

Suggested Laboratory Exercises

1. Study of prokaryotic organisms; bacteria (Bacillus, Coccus, Streptococcus, Spirillum), Bacterial staining (Gram's staining), Blue green algae-Anabaena.
2. Study of eukaryotic organisms.
3. Algae : Volvox, Chara, Oedogonium, Ectocarpus. Polysiphonia.
4. Fungi : Rhizopus, Yeast, Aspergillus, Penicillium, Chaetomium, Peziza. Agaricus.
5. Study of morphology, anatomy and reproductive structure in Riccia, Marchantia, Anthoderos, Funaria.
6. Study of morphology, anatomy and reproductive structures in Rhynia, Lycopodium, Selaginella, Equisetum, Marsilea, Pteris, Lepidodendron, Lepidocarpon.
7. Study of morphology, anatomy and reproductive structures in Cycas, Pinus, Gnetum or Ephedra.
8. A study of representative members of the following angiosperm families : Ranunculaceae or Brassicaceae, Euphorbiaceae, Fabaceae (Papilionoideae, Caesalpinoideae, Mimosoideae), Apiaceae, Acanthaceae/Labiatae, Asteraceae, Liliaceae, Poaceae Apocyanaceae.

Course II. Cell Biology and Basic Biochemistry

Unit-I

Cellular Chemistry : Covalent and noncovalent interactions; hydrogen bond; electrostatic interactions: hydrophobic interactions; Van der Waals forces and their significance; Structure; properties and biological significance of water, pH and its significance; pH scale; Henderson-Hasselbach equation; isoelectric point; buffers (inorganic and organic) and their importance; ATP the energy currency; phosphorylation/dephosphorylation of proteins.

Energy flow and enzymology : Laws of thermodynamics; concept of free energy; energy transfer and redox potential; classification and nomenclature of enzymes; enzymes as biocatalysis; physico-chemical properties of enzymes; cofactors and coenzymes; isozymes; kinetics of enzyme action; significance of K_m ; regulation of enzyme activity; factors affecting enzyme activity, e.g. temperature, pH; allosteric modification and feedback regulation.

Unit-II

The Cell : Historical background; cell theory; kingdom-wise cell

48

size and cell structure; viroids and prions; comparative account of prokaryotic and eukaryotic cell; characteristics of archaeobacteria and mycoplasma.

Cell division and its regulation : Mitosis and meiosis-historical perspective and significance; various stages of cell division progression; cytokinesis; role of centromere, kinetochore and spindle apparatus; animal and plant cell cycle; mechanisms of cell cycle control; apoptosis. Nucleus and ribosomes; Ultrastructure; nuclear envelope and nuclear pore complex; nuclear matrix and nucleoplasm; DNA and histones; nucleosome and higher level of organization; centromere and telomeres; ribosome structure (prokaryotic, eukaryotic cell organelle ribosomes) and their functional significance.

Mitochondrion and chloroplast : Origin of organelles; organelles structure and biogenesis; organelle membranes and organization of macromolecular complexes; variation in size, shape and number; types of plastids' organelle-nuclear interactions; organelle genome organization.

Unit-III

Structure/function of other sub-cellular structures : Golgi complex; endoplasmic reticulum; lysosomes; microbodies-peroxisomes and glyoxysomes; cytoskeleton.

Cell wall and cell membrane : Origin, ultrastructure, chemical constituents and functions of cell wall; models of cell membrane organization; role of various membrane proteins, lipids and carbohydrates; role of ion channels and pumps in cellular transport and signalling.

Techniques in cell biology : Principles of light and electron microscopy; phase contrast and fluorescence microscopy; TEM and SEM; cell fractionation procedures; principles of various chromatography techniques-paper chromatography, TLC, GLC and HPLC autoradiography and its applications.

