dispersal strategies

Community ecology and Succession: Community characteristics, frequency, density, cover, life forms and biological spectrum. Succession: concept, classification and examples (hydrosere&xerosere)

Unit III: Ecosystems and Productivity: Ecosystem — Structure, abiotic & biotic components, food chain, food web, ecological pyramids, energy flow, biogeochemical cycles of carbon, nitrogen, phosphorus and Sulphur.

Productivity: Primary productivity, its measurements and factors affecting primary productivity

Unit IV: Environmental Biology of Indian Desert: Climate, vegetation types, adaptive strategies of desert plants. Desertification: meanings, causes, critical issues & driving forces. Agroforestry and its impact on desert agriculture. Desert biodiversity, Geomorphology, natural resources exploitation and their impact on desert environment

Unit V: Pollution Ecology: Definitions, classification, air, water and land pollution. Concepts of Industrial Ecology in pollution management. Global warming : Concepts and Current status.

Phytogeography: Vegetation types of India — Forest and Grasslands. Biogeographical regions of India, Remote sensing: The basics and applications in ecological studies

Suggested Laboratory Exercises

1. To determine minimum number of quadrats required for reliable estimation of biomass in herbaceous vegetation

2. To study the frequency of herbaceous species and to compare the frequency distribution with Raunkaier's Standard frequency diagram

3. To estimate Importance Value Index for herbaceous vegetation on the basis of relative frequency, relative density and relative biomass in protected and Gochar land

4. To measure the vegetation cover of grassland through point frame

5. To measure the above ground plant biomass in a natural field

6. To determine diversity indices (richness Simpson, Shannon-Weaver) in natural fields

7. To estimate bulk density and porosity of soil samples

8. To determine moisture contents, water holding capacity and texture of soil samples

9. To estimate qualitatively nitrate, phosphate and potassium in soil samples

10. To study the vegetation structure through profile diagram

11. To estimate transparency and pH of different water bodies

12. To measure dissolved oxygen content in polluted and unpolluted water samples

13. To estimate salinity, hardness, carbonates and bicarbonate in different water samples

14. To determine the percent leaf area injury of different leaf samples collected around polluted site

15. To estimate dust holding capacity of the leaves of different plant species

16. Plant adaptive modifications: Specimens/Slides:

i)   Succulents:*Opuntia, Euphorbia*

ii)   Salt secretion:*Atriplex, Chloris*

iii)   Salt accumulation:*Suaeda, Salsola, Zygophyllum*

iv)   Xerophytes:*Calligonum, Capparis, Leptadenia, Parkinsonia*

v)   Hydrophytes:*Eichhornia, Nymphaea, Hydrilla*

Suggested Readings

Dash, M.C. Fundamental of Ecology, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1996

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

Kumar, H.D. General Ecology, Vikash Publishing House Pvt. New Delhi, 1995

Mukherjee, B. Environmental Biology, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1997

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

Sen, D.N. Environment and Plant Life in IndianDesert, Geobios International, Jodhpur, 1982

Sharma, P.D. Ecology and Environment, Rastogi Publications, Meerut 2002

PAPER – II

PLANT PHYSIOLOGY AND BIOCHEMISTRY

Unit 1: Plant-water relations: Importance of water to plant life; physical properties of water; diffusion and osmosis; absorption, transport of water and transpiration; physiology of stomata

Mineral nutrition: Essential macro- and micro-elements and their role, mineral uptake; deficiency and toxicity symptoms

Introduction to phloem transport; source-sink relationship; factors affecting translocation

Unit 2: Photosynthesis: Significance; historical aspects; photosynthetic pigments; action spectra and enhancement effects; concept of two photosystems; Z-scheme;

photophosphorylation; Calvin cycle; C4 pathway; CAM plants; photorespiration. Rubisco enzyme.

Unit 3: Respiration: Aerobic and anaerobic respiration; Kreb's cycle; electron transport mechanism (chemi – osmotic theory); redox potential; oxidative phosphorylation pentose phosphate pathway

Basics of enzymology: Discovery and nomenclature; characteristics of enzymes; concept of holoenzyme, apoenzyme, coenzyme and cofactors; regulation of enzyme activity; mechanism of action, Protein structures

Unit 4: Nitrogen and lipid metabolism: Biological Nitrogen fixation. Importance of nitrate reductase and its regulation; ammonium assimilation. Structure and function of lipids; fatty acid biosynthesis; B-oxidation; storage and mobilization of fatty acids

Unit 5: Growth and development: Definitions; phases of growth and development. Brief account on seed dormancy, seed germination and senescence. Photoperiodism, physiology of flowering; florigen concept, biological clock,vernalization. Plant Hormones-auxins, gibberellins, cytokinins, abscisic acid and ethylene, history of their discovery, Physiological role and general mode of actions. Photomorphogenesis; Brief account on phytochromes and cryptochromes.

Suggested Laboratory Exercises

1.   To study the permeability of plasma membrane using different concentrations of organic solvents

2.   To study the effect of temperature on permeability of plasma membrane

3.   To prepare the standard curve of protein and determine the protein content in unknown samples

4.   To study the enzyme activity of catalase and peroxidase as influenced by pH and temperature

5.   Comparison of the rate of respiration of various plant parts

6.   Separation of chloroplast pigments by solvent method

7.   Determining the osmotic potential of *vacuolar sap by*plasmolytic method
8.   Determining the water potential of *any tuber*

9.   Separation of amino acids in a mixture by paper chromatography and their identification by comparison with standards

10.   Bioassay of auxin, cytokinin, GA, ABA and ethylene using appropriate plant material

11.   To study the regulation of stomatal movement using growth regulators, KCI and anti-transpirants

Suggested Readings

Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell (eds.). Plant Metabolism (2nd ed.), Longman, Essex, England, 1997
Galston, A.W. Life processes in Plants, Scientific American Library, Springer-Verlag, New York, USA, 1989
Hopkins, W.G. Introduction to plant physiology, John Wiley & Sons, Inc., New York, USA, 1995
Lea, P.J. and Leegood, R.C. Plant Biochemistry and Molecular Biology, John Wiley & Sons, Chichester, England, 1999
Mohr, H. and Schopfer, P. Plant Physiology, Springer-Verlag, Berlin, Germany, 1995
Salisbury, F.B. and Ross, C.W. Plant Physiology (4th ed.), Wadsworth Publishing Co., California, USA, 1992
Srivastava, H.S. Plant Physiology, Rastogi Publication, Meerut, 2001
Taiz, L. and Zeiger, E. Plant Physiology (2nd ed.), SinauerAssociats, Inc. Publishers, Massachusetts, USA, 1998

Suggested Readings

(for Laboratory Exercises)

Amar Singh. Practical Plant Physiology, Kalyani Publishers, New Delhi, 1977
Moore, T.C. Research Experiences in Plant Physiology: A Laboratory Manual, Springer-Verlag, Berlin, 1974
Nifa, A.J. and Ballou, D.P. Fundamental Laboratory Approaches for Biochemistry and Biotechnology, Fitzrierald Science Press, Inc., Maryland, USA, 1998
Robalts and Tucker, G.A. (Eds.) Plant Hormone Protocols, Humana Press, New Jersey, USA, 2000
Scot, R.P.W. Techniques and Practice of Chromatography Marcel Dekker, Inc., New York, 1995
Wilson, K. and Goulding, K.H. A Biologists Guide to principles and techniques of Practical Biochemistry, Ed-ward Arnold, London, 1986

PAPER-III
PLANT BIOTECHONOLOGY AND MOLECULAR BIOLOGY

Unit 1: Cell theory and concept of totipotency and pluripotency. History of plant tissue culture and biotechnology.Basic tools and techniques of Plant tissue culture and

molecular biology: General introduction about applications of biotechnology, bioinformatics and NanoBiotechnology.

Unit 2: Introduction to Bacterial Genome organization Genetic recombination in bacteria. Introduction to vectors for gene cloning: p-BR322, Cosmids, Phagemids and BAC.c-DNA libraries. Detection and screening of recombinant DNA.