Suggested Readings

1. Alberts, B., Bray, D. Lewis, J., Raff, M., Roberts, K. and Watson, J.D. 1999. Molecular Biology of Cell. Garland Publishing Co., Inc., New York, USA.
2. Avers, C.J. 1986. Molecular Cell Biology, Addison-Wesley Publishing Co., Inc., New York, USA.
3. Avers, C.J. 1986 Molecular Cell Biology. Addison-Wesley

- Publishing Co., Massachusetts, USA.
4. Campbell, M.K. 1999. Biochemistry (3rd Edition). Saunders College Publishing, Philadelphia. USA.
 5. Gupta, P.K. 1999. A Text-book of Cell and Molecular Biology, Rastogi Publications. Meerut, India.
 6. Kleinsmith, L.J. and Kish. V.M. 1995. Principles of Cell and Molecular Biology (2nd Edition). Harper Collins College Publishers, New York, USA. Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell, J. 2000. Worth Publishers, New York, USA.
 7. Lodish, H.; Berk, A.; Zipursky, S.L.; Mastudaira, P.; Baltimore, D. and Darnell, J. 2000. Molecular cell (Fourth edition) W.H. Freeman & Co., New York, USA.
 8. Rawn, D.J. 1989. Biochemistry Neil Patterson Publisher, North Carolina, USA
 9. Stryer, L., 1995. Biochemistry. W.H. Freeman and Co., New York, USA.
 10. Wolfe, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing Co., California. USA.
 11. Zubay, G. 1993. Biochemistry (3rd Edition) WCB Publishers, Iowa, USA.

Suggested laboratory Exercises

1. Study of cell structure from onion leaf peels; demonstration of staining and mounting methods.
2. Comparative study of cell structure in onion cells, Hydrilla and Spirogyra. Study of cyclosis in Tradescantia staminal hairs.
3. Study of plastids to examine pigment distribution in plants (e.g. Cassia, Lycopersicon, Capsium).
4. Examinations of electron micrographs of eukaryotic cells with special reference to organelles.
5. Preparation of phosphate buffer measurement of pH of different plant juices.
6. Use of dialysis to separate small molecules from larger molecules.
7. Enzymology : activity of catalase, invertase, amylase and urease, and effect of pH and temperature on enzyme activity.
8. Study of various stages of mitosis and meiosis using appropriate plant material (e.g. root tips and flower buds of onion).

Suggested Readings (for laboratory exercises)

1. Dryer, R.L. and Lata, G.F. 1989. Experimental Biochemistry. Oxford University Press, New York.
2. Gunning, B.E.S. and Steer, M.V. 1996. Plant Cell Biology : Structure and Function. Jones and Bartlett Publishers, Boston, Massachusetts.
3. Harris, N. and Oparka, K.J. 1994, Plant Cell Biology. A Practical Approach. IRL Press, at Oxford University Press, Oxford, U.K.
4. Ninfa, A.J. and Ballou, D.I.P. 1998. Fundamental Laboratory Approaches for Biochemistry and Biotechnology, Fitzgeralds Science Press, Inc., Maryland. USA.
5. Wilson K. and Goulding. K.H. (Eds.) 1986. A Biologists Guide to Principles and Techniques of Practical Biochemistry Edward Arnold, London. UK.

Paper-III. Plant Physiology and Ecology

Unit-I

PLANT PHYSIOLOGY

Plant-water relations : Water transport processes; diffusion and osmosis; water potential and chemical potential; absorption of water transport through tracheids and xylem; transpiration and its significance; factors affecting transpiration; mechanism of stomatal movement.

Mineral nutrition : Criteria of essentiality of elements; macro- and micronutrients; role of essential elements; mineral deficiency symptoms and plant disorders; nutrient uptake and transport mechanism; role of cell membrane, ion pumps and carriers.

Photosynthesis : Historical background and significance; structure of photosynthetic apparatus; photosynthetic pigments; accessory reactions; electron transport pathways in chloroplast membranes; photophosphorylation; Calvin cycle; C₄ carbon cycle; crassulacean acid metabolism; synthesis of starch and sucrose; photorespiration.

Transport of organic substances : Transport of photosynthates; Source-sink relationship; the mechanism of translocation in the phloem; assimilate partitioning.

Respiration : Glycolysis; TCA cycle and its regulation; electron transport in mitochondria; oxidative phosphorylation, pentose, phosphate pathway, cyanide-resistant respiration.

Nitrogen metabolism : Biological nitrogen fixation, reduction of N_2 to ammonia, nif genes; regulation of nitrate reductase and nitrogenase; nitrate and ammonium assimilation.

Unit-II

Growth and development : General aspects-definitions, phases of growth; kinetics of growth; physiology of seed dormancy and seed germination; concept of photoperiodism; physiology of flowering; the florigen concept and role of hormones; vernalization; senescence and fruit ripening, importance of respiratory climacteric; discovery, physiological role and mechanism of action of the phytohormones-auxins, cytokinins, gibberellins, abscisic acid, Signal transduction basic concept; plant movements-tropic and nastic Biological clock.

ECOLOGY

Introduction : Holocenonotic nature of environment; limiting factors; ecological amplitude; triggering factors (soil, water, atmosphere).

Ecological adaptations : Concept, ecads, ecotypes and significance of photosynthetic pathways.

Population : Concepts; density and pattern; idealized plant life history; population growth; carrying capacity; population regulation : r and k selection; population interactions.

Unit-III

Community : Community characteristics and their measurement; species diversity (alpha, beta, and gamma); niche.

Ecosystem : Concept, components and organization; energy flow, ecological efficiencies; cycling of C, N and P Characterization structure of ecosystem; the biotic and abiotic components, their inter-relationship the processes within ecosystem; the trophic organization; autotrophy, heterotrophy, parasitism, detritus, decomposition.

Ecological succession : Mechanism and types; nature of climax; food chains and food webs; ecological pyramids.

Flow of energy and materials : Flow of energy and materials within ecosystem; models of energy flow; ecosystem productivity; biogeochemical cycles; major types of ecosystems. Plant indicators and their role in environmental monitoring.

Phytogeograph : General principles, vegetation of India.

Suggested Readings

Plant Physiology

1. Glaston, A.W. 1989. *Life Processes in Plants*, Scientific American Hall, Library, Springer-Verlage, New York, USA.
2. Hooykass, P.J.J., M.A. and Libbenga, K.R. (eds) 1999. *Biochemistry and Molecular Biology of Plant Hormones*. Elsevier, Amsterdam, The Netherlands.
3. Hopkins, G.C. 1995. *Introduction to Plant Physiology* John Wiley & Sons, Inc., York, USA.
4. Moore, T.C. 1989 *Biochemistry and Physiology of Plant Hormones* (2nd edition). Springer-Verlag, New York, USA.
5. Salisbury, F.B. and Ross, C.W. 1972 *Plant Physiology* (4th edition). Wadsworth Publishing Co., California, USA.
6. Taiz, and Zeiger, E. 1998. *Plant Physiology* (2nd edition). Sinauer Associates, Inc., Publishers, Massachusetts, USA.

Ecology

1. Odum, E.P., 1983, *Basic Ecology*, Saunders, Philadelphia.
2. Barbour, M.G., Burk, J.H., and Pitts, W.D. 1987. *Terrestrial Plant Ecology*.
3. Benjamin/Cummings Publication Co., California.
4. Kormondy, E.J. 1996. *Concepts of Ecology*, Prentice-Hall of India Pvt. Ltd., New Delhi.
5. Mackenzie, A. et al. 1999. *Instant Notes in Ecology*. Viva Books Pvt. Ltd., New Delhi

Suggested Laboratory Exercises

Plant Physiology

1. To study the permeability of plasma membrane using different concentrations or organic solvents.
2. To study the effect of temperature on permeability of plasma membrane.
3. To extract enzymes and study their activity, e.g. amylase, lipase, phosphatase, catalase, peroxidase.
4. Effect of the following factors on enzyme activity : pH, temperature, enzyme and substrate concentration.
5. Comparative study of rate of respiration of various plant parts.
6. To extract and separate chloroplast pigments by solvent method and demonstrate fluorescence in chloroplast extracts.
7. To determine the osmotic potential of vacuolar sap by plasmolytic method.
8. Bioassay of plant hormones—auxina, ethylene, GA, ABA and

cytokinin.

9. To determine stomatal index, stomatal frequency and percentage of leaf area open through stomata. Also, to study the effect of ABA on stomatal closure.
10. Role of light in germination of photoblastic seeds, e.g. *Lactuca sativa*, *Arabidopsis*.

Suggested Reading (for laboratory exercises)

1. Copeland, R.A. 1996. Enzymes : A practical introduction to Structure, Mechanism, and Data Analysis. VCH Publishers, New York.
2. Dryer, R.L., and Lata G.F. 1989 Experimental Biochemistry. Oxford University Press, New York.
3. Moore. T.C. 1974, Research Experience in Plant physiology. A Laboratory Manual Springer-Verlag, Berlin.
4. Wilson, K. and Goulding, K.H. (Eds.) 1986. A Biologists Guide to principles and Techniques of Practical Biochemistry. Edward Arnold, London, UK.