Unit 3: Concepts of organogenesis-somatic embryogenesis and androgenesis. Somaclonal variations and its applications.Protoplast isolation, fusion and somatic hybridization. Cryopreservation of germplasm. Introduction to bioreactors and production of secondary metabolites with special reference to alkaloids obtained from *Ephedra*, shikonin, diosgenin and Strategies used to optimize secondary metabolite production.

Unit-4: Genetic engineering of plants:*Agrobacterium* mediated gene transfer, t-DNAtransfer mechanism integration and expression in plants.Direct method of gene transfer in plants: Chemical methods electroporation, particle gun delivery, lipofection, microinjection, macroinjection, pollen transformation, laser induced and silicon fiber mediated. Reporter (Lucifarase,GUS and GFP) and marker genes.

Unit-5: Biotechnology and society: Development of transgenic crop plants against biotic and abiotic stresses. Genetically modified crops: Golden rice, Bt cotton (as a model system).Intellectual Property Right (IPR) and Plant Breeder's Rights (PBR) in current regime of WTO. Impact of GM crops on society and environment.

SUGGESTED LABORATORY EXERCISES

1.   Demonstration of the technique of micropropagation by using different explants, e.g. auxiliary buds, shoot meristems

2.   Demonstration of the techniques of anther culture

3.   Isolation of protoplasts from different tissues using commercially available enzymes

4.   Demonstration of root and shoot formation from the apical and basal portions of stem segments in liquid medium containing different hormones

5. Demonstrations/poster on GM Crops and related issues

Suggested Readings

Bhojwani, S.S. Plant Tissue Culture: Application and Limitation, Elsevier Science Publishers, New York, USA, 1990

Old, R.W. and Primrose, S.B. Principles of Gene Manipulation, Black well Scientific Publications, Oxford, U.K., 1986

Raghavan, O. Embryogenesis in Angiosperms: A Developmental and Experimental Study, CambridgeUniversity, Press, New York, USA, 1986

Vasil, I.K. and Thorpe, T.A. Plant Cell and Tissue Culture, Kluwer Academic Publishers, TheNetherlands, 1994

SUGGESTED READINGS

(for Laboratory Exercises)

Ball, R.D. (ed.) Plant Cell Culture Protocols, Humana Press, Inc. New Jersey, USA, 1999

Dixon, R.A. (ed.) Plant Cell culture: a Practical Approach, IRL, Press Oxford, 1987

Glick, B.R. and Thompson, J.E. Methods in Plant Molecular Biology and Biotechnology, CRC Press, Boxa Raton, Florida, 1993

Roberts, J. and Tucker, G.A. (eds.) Plant Hormone Protocols Humana Press, New Jersey, USA 2000.

BIOTECHNOLOGY 2017

Max

Marks: 50

PAPER I: RECOMBIANT DNA TECHNOLOGY

Unit I: What is gene cloning and why do we need to clone gene?Tools and Techniques: Plasmid and other vehicle. Genomic-DNA, handling of DNA and RNA. Restriction enzymes and reagents. Laboratory techniques and other requirements.

Unit II: Safety measures and related regulations for recombinant DNA work,choice and selection of the tools and techniques. Vehicles: Plasmids and bacteriophages, available phagemids,cosmids and viruses.

Unit III: Purification of DNA from bacteria, plant and animal cells. Manipulation of purifiedDNA.Introduction of DNA into living cells. Cloning vectors for *E-coli*.

Unit IV: Cloning vectors for organism other than *E-coli,* yeast, fungi, plants- agro bacteria, plants viruses and animal viruses. Applications of cloning in gene analysis- how to obtain a clone of a specific gene, studying gene location and structure, studying gene expression.

Unit V: Gene cloning and expression of foreign genes in research and biotechnology. Production of protein from cloned genes. Gene cloning in medicine: Pharmaceutical compounds, artificial insulin gene, recombinant vaccine, and diagnostic reagents.

PAPER II: PLANT BIOTECHNOLOGY

Max Marks: 50

Unit I: Introduction to in–vitro methods. Terms and definitions. Use of growth regulators. Beginning of in-vitro cultures in India (Ovary and Ovule culture), in-vitro pollination and fertilization. Embryo culture, embryo rescue after wide hybridization and its application.

Unit II: Introduction to processes of embryogenesis and organogenesis and their practical applications. Clonal multiplication of elite species (micropropagation) through axillary bud, shoot tip and meristem culture Haploids and their applications. Somaclonal variation and their applications.

Unit III: Endosperm culture and production of triploids.

Single Cell suspension culture and their application in selection of variant mutants with or without mutagen treatment (of haploid cultures preferably).

Unit IV: Testing of viability of isolated protoplasts, various steps in the isolation and regeneration of protoplasts.

Somatic hybridization –Introduction, various methods of fusion of protoplasts (chemical and electrical), use of markers for selection of hybrid cells.

Unit V: Practical application of somatic hybridization (hybrids/cybrids). Use of plant cell, protoplasts and tissue culture for genetic manipulation of plants. Introduction to *Agrobacterium tumefaciens*: Tumour formation on plants using *A. tumefaciens* (monocots v/s dicots)

Hairy Root formation using using *Agrobacterium rhizogenes*

Practical applications of genetic transformation.

Plant genomics (e.g.Rice, Arabidopsis)

PAPER III: ENVIRONMENTAL AND ANIMAL BIOTECHNOLOGY

Max Marks: 50

Unit I: General metabolism of animal cells. Special secondary metabolites/products (Insulin, growth hormone, Interferon, t- plasminogen activator, and factor VIII

)Expressing cloned proteins in animal's cells. Over production and processing of chosen protein: The need to express in animal cells.

Unit II: Production of vaccines in animal cells.Production of monoclonal antibodies. Growth factors promoting proliferation of animal cells (EGF, FGF, PGDF, IL-1, IL-2, NGF, and Erythropoietin). Bioreactors for large-scale culture of cells. Transplanting cultured cells.

Unit III: Renewable and Non–Renewable resources. What is Renewable should be Bio-assimable / Biodegradable. Major consumable items: Food, Fuel and Fibers. Conventional Fuels and their Environmental impacts: Fire wood, Plant and Wastes, coal, gas, animal oils. Modern fuel and their environmental impacts: Methanogenic bacteria and biogas, microbial hydrogen production, conversion of sugars to ethanol the gasohol experiment, Solar energy converters- hopes from the photosynthetic pigments, plant based petroleum industry, cellulose degradation for combustible fuel.

Unit IV: Biotechnological inputs in producing good quality and natural fibers-transgenic animals and transgenic plants. Microbial quality of food and water .Treatment of municipal waste and industrial effluents.

Degradation of Pesticides and other toxic chemicals by micro organisms. Thuringiensis toxin as a natural pesticide, Biological control of other insects swarming the agricultural fields. Enrichment of ores by microorganisms,Biofertilizers. Nitrogen fixing microorganisms enrich the soil with assimilable nitrogen.

Unit V: Biodiversity and its conservation: Alpha- and Beta-biodiversity, steps to preserve biodiversity, in-situ and ex-situ conservation.

Intellectual property, IPR, and plant genetic resources, TRIPS and GATT

Patenting: Patenting of genetic material, obligations and complications, current issues: Ethics, Environmental safety.Risk assessment of GEOs (Genetically Engineered Organisms), Plant Breeder's right and farmer's rights.

Practical

1.   Initiating Plant tissue culture: differentiation of explants.
2.   Growth of plant cells into undifferentiated mass
3.   Large-scale cultivation of plant cells in suspension
4.   Induction of differentiation by modulating the hormonal balance
5.   Culture of lymphocytes from blood samples
6.   Preparation of media, filler sterilization, monitoring microbial contamination (bacteria, fungi & mycoplasma)
7.   Cloning of animal cells by cell and colony purification
8.   Fusion of cultured cells with myeloma cells.

Books Recommended

Old & Primrose: Principles of gene manipulation, Blackwell Scientific Publications

Sambrose& Russell: Molecular cloning CSH Press

Ausber: Current protocols in molecular biology CSH Press

Michel: Introduction to environmental microbiology

B.D. Singh Plant Breeding: Kalyani Publisher

Alexander, M: Microbial Ecology, John Wiley & sons

EC Eldowney, Hardman & Waite: Pollution Ecology biotreatment- Longman Scientific Technical

Baker &Herson - Bioremediation –Tata McGraw Hill

P.C.Debergh& R.H. Zimmerman: Micropropagation Technique & Applications. Kluwer Academic Publishers

K.Lindsey & M.G. K. Jones: Plant Biotechnology in Agriculture

R.A.Meyers: Molecules Biology & Biotechnology VCH Publishers N.Y.

B. D. Singh: Plant Biotechnology,Kalyani Publishers

Indra K Vasil &Trevar A Thorpe: Plant Cell & Tissue Culture, Kluwer Academic Publishers

S.S Bhojwani& M.K.Razdan: Plant Tissue Culture Theory & Practice, Elsevier

Practical

Time 5:00hr

Max. Marks: 75

Min. Marks: 27

1.	Preparation of nutrient medium and its sterilization	13
2.	Preparation of explant (pretreatment), sterilization and inoculation for the given tissue culture technique	08
3.	Identification of microbial contamination in the given nutrient medium	07
4.	Identify & comment upon the Spots (1to6)	27
5.	Viva- Voce	10
6.	Practical Record	10

PAPER - I

CH – 301 Inorganic Chemistry – III

UNIT I

Metal-Ligand bonding in transition metal complexes:

Valence bond theory of complexes and its limitation, Crystal field theory, Crystal field splitting of energy levels in octahedral, tetrahedral and square planer complexes, crystal-field stabilization energy of octahedral complexes (Calculation Only).

UNIT II

Hard and soft Acid Base Concept (HSAB): Classification of acid and base as hard and soft. Pearson's HSAB concept and its application.

Magnetic properties of transition metal complexes: Types of magnetic behaviour, magnetic properties of metal complexes, spin only formula, methods of determining magnetic moment and magnetic susceptibility.

UNIT III

Stability of metal complexes: A brief outline of thermodynamic stability of metal complexes and factors affecting the stability. Kinetic stability, labile and inert complexes, colour of transition metal complexes, effective atomic number (EAN), pi accepter ligands, experimental determination of stability constant and composition of complex (Job's Method and Bjerrum's Method).

UNIT IV

Organometallic Chemistry: Defination, nomenclature and classification of organometallic compounds, bonding, preparation, properties and application of organometallic compounds of Li, Al, Hg and Sn (alkyls and aryl).

Bioinorganic Chemistry: Essential and trace elements in biological processes, Biological role of alkali (Na, K, Li) and alkaline earth (Mg, Ca) metals.

UNIT V

Basic principles of Metallurgy and metallurgical processes.

Metallurgy of Copper, Zinc, Platinum and Uranium from their main ores.

Books Recommended:

1. Inorganic Chemistry Part I and part II by N.C.Sogani, M.L.Sharma, G.K.Rastogi

2. Inorganic Chemistry by G.C.Shivhare, V.P.Lawania
3. Text Book of Inorganic Chemistry by P.L.Soni
4. Text Book of Inorganic Chemistry by Satya Prakash, Tuli & Madan

CH-302 Organic Chemistry

UNIT : I.

Spectroscopy

Nuclear magnetic resonance (NMR) spectroscopy.

Proton magnetic resonance (^{1}H PMR) spectroscopy , nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, toluene and acetophenone.

UNIT : II

Heterocyclic Compounds

Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basic nature of pyridine, piperidine and pyrrole.

Introduction to condensed five and six – membered heterocycles. Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis. Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.

UNIT : III.

Carbohydrates

Classification and nomenclature. Monosaccharides, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threo diastereomers. Conversion of glucose into mannose. , mechanism of osazone formation, Formation of glycosides, ethers and esters. Cyclic structure of D(+)-glucose. Determination of ring size of monosaccharides, Mechanism of mutarotation. Structures of ribose and deoxyribose.

An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides(starch and cellulose)without involving structure determination.

UNIT – IV.

Amino Acids, Peptides, Proteins and Nucleic Acids

Classification, structure and stereochemistry of amino acids; Acid-base behavior, isoelectric point, electrophoresis and separation of amino acids by chromatography.

Preparation and reactions of α-amino acids. Structure and nomenclature of peptides and proteins. Classification of proteins. selective hydrolysis of peptides. Classical peptide synthesis, solid-phase peptide synthesis. Peptide structure determination, end group analysis, Structures of peptides and proteins. Levels of protein structure. Protein denaturation/renaturation.

Nucleic acids: introduction. Constituents of nucleic acids. Ribonucleosides and ribonucleotides. The double helical structure of DNA.

UNIT –V:

Fats, Oils, Detergents and Synthetic Polymers : Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils. Saponification value, iodine value, acid value. Soaps, synthetic detergents, alkyl and aryl sulphonates. Addition or chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization and vinyl polymers. Condensation or step growth polymerization. Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes

Books Recommended:

1. Advanced Organic Chemistry by Morrisom & Boyd
2. Organic Chemistry by Behal & Behal
3. Text Book of Organic Chemistry by M.K.Jain
4. Polymer Chemistry by P. Bahadur and N.V. shastri.

PAPER – III
CH-303 Physical Chemistry – III

UNIT I
Elementary Quantum Mechanics

Black-body radiation, Planck's radiation law, photoelectric effect. Compton effect, De Broglie hypothesis, the Heisenberg's uncertainty principle, Schrodinger wave equation and its importance, physical interpretation of wave function.

Adsorption: **Difference between adsorption, absorption and sorption, Chemisorption, adsorbent and adsorbate, reversible and irreversible adsorption, characteristics of adsorption, adsorption of gases by solids, factors affecting adsorption, types of adsorption, types of adsorption isotherms, Freundlich and Langmuir adsorption isotherms. Numericals**

UNIT II
Spectroscopy

Introduction: electromagnetic radiation, regions of the spectrum, Basic features of different Spectrometers, Born-Oppenheimer approximation, degrees of freedom.

Rotational Spectrum: Diatomic molecules, Energy levels of a rigid rotator (semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotator, isotope effect. Numericals.

UNIT III

Vibration and Raman Spectroscopy
Vibrational Spectrum:Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum.

Raman Spectroscopy: concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules. Numericals.

UNIT IV

Electronic Spectrum: Origin of electronic spectrum, Selection rules, vibrational course structure and rotational fine structures considering no interaction of rotational and vibrational energies. qualitative description of selection rules and Franck-Condon principle.

Photochemistry: **Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grothus – Drapper law, Stark – Einstein law, Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions – energy transfer processes (simple examples). Numericals**

UNIT V

Solid State

Crystal state, classification of crystals, space lattice, unit cell.

Laws of crystallography – (i) Law of constancy of interfacial angles (ii) Law of rationality of indices (iii) Law of symmetry. Symmetry elements in crystals.

X-ray diffraction by crystals. Derivation of Bragg equation. Determination of crystal structure of NaCl, KCl and CsCl (Laue's method and powder method). Numericals.

Books Suggested:

1. The Elements of Physical Chemistry, P.W. Atkins, Oxford.
2. Physical Chemistry Through problems, S.K. Dogra and S. Dogra, Wiley Eastern Ltd.
3. Principles of Physical Chemistry, B.R. Puri, L.R. Sharma and M.S. Pathania, Shobhan Lal Nagin Chand & Co.
4. Physical Chemistry by S.C.Ameta, A.V.Singh, R.Ameta, R.Mathur
5. Bhotic Rasayan, K.R. Genwa, RBD Jaipur

CH – 304 Laboratory Course – III

<u>Inorganic Chemistry:</u>

Preparations: [5]

Micro cosmic salt., Tetraaminecopper(II) sulphate, Nickel ammonium sulphate, Sodium thiosulphate, Chrome Alum, Ferrous Sulphate, Ferrous Ammonium Sulphate

<u>Organic Chemistry:</u>

(a) **Qualitative Analysis: -** Analysis of an organic mixture is containing two solid components, using water, $NaHCO_3$ and NaOH for separation.
       [15]
(b) **Synthesis of organic compounds:-**
       [10]
(i)   Acetylation of salicylic acid, aniline and p-nitroacetanilide.
(ii)   Preparation of iodoform from ethanol and acetone.
(iii)   Diazotization/Coupling of primary aromatic amines (aniline).
(iv)   Preparation of methyl orange.
(c) **Thin Layer Chromatography**
   [10]
      (i)   Separation of dyes
      (ii)   Separation of green leaf (Spinach) pigments.

Physical Chemistry
        [15]

   (a) **Colloids:** To determine precipitation value for the following sols and also verify Hardy's Schultz law (i)As_2S_3 Sol (ii)Fe $(OH)_3$ Sol .
   (b) **Distribution law**: To determine the partition coefficient of benzoic acid between water and benzene at R.T.
   (c) **Adsorption**: To study the adsorption of acetic acid by activated charcoal and verify the Freundlich **a**dsorption isotherm.

Viva   **[5]**

Record   **[15]**

Books Suggested (Laboratory Courses):

   1. Practical Chemistry, S.Giri, D.N.Bajpai and O.P.Pandey Publ. S. Chand
   2. Experimental Organic Chemistry Vol I & II, P.R. Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.
   3. Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern.
   4. Vogel's Textbook of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchell, ELBS.
   5. Experiments in General Chemistry, C.N.R. Rao and U.C. Agarwal, East-West Press.
   6. Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGraw Hill.
   7. Advanced Practical Physical Chemistry, J.B. Yadav, Goel Publishing House.
   8. Advanced Experimental Chemistry, Vol. I-Physical, J.N. Gurtu and R. Kapoor, S. Chand & Co.

Examination & Marking Scheme

Time: 5 hours   Max. Marks: 75   Min. Pass Marks: 27

	Regular	Ex
	Student	Student
Inorganic Preparation	05	05
Qualitative Analysis	15	15
Organic Synthesis	10	10
Chromatography	10	10
Physical Experiment	15	15

Viva- Voice	5	5
Sessional and Record	15	…
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Total	75	60*

*To be converted out of 75

Theory

Paper I	Economic Geology	50 Marks
Paper I I	Structural Geology	50 Marks
Paper I II	Applied Geology	50 Marks
Practicals :	Practical Examination	75 Marks

Total   225 Marks

Duration of each theory paper Examination	3 Hrs.
Duration of Practical Examination	3 Hrs.

PAPER I : ECONOMIC GEOLOGY

Unit I :

Ore forming process and deposits : Magmatic Concentration, Pegmatite, Contact metasomatism (including Skarns), Hydrothermal process and deposits.

Unit II :

Ore forming process and deposits : Sedimentation (Chemical Precipation and Evaporation), Weathering (Residual and Mechanical Concentration), Oxidation and Supergene sulphide enrichment. Volcanogenic, Metamorphic and Biogenic Process and deposits.

Unit III :

Geological setup and economic aspects of (a) Gold deposits of India (including Kolar Gold Field), (b) Lead Zinc and Copper deposits of India (including Zawar, Rajpura-Dariba, Malanjkhand, Khetri and Singhbhum deposits) (c) Iron and manganese deposits of India   (d) Aluminium, Chromium, Tin and Tungsten deposits of India.

Physical properties, mode of occurrence and genesis, Indian location and economic use of following Ore minerals : Native Gold, Galena, Sphalerite, Chalcopyrite, Limonite (Gossan), Magnetite, Hematite, Pyrolusite, Psilomelane, Wed Ore, Bauxite, Chromite, Wolframite and Casseterite.

Unit VI :

Description of minerals used and the industries including, Cement, Fertilizer, Refrecatory, Abrassive, and Gem Stones.

Introduction of mineral used and industries including, Glass and Ceramics, Paint and Pegments, Insulator, Electronic and Building Stones.

Physical properties, mode of occurrence and genesis, economic use and Indian location of following industrial minerals and rocks : Apatite, Phosphorite, Pyrite, Gypsum, Diamond, Zircon, Kyanite, Magnesite, Garnet, Corundum, Quartz, Feldspar, Asbestos, Wollastonite, Talc, Fluorite, Barite, Muscovite, Ochur, Malachite, Azurite, Graphite. Limestone, Marble and Granite.

Unit V :

Energy Minerals : (A) Coal : Proximate and ultimate analysis of coal, classification of coals, ranks of coal, Origin of coal. Indian coal fields (B) Petroleum : Origin of Petroleum. Petroleum geology of Bombay High, Cambey basin, Northeastern India and Barmer-Sanchor basin,　　(C) Nuclear Minerals : Types and Origin of various uranium and Thorium deposits. Geology of Jaduguda uranium deposit. Coastal Thorium Sand deposits.

PAPER II :   STRUCTURAL GEOLOGY

Unit I :

Concept of Bed, Dip and Strike, True and Apparent dips. Toposheet, Clinometer, Brunton compass. Geological Map definition and components. Methods of geological mapping in the field. Determination of thickness of bed, dip and strike in the Geological map. Preparation of cross section of Geological maps.

Unit II :

Determination of top and bottom of Sedimentary beds. Outlier, Inlier, Overlap and Offlap structures. Stereographic projection and its use in Structural analysis.

Unit III :

Fold : Definition and morphology. Geometric and genetic classifications. Elementary idea about mechanism of folding. Recognition of folds in map and field.

Unit IV :

Faults : Definition. Terminology of parts. Classifications. Effect of faulting on outcrops. Recognition of faults in map and field.

Unit V

Unconformities : types and recognition. Joints : Characteristics and Types. Cleavage, Schistosity and Lineation : types and their significance to recognize the major structures.

PAPER III : APLIED GEOLOGY

Unit I :

Environmental Geology : Concept of natural ecosystem, Intraction and interrelation of Atmosphere, Hydrosphere, Lithosphere and Biosphere. Soils. Hydrological cycle.

Remote Sensing : Fundamentals of Remote Sensing. Preparation and study of areal photographs for Geomorphology, Structural geology and Lithology. Preparation of Geological map using Remote sensing. Applications of Remote sensing.

Unit II :

Groundwater hydrology : Groundwater and Surface water reservoirs. Aquifer, Aquiclude and Aquifuge. Darcy's law and its validity. Groundwater provinces of Rajasthan and India. Watershed management and linking of rivers. Quality of groundwater.

Unit III :

Engineering Geology :Types and terminology of Dams and Tunnels. Geological considerations to locate dams and tunnels including (a) structural geology (b) Lithology and (c) Groundwater.

Geological disasters : Earthquakes and Tsunami, Volcano, Flood and Landslide.

Unit VI :

Mineral exploration : Surface and subsurface exploration methods.Remote sensing and exploratory mapping. Geophysical exploration : Gravity, Electrical, Magnetic, and Seismic methods of exploration. Geobotanical and geochemical methods of exploration. Drilling: Types, logging and problems.

Unit V :

Principles of mineral economics : National policy. Strategic, critical and essential minerals. mineral production in India. Changing pattern of mineral consumption. Mineral concession rules. Marine mineral resources and Law of sea.

PRACTICALS

1. Physical properties, mode of occurrence and genesis, Indian location and economic use of Metallic minerals (ores).
2. Physical properties, mode of occurrence and genesis, Indian location and economic use of Non Metallic (industrial Minerals) and Coals.
3. Preparation of map showing distribution of important economic deposits.
4. Preparation of Cross section of Geological maps and/or completion of outcrop maps.
5. Use of Stereographic projections for Structural geology.
6. Sessional Marks.

SUGGESTED READING

1. Jenson M and Bateman A M 'Economic Mineral Deposits'. John Wiley and Sons Newyork.

2. Gokhle KVand GK Rao 'Ore Deposits of India,. Thomson Press

3. Vyas GK 'Arthik Bhu Vigyan'. Madhya Pradesh Hindi Granth Academy

4. Manjrekar RP 'Arthik Evam Vyavharik Bhu Vigyan'. Madhya Pradesh Hindi Granth Academy

5. Rakshpal R. 'Bharat ki Khaniz Sampda Evam Udyog'. Rajasthan Hindi Granth Academy

6. Billings M. P. 'Structural Geology'

7. Shrivastava D.K. Sanrachnatmak Bhu Vigyan Madhya Pradesh Hindi Granth Academy

8. Arogyaswami RNP 'Mining Geology' CBS publishers

9. Todd 'Groundwater Hydrology'

10. Todd D. K. 'Bhaum Jal Vigyan' Madhya Pradesh Hindi Granth Academy

11. Satyanarayan Swami B. S. 2000 : 'Engineerig Geology' Dhampat Rai and Cop Delhi

12. Pandey SN 1987 'Principles and Applications of Photogeology' Wiley Eastern New Delhi

DEPARTMENT OF MATHEMATICS & STATISTICS
B.Sc. THIRD YEAR-2017

TEACHING AND EXAMINATIION SCHEME

Subject/Paper	Period/Week		Exam. Hours	Max Marks	Min.Pass Marks
	L	P			
MATHEMATICS					
Paper I	3	-	3	75	
Paper II	3	-	3	75	81
Paper III	3	-	3	75	
STATISTICS					
Paper I	2	-	3	50	
Paper II	2	-	3	50	54
Paper III	2	-	3	50	
PRACTICALS	**6**	**-**	**4**	**75**	**27**

B.Sc. Part III Examination 2017
MATHEMATICS

Paper I   : Abstract Algebra
Paper II   : Analysis and Laplace Transforms
Paper III   : Mechanics II (Dynamics of Rigid Bodies and Hydrostatics)

Note: Each theory paper is divided in three parts i.e. Section – A, Section – B and Section – C

Section A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited up to 30 words. Each question will carry 2 marks.
Section B: Will consist of 10 questions. Each unit will be having two question; students will answer one question from each Unit. Answer of each question shall be limited up to 250 words. Each question will carry 5 marks.
Section C: Will consist of total 05 questions one from each unit. Students will answer any 03 questions and answer of each question shall be limited up to 500 words. Each question will carry 10 marks.
Total Marks: 75

Paper I
Abstract Algebra

Unit 1: Definition and example of groups. General properties of groups, Order of an element of a group. Permutations : Even and Odd permutations. Groups of permutations. Cycle group, Isomorphism, Isomorphism of cyclic groups, Cayley's theorem.

Unit 2: Subgroups, Cosets, Lagrange's theorem, Product Theorem of subgroups, Conjugate elements, conjugate complexes, Central of a groups, Normaliser of an element and of a complex. Normal subgroups, quotient Groups, Commutator subgroup of a group. Homomorphism, Fundamental theorem of homomorphism.

Unit 3: Definition and kinds of rings, Integral domain, Division ring, Field, Subring of a ring, Subfield of a field. Characteristic of a ring and field.

Unit 4: Ideals of a ring, Quotient rings, Prime fields, Prime ideals, Field of quotients of an integral domain, Definition and examples of a vector space, subspace of a vector space, Linear combination and linear space, Linear dependence and independence of vectors. Direct product of vector spaces and internal direct sums of subspaces.

Unit 5: Bases and dimension of a finitely generated spaces, Quotient space, Isomorphism, Linear transformation (Homomorphism), Rank and nullity of linear transformation.

SUGGESTED BOOKS

Sharma, G.C. : Modern Algebra; Ram Prasad & Sons, Agra.
Bansal & Bhargava : Abstract Algebra (Hindi Ed.); Jaipur Publishing House,
Jaipur. Agarwal, R.S. : Text Book on Modern Algebra; S. Chand & Co., New Delhi.
Gokhroo & Saini : Abstract Algebra (Hindi Ed.); Jaipur Publishing House, Jaipur.

Paper – II

Analysis and Laplace Transforms

Unit 1 : Dedekinds theory of real numbers. Linear sets. Upper and Lower bounds, Limiting points, Weierstrass's theorem. Derived sets, Enumerable Sets, Open and Closed sets.

Unit 2 : Theory of Riemann integration, Darboux theorem. Fundamental theorem of integral calculus, Mean value theorem of integral calculus.

Unit 3 : Functions, Limits, and continuity. Differentiability, Concept of an analytic function, Cartesian and Polar form of Cauchy-Riemann equations. Harmonic function, Conjugate function, Laplace's differential equations, Orthogoanl system, Construction of analytic functions. Power Series: Absolute convergence of power series, circle and radius of convergence of power series, sum function of a power series.

Unit 4: Basic definition and Properties of complex integration Complex integration as the sum of two line integrals, Inequality for complex integrals. Curves in complex plane, Cauchy-Goursat theorem, Connected regions, Indefinite integral (or Anti Derivative). Derivative of Single-valued functions F(z). Cauchy's integral formula, Extension of Cauchy's integral formula to multiconnected, regions, Cauchy's integral formula for the derivative of an analytic function, Successive derivative of an analytic function, Morera's Theorem. Liouville's Theorem, Poisson's integral formula.

Unit 5: Laplace Transforms and Inverse Laplace Transforms. Laplace transforms of derivatives and integrals. Shifting theorems. Convolution theorem. Applications of Laplace Transform to the solution of differential equations.

SUGGESTED BOOKS

Shanti Narayan: Real Analysis; S.Chand & Co., New Delhi.
G.N.Purohit: Real Analysis; Jaipur Publishing House, Jaipur.
Bhargava, Goyal: Real Analysis (Hindi Ed.); Jaipur Publishing House, Jaipur.
Gokhroo, Saini, Ozgha: Real Analysis (Hindi Ed.); Jaipur Publishing House, Jaipur.
Shanti Narayan: Theory of Functions of a Complex Variable; S.Chand & Co., New Delhi. Gupta, K.P. : Complex Analysis; Pragati Prakashan; Meerut
Gokhroo, Saini & Yadav: Complex Analysis (Hindi Ed.); Navkar Publication, Ajmer
G.N. Purohit: Complex Analysis; Jaipur Publishing House, Jaipur.
S. Ponnusamy: Foundations of Complex Analysis, Narosa Publishing House, Bombay, New Delhi.
V. Karunakaran: Complex Analysis, Narosa Publishing House. Bombay, New Delhi (2002).
N.Levinson and R.M. Redheffer: Complex Variables, Tata McGraw-Hill Publ. Co. Ltd., New Delhi (1980).

Paper III

Mechanics – II

(Dynamics of Rigid Bodies and Hydrostatics)

Unit 1: Moments and Products of inertia. D'Alemberts' principle, the general equations of motion of a rigid body, Motion of the center intertia and motion relative to the center of inertia. Motion about a fixed axis under finite forces.

Unit 2: The compound Pendulum. Reaction of the Axis of rotation. Motion of a rigid body in two dimension under finite forces.

Unit 3: Fluids and Fluid Pressure, homogeneous and heterogeneous fluids, Surface of equal pressure, fluid at rest under action of gravity, Fluid pressure on Plane surfaces.

Unit 4: Centre of pressure, resultant pressure on curved surfaces.

Unit 5: Equilibrium of floating bodies, Centre of buoyancy, Surface of buoyancy. Stability of equilibrium of floating bodies, Meta Centre.

SUGGESTED BOOKS

Loney, S.L. : Rigid Body Dynamics; Cambridge Univ. Press.

Gupta, P.P. : Rigid Body Dynamics, Vol.I; Krishna Prakashan, Mandir; Meerut

Bansal, J.L. : Rigid Body Dynamics; Jaipur Publishing House, Jaipur.

Prasad, B.N. : Hydrostatics; Krishna Prakashan, Mandir; Meerut

Mathur, S.M. : A Text Book of Hydrostatics; Ramesh Book Depot, jaipur.

Sharma, Gokhroo,kSaini, Agarwal.: Elements of Hydrostatics; Jaipur Publishing House, Jaipur.

Statistics
Paper   I : Sampling Distribution, Estimation and Testing of Hypothesis
Paper   II : Statistical Quality Control & Operation Research
Paper   III: Designs of Experiments and Non-Parametric Tests
Practical

Note: Each theory paper is divided in three parts i.e. Section – A, Section – B and Section – C.
Section A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited up to 30 words. Each question will carry 1 mark.

Section B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited up to 250 words. Each question will carry 3.5 marks.

Section – C: Will consist of total 05 questions one from each unit. The paper setter will set one question from each Unit and Students will answer any 03 questions and answer of each question shall be limited up to 500 words. Each question will carry 7.5 marks.
Total Marks: 50

Paper I
Sampling Distribution, Estimation and Testing of Hypothesis

Unit 1: Concepts of sampling distribution and standard error, derivation of X^2 (chi-square), t and F distribution, their simple properties.

Unit 2: Concepts of point estimation, properties of point estimators such as consistency, unbiasedness, minimum variance. Unbiased estimators, efficiency and simple notion of sufficiency, factorization theorem (without proof).

Unit 3: Different methods of finding estimators such as method of moments, method of minimum variance, method of least square and maximum likelihood (without detailed discussion of their properties).

Unit 4 : Testing of hypothesis, siple and composite hypotheses, two types of errors, idea of best critical region, power of a test, power curves in simple cases. Nayman- Pearson lemma.

Unit 5 : General theory of test of significance, Large sample tests for mean and proportions. Applications of X^2 (chi-square) t and F in testing of hypotheses. The interval estimation of Normal population mean, variance, difference of means, ratio of variances.

SUGGESTED BOOKS
Gupta, S.C. and Kapoor, V.K.: Fundamental of Mathematical Statistics, Sultan Chand and Sons, Delhi.
Surendran, P.U. and Saxena, H.C.: Statistical Inference, S.Chand & Co., Delhi.

Paper II

Statistical Quality Control & Operation Research

Unit 1: Concept of Statistical quality control, Control charts: $(x, \bar{R})$, $(\bar{x}, \sigma)$, p, np, c-charts, their constructions and uses.

Unit 2: Sequential Analysis: Sequential probability ratio test, O.C. and A.S.N. functions and their applications.

Unit 3: Sampling Inspection by attributes: Producer's risk, consumer's risk, AOQL, ASN, OC, Single, Double and Sequential Sampling plans and their comparison.

Unit 4: Introduction to operation Research, Queuing theory (I): Queuing systems, characteristics of queuing system, Poisson process, exponential distributions of number of arrivals, inter arrival time, service time.

Unit 5: Queuing Theory (II): Classification of queues, model I: Model $(M/M/I)$: (∞ / FIFO) and its characteristics, waiting time distribution. Introduction of Model II (M/M/I): ($<\infty>>$ / SIRO)**.**

BOOKS SUGGESTED

Gupta, B.N.: Statistics (Theory and Practical), Sahitya Bhawan, Agra.
Saini, Yashpan and Fiedman: Operation Research Methods and Problems, Hohn Wiley and Sons, New York.
Goon, Gupta, Dasgupta: Fundamentals of Statistics, Vol. II Grant,
E.L.: Statistical Quality Control, Mc-Graw Hill, New York.

Paper III

Designs of Experiments and Non-Parametric Tests

Unit 1 : Analysis of variance, one way and two way classification, including multiple but equal number of observations per cell.

Unit 2 : The completely randomized design, Randomized block design, comparison of RBD with CRD, Lay-out of RBD.

Unit 3 : The latin square design, its layout and analysis. Factorial experiments, the main effects and interactions layout and its analysis (in 2^2 and 2^3 carried out in a RBD only).

Unit 4 : Non-parametric Tests: Order Statistics Cumulative and probability distribution function of a Single Order Statistics, expectation of function of order statistics. Non-parametric methods and advantages and disadvantages, Power efficiency, Sign test (Simple, for paired observations), Run test for randomness.

Unit 5 : Wilcoxon signed Rank test, Median Test, Mann-Whitney Wilcoxon U-Test, Wald-

wolfowitz Run test (two sample problem), Kolmogorov-Smirnov Goodness of fit test.

BOOKS SUGGESTED

Gupta, S.C. and Kapoor, V.K.: Fundamentals of Applied Statistics, Sultan Chand & Sons, Delhi.
Goon, Gupta, Dasgupta: Fundamentals of Statistics, Vol. II, World Press, Calcutta.
Rahatgi, V.: Statistical Inference, Wiley.

PRACTICAL

The students will be asked to attempt three exercises out of five exercises. The distribution of marks will be as follows:

	Regular Students	Ex-Students
(a) Three Practical exercise	45 Marks	45 Marks
(b) Practical record work	10 Marks	-
(c) Viva-Voce	20 Marks	20 Marks
Total	75 Marks	65 Marks*

*To be converted out of 75 marks.

The following topics are prescribed for practical works:

01. Analysis of variance: One way and two way classifications.

02. Analysis of (i) completely randomized (ii) randomized block and latin square designs, factorial experiments.

03. Practical on SQC (Covered in Paper III).

04. Test of significance based on normal, X^2, t and F tests, power

curve. 05. Practical on Non-Parametric Tests (covered in Paper – III).

06. 'Working knowledge of SPSS Package'.

DEPARTMENT OF PHYSICS
B.Sc. THIRD YEAR-2017

TEACHING & EXAMINATION SCHEME
For the Examination – 2016-17

THEORY

			Pd/W (45mts.)	Exam. Hours	Max. Marks
					150
Phy.301	Paper I	Solid State Physics	2	3	50
Phy.302	Paper II	Nuclear Physics	2	3	50
Phy.303	Paper III	Relativity and Electrodynamics	2	3	50
PRACTICAL			6	5	75
		TOTAL:			**225**

B. SC. PART-III

PAPER I : SOLID STATE PHYSICS

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

Section – A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.

Section – B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.

Section – C: Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

UNIT-1 :

Crystal structure : Different terms of crystal structure, Fundamental types of lattices, Two and three dimensional lattice types; Seven system of crystals, Characteristics of sc, bcc, fcc, hcp; Miller indices, orientation of planes in cubic lattices; Distribution of Atoms in atomic planes of cubic lattices. Distance between successive planes; Von-Laue's equations of diffraction of X-rays, Bragg's Law, scattering from lattice of point-atoms. Scattering factor. Geometrical Scattering factor for sc, bcc, fcc. Reciprocal lattice and its properties.

UNIT-2 :

Crystal binding and lattice vibrations : Inter-atomic forces of solids. Crystal of inert gases, cohesive energy and bulk modulus. Ionic crystals, Madelung energy and bulk modulus. Covalent crystals. Hydrogen bonded crystals, Atomic radii. Concept of phonons Vibration of monatomic lattices, lattice with two atoms per primitive cell. Local phonon modes. Density of states in one dimension, three dimensions, lattice heat capacity for Einstein model, Debye model.

UNIT-3 :

Free Electron theory of metals : Free electron model, Density of states of electron gas, Fermi-Dirac distribution function, effect of temperature on Fermi-Dirac distribution function, Fermi energy at absolute zero temperature and low temperature. Electron heat capacity. Thermionic emission. Boltzmann transport equation, Sommerfeld theory of electrical conductivity, Thermal conductivity, Wiedmann-Franz Law. Hall effect.

UNIT-4 :

Band theory : Formation of bands and origin of energy gap, Bloch theorem, Kronig Penney model, crystal momentum and velocity of an electron. Effective mass of electrons. Electrons and holes. Number of states in a band, insulator, semi-conductor and metal. Construction of Brillouin Zones and Fermi-surfaces. Fermi levels in intrinsic, n- type and p- type semi-conductors, Mass action Law. The static dielectric constants of solids. Local electric field at an atom.

UNIT-5 :

Magnetism : Diamagnetism and Larmor precession, classical theory of diamagnetism, Para-magnetism and its classical theory, free electron theory. Molecular theory of ferromagnetism.

Experimental Survey of Superconductivity : Zero resistance, persistent currents, effect of magnetic fields, flux exclusion, Intermediate state, Entropy effect, frequency effects, Gyromagnetic ratio, Isotope effect. Occurrence of superconductivity. Thermoelectric effects, thermal conductivity. High temperature oxide, superconductors and their properties. BCS theory (elementary idea without mathematical derivation), Magnetic levitation.

Books suggested :

Kittel : Introduction to Solid State Physics, Wiley Eastern.

A.J. Dekker : Solid State Physics, McMillian India.

L. Azaroff : Theory of Solids.

Paper II: NUCLEAR PHYSICS

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

Section – A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.

Section – B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.

Section – C: Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

Unit I:

Rutherford alpha scattering experiment, scattering formula and experimental verification of scattering formula. nuclear charge, Chadwick's determination of nuclear charge, theories of nuclear composition, nuclear mass, Determination of size of nucleus using Mesonic X ray method, Measurement of potential radius from life time of alpha emitters and scattering of fast neutron. nuclear spin, Determination of nuclear spin from hyperfine splitting of the atomic energy, parity, method of parity investigation, nuclear magnetic moment and electrical moment, relation between quadrupole moment and nuclear spin.

Unit II:

Mass defect, binding energy and packing fraction of nucleus. Liquid drop model of Nucleus, magic number and evidence of it, WEIZSACHER's Semi Empirical Mass formula, Predication of stability against beta-decay for members of an isobaric family.

Types of nuclear reactions, The balance of Mass and energy in nuclear reactions, conservation law in nuclear reactions, Q equation. Solution of the Q equations, concept of centre of mass in nuclear reaction, proton-proton collision and neutron-nucleus collision in CM frame.

Unit III:

The law of radioactive decay, statistical nature of radioactivity. Radioactive growth and decay. Ideal equilibrium, transient equilibrium and secular equilibrium, Radioactive series, Fundamental law of radioactivity, induced radioactivity, radioactivity dating.

Alpha decay: Disintegration Energy, Range of alpha particles, Geiger Nuttal's Law, spectrum and fine structure. alpha particles paradox, Barrier penetration, Beta Decay, disintegration energy of Beta Decay, principle, working and uses of beta ray spectrometer.

Unit IV:

Nuclear Energy: Nuclear induced fission, energy released in fission of U^{235}, Fission chain reaction, stability limits against spontaneous fission, Energetic of Symmetric fission, Neutron cycle in a thermal reactor. Four factor formula. Elementary idea of nuclear reactors, types of nuclear reactor, nuclear reactor in India. Nuclear fusion, fusion in stars, carbon and pp cycle, problems of controlled fusion, fissile and fertile materials and their characteristics.

Unit V:

Gas filled ionisation detectors, Detailed description, principle working and uses of (i) proportional counter (ii) Geiger-Muller Counter, dead time, recovery time and paralysis time,

principle of acceleration, classification of accelerators, electrostatic accelerators, linear accelerators, cyclotron, synchrocyclotron, betatron.

Properties of elementary particles, Classification of elementary particles, quantum number of elementary particles, conservation laws, experimental evidence of violation of parity conservation in Beta Decay, C.P.T. theorem, types of cosmic rays and properties of primary cosmic rays.

Books suggested:

Alonso & Finn: Fundamental University Physics – Vol. III, Addision Wesley.

S.N. Ghoshal: Atomic & Nuclear Physics – Vol. II, S. Chand, New Delhi.

Satyapraksh: Nuclear Physics, Pragati Prkashan Meerut

R. R. Roy and B. P. Nigam, Nuclear Physics, New Age Int.(P) Ltd

D.C. Tayal: Nuclear Physics, Himalaya Publishing House

PAPER III: RELATIVITY AND ELECTRODYNAMICS

Note: The question paper for the examination will be divided in three parts i.e., Section – A, Section – B and Section – C.

Section – A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited upto 30 words. Each question will carry 1 mark.

Section – B: Will consist of 10 questions. Two questions from each unit will be set and students will answer one question from each Unit. Answer of each question shall be limited upto 250 words. Each question carry 3.5 marks.

Section – C: Will consist of total 05 questions. The paper setter will set one question from each Unit and students will answer any 03 questions and answer of each question shall be limited upto 500 words. Each question will carry 7.5 marks.

UNIT-1

Electromagnetic Waves: Displacement current, Maxwell's equations, Electromagnetic wave equation, Poynting theorem, Plane Electromagnetic waves in free space, wave impedance of free space, Propagation of plane Electromagnetic waves in non-conducting and conducting media, Skin depth, propagation of Electromagnetic waves in ionized gases, Polarization of Electromagnetic waves.

UNIT-2

Reflection and Refraction of Electromagnetic waves: Boundary conditions at the surface of discontinuity, reflection and refraction of Electromagnetic waves at the interface of non-conducting media, Fresnel's equations and their experimental verification, reflection and transmission coefficients, Brewster's Law and degree of polarization, total internal reflection,

phase difference between parallel and perpendicular components and polarization of the reflected wave, reflection from a conducting plane.

UNIT-3

Interaction of Electromagnetic waves with matter: Normal and anomalous dispersion of light, empirical relations, Lorentz theory of dispersion of gases, experimental demonstration of anomalous dispersion in gases, scattering of electromagnetic waves and scattering parameters, Thomson, resonant and Rayleigh's scattering cross-section, polarization of scattered light, coherent and incoherent scattered light, dispersion in liquids and solids, Claussius Mossotti equation and Lorentz-Lorentz formula.

UNIT-4

Relativistic Mechanics: Coordinate transformation, contra variant and covariant vectors, tensors of second and higher rank, addition, subtraction, contraction, outer and inner product of tensors, covariance of tensor equations, Minkowski space, geometrical interpretation of Lorentz transformation, space like and time like intervals, four vectors, four dimensional gradient, divergence and curl operators, four-velocity, four-acceleration, four-momentum, four-force, relativistic classification of particles.

UNIT-5

Relativistic Electrodynamics : Invariance of charge, transformation of surface charge density, transformation of volume-charge density and current density, Equation of continuity in the covariant form, Scalar and vector potentials, Transformation of Electromagnetic potentials, Lorentz condition and its covariant form, Electromagnetic field tensor, Covariance of Maxwell's equations, Transformation of Electro-Magnetic fields, Lorentz-force in a covariant form, Electromagnetic field due to a moving charge.

Books suggested:

S.P. Puri: Electrodynamics, Tata McGraw Hill

J.D. Jackson: Classical Electro-dynamics, John Wisely, New York

B.B. Laud: Electromagnetic, John Wisely, New York

E.C. Jordan: Electromagnetic waves, PHI, New Delhi

D. J. Griffiths: Introduction to Electrodynamics, PHI

Practicals of B.Sc. III Year Physics

Note: These Practicals are divided into three sections, Lab. A, Lab. B & Lab. C.

1. Lab. A is for all students.
2. Lab. B is only for the students having Electronics as an optional subject in B. Sc.
3. Lab. C is for all the students except those who offer Electronics as an optional subject.

Examination Scheme for Laboratory Work:

1. Students with Electronics shall be examined in one experiment from each of Lab. A and Lab. B.
2. Students with Combinations not involving Electronics shall be examined in one experiment of Lab. A and one experiment from Lab. C

LAB. A: PHYSICS PRACTICALS

1. Determination of Planck's constant using solar cell/ LED.
2. Determination of Stefan's constant (B-B method).
3. Study of characteristics of a GM counter and verification of inverse square law for the same strength of a radioactive source.
4. Determination of coefficient of rigidity as a function of temperature using torsional oscillator (resonance method).
5. e/m measurement by Helical Method.
6. Measurement of magnetic field using Ballistic galvanometer and search coil.
7. Measurement of electric charge by Millikan's oil drop method.
8. To study hysteresis loss of transformer by B-H curve using CRO.
9. Determination of dielectric constant of solids and liquids.
10. Determination of velocity of sound in air.
11. Verification of Cauchy's formula.
12. Study of Lissajous patterns.
13. Determination of separation of plates of Etalon using spectrometer.
14. To verify Fresnel's formula for the reflection of light.

LAB. B: COMPUTER APPLICATIONS

The following exercises to be performed using MS Excel software

1. Solution of given differential equation using Euler's method.
2. Solution of given equation in one variable using Newton – Raphson method.
3. Calculating value of e^x for given x using series expansion.
4. Calculating value of sin(x) for given x using series expansion.
5. Evaluating integral of given function using Simpson's Method.
6. Plotting time displacement graph for projectile motion.
7. Calculating mean and standard deviation of given data.

LAB. C: ELECTRONICS

1. Study of ripple factor for shunt capacitor, series inductor, L-section and π section filters using full wave rectifier circuit.
2. Study of frequency response of single stage transistor amplifier (variation of gain with frequency).
3. Study the characteristics of field effect transistor (FET).
4. Study the negative feedback effect on voltage gain, and input and output impedances of the amplifier.
5. Study of operational amplifier (OP-AMP).
6. Study of RC circuits as integrating and differentiating systems with Square input.
7. Study of series and parallel LCR resonance circuit.
8. Design and Voltage study of AND, OR, NOT, NAND and NOR gates circuits using diodes and transistors.
9. Design and study of RC phase shift oscillator.
10. Study of Nano TiO_2 Solar Cell.
11. Study of Hybrid Solar and wind energy.
12. Transient Analysis of C-R and L-R circuit.
13. Determination of parameter of transformer.

Note: - New experiments may be added on availability of equipments

Theory		Marks
		(Min. Pass Marks; 54)
Paper I	: Animal Physiology and Biochemistry	50
Paper II	: Ecology and Behavior	50
Paper III	: Applied Zoology	50
Practical	:	75
		(Min. Pass Marks; 27)

Duration of each theory paper	3 hours
Duration of practical examination	5 hours

Note: Each theory paper is divided in three parts i.e. Section-A, Section –B and Section –C.

Section-A: Will consist of 10 compulsory questions. There will be two questions from each unit and answer of each question shall be limited up to 30 words. Each question will carry of 1 mark.

Section –B: Will consist of 10 questions. Each unit will be having two questions; students will answer one question from each Unit. Answer of each question shall be limited up to 250 words. Each question carries 3.5 Marks.

Section-C: will consist of total 05 questions. Students will answer any 03 questions and answer of each question shall be limited up to 500 words. Each question carries 7.5 Marks

PAPER I
Animal Physiology and Biochemistry

Unit 1: Digestion; digestive enzymes, process of digestion, digestion of protein, carbohydrate

and lipid

Blood: Composition and functions, Blood groups, Rh factor and their significance, blood clotting mechanism, blood pressure and cardiac cycle, respiratory pigments, cardiac muscle activity.

Unit 2: Muscle: Structure of various types of muscles and mechanism of muscle contraction
Excretion: Structure of kidney, types of nephron, mechanism of urine formation and its elimination and arginine, ornithin cycle.

Unit 3: Respiration: Structure of lung, mechanism of respiration, respiratory pigment, exchange and transport of oxygen and carbon dioxide.
Nervous System: Structure of neuron and its classification, Nerve impulse, impulse conduction and reflex action.

Unit 4: Endocrine glands: Structure and functions of various endocrine glands, diseases caused by hormonal deficiency; Mechanism of hormone action.

Unit 5: Structure of Protein and Carbohydrates; oxidation of glucose through glycolysis, Krebs cycle and oxidative phosphorylation, deamination, transamination and decarboxylation.

PAPER II

Ecology and Behaviour

Unit 1: Introduction of ecology, definition, history, sub division and scope of ecology. Envirnmental factors; physical factors- soil, water, air and temperature. Biotic factors- interspecific and intraspecific relations, neutralism, mutualism, commensalism, antibiosis, parasitism, predation, competition. Concept of limiting factors, Liebig's law of minimum, Shelford's law of tolerance, combined concept of limiting factors.

Unit 2: Population and community ecology, measurement of population density, Factors affecting population growth, growth factors, dispersal, characteristic of community, concept of ecosystem and niches.
Food chain, food web, Ecological pyramid. Energy flow in an ecosystem, biogeochemical cycles of CO_2, N_2, O_2, S and P; Prospects and stratigies of sustainable development.

Unit 3: Brief introduction to the major ecosystem of the world and ecological succession, conservation of natural resources; Ecology in relation to Thar desert, Brief account of environmental pollution, global warming and its impact upon Human race.

Unit 4: General survey of various types of animal behavior; Methods of studying animal behavior, Role of hormones and pheromones in behavior, Biological rhythms.

Unit 5: Learning and Memory: Conditioning, Habituation, Insight learning, Association learning, Reasoning and Communication; Wildlife of Rajasthan and its conservation.

PAPER III

Applied Zoology

Unit 1: Poultry keeping: Types of poultry breeds, poultry housing, farm and farm management, system of poultry farming; Grading, handling and marketing of eggs; Poultry diseases and Vermiculture; Methodology and products.

Unit 2: Sericulture: Different kinds of silk producing insects in India and its potentialities, Host plants of silk insects, Grainage, rearing and life cycle, Breeding and various diseases of silkworm, Reeling and fibre technology, Economics of sericulture.

Unit 3: Apiculture: Different kinds of honey bees found in India and, their identification. Identification of Queen, worker and drone, Importance of keeping bees in artificial hives and different kinds of hives, Care and management of bee colonies, Bee enemies and their control, Extraction and processing of honey from the comb, Utility and economics of production of honey, Honey bees and pollination strategy in agricultural crops.

Unit 4 : Pest Management : Insect pests of important crops (cotton, Rice, sugar cane & pulses), insect pest of veterinary and medical importance, pest outbreaks and assessment of losses caused by the insect pests on crops; population dynamics of insect pests;

Principles of Biological, mechanical and cultural methods of pest control, Integrated Pest Management (IPM), Principles of pest control by pesticides, Important vertebrate pests, birds and mammals with special reference to rodents and their management.

Unit 5:   General principles of aquaculture; transportation of fish seed and brooders, Induced Breeding, Composite fish culture, Lay out of fish farm and its management, By-products of fishing industry; Prawn culture; Management of water bodies for aquaculture.

Practical

1. Haemoglobin estimation of mammalian blood
2. Preparation of heamin crystals
3. Osmotic effect of R.B.C.
4. Preparation of mammalian blood film and identification of different types of blood cells
5. Determination of blood groups and Rh-factor
6. To determine the rate of oxygen consumption of rat
7. Analysis of urine for sugar, protein and pH
8. Estimation of E.S.R.
9. Demonstration of amylase activity
10. Estimation of packed cell volume [PCV]
11. Demonstration of working of pH meter
12. Demonstration of working of colorimeter
13. Measurement of blood pressure
14. Study of different spraying and dusting equipment
15. Use of pesticides and precautionary measures
16. Measurement of temperature and relative humidity
17. Estimation of soil moisture
18. Estimation of water holding capacity of different soils
19. Ecosystem study : Aquarium
20. Pond water study to identify zoo-planktons and their permanent preparations
21. Permanent preparation of any two stored grain pests. Two parasitic insects and termites
22. Honey bee : Permanent preparation of pollen basket and mouth parts
23. Permanent preparation of mouth parts of butterfly, moth, mosquito and cockroach
24. Project report based upon study of local fauna
25. Dissection of nervous system of grasshopper/locust and cockroach

Distribution of Marks

Maximum Marks: 75
Minimum Pass Marks: 27

		Regular	Ex.
Physiology Experiment		12	15
Ecology Experiment		12	15
Spots (six)		12	18
Dissection		07	10
Project report on local fauna	07	--	
Permanent preparation		05	07
Viva-voce		10	10
Record	10	--	
	Total	75	75

List of Recommended Books:

1. Srivastava, H.S. : Elements of Biochemistry, Rastogi Publications, Meerut
2. Goel, K.A. and Shastry, K.B. : Animal Physiology, Rastogi Publication, Meerut
3. Dalela, R.C. : Animal Physiology, S. Chand & Co. Ltd., New Delhi
4. Agarwal, R.A., Srivastava, Anil Kumar and Kaushal Kumar: Animal Physiology and Biochemistry, S. Chand & Co. Ltd., New Delhi
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