Ecology :

1. To determine the working and use of instruments for the measurement of temperature (soil, air, water), rainfall, relative humidity, soil moisture, wind velocity and direction light, intensity.
2. To study selected soil properties by spot test; texture; pH, carbonate, nitrate, base deficiency and reductivity.
3. To study ecological adaptations (morphological and anatomical) in plants (hydrophytes, xerophytes, epiphytes).
4. To determine minimum area of sampling unit (quadrant) for the study of grassland community.
5. To estimate Importance Value Index for grassland species.
6. To study leaf from spectrum of a woodland.
7. To prepare maps of India with respect to (i) major climatic zones (ii) forest types, and (iii) biogeographical regions and to comment on it.

Suggested Reading (for laboratory exercises)

1. Smit. R.L. 1996, Ecology and Field Biology, Haper Collins, New York, P.W. and Chapman, S.B. 1986. Methods in Plant Ecology, Blackwell Scientific Publications.
2. Misra, R. 1968. & cology work book, oxford & IBH, New Delhi.

Paper IV. : Development of Plants and their Utilization

Unit-I

Organization of the higher plant body : Shoot and root systems : variation in habit and longevity; environment influences.

Meristems and development : Shoot apical meristem, root apical meristem, lateral meristems and their functions.

Range of form and structure of stem, leaf and root; their tissues and functions.

Secondary body of the plant : Vascular cambium; secondary xylem (basic structure of wood); secondary phloem and periderm.

Role of wild plants in ecosystem functioning; A general account.

Unit-II

Domestication of plants: Primary and secondary centers of diversity; plant introduction.

A general account of plants : Primary and secondary centers of diversity; plant introduction. A general account of wheat, rice, maize, sorghum, bajra, potato and sugarcane.

Legumes; Chickpea (Bengal gram), red gram (arhar) and fodder legumes general account.

Vegetable oil sources : Mustard, groundnut, soybean and coconut a brief account.

Unit-III

Plant fibers : Cotton, jute and choir.

Timber and firewood species : A general account of use of properties of any ten plants of your region.

Medical plants : A brief account of ten important plant drugs and their chief constituents used in indigenous and allpathic system of medicine.

Natural rubber (Hevea brasiliensis), essential oil, insecticides and dyes-a concise account.

Ornamental plants Familiarity with seasonals and perennials grown in your locality.

Suggested Readings

1. Carlquist, S. 1988. Comparative Wood Anatomy; Systematic, Ecological and Evolutionary Aspects of Dicotyledonous Wood. Springer-Verlag, Berlin.
2. Cutter, E.G. 1969 Part I. Cells and Tissue. Edward Arnold, London.

55

3. Cutter E.G. 1971. *Plant Anatomy : Experiment and Interpretation. Part II. Organs.* Edward Arnold, London.
4. Esau, K. 1977. *Anatomy of Seed Plants*, 2nd edition, John Wiley and Sons, New York.
5. Fahh, A. 1974 : *Plant Anatomy*, 2nd edition, Pergamon press. Oxford.
6. Fuller, K.W. and Gallon, J.R. 1985. *Plant Products and New Technology.* Clarendon Press, Oxford, New York.
7. Lyndon, R.F. 1990. *Plant Development; The Cellular Basis.* Unwin Hyman, London.
8. Mauseth, J.D. 1988. *Plant Anatomy.* The Benjamin/Cumins Publishing Company Inc., Menlo Park, California, USA.
9. Nair, M.N.B. 1998. *Wood Anatomy and Major Uses of Wood.* Faculty of Forestry. University Putra Malaysia, 43400 Serdang, Selangor D.E. Malaysia.
10. Reghvan. V. 2000. *Developmental Biology of Flowering Plants,* Springer Verlag. New York.
11. Raven, P.H. Evert R.F. and Eichhoron, S.E. 1999. *Biology of Plants.* 5th edition W.H. Freeman and Co., Worth Publishers, New York.
12. Sambamurthy. A.V.S.S. and Subramanyam, N.S. 1989. *A Textbook of Economic Botany.* Wiley Eastern Ltd., New Delhi.
13. Sharma O.P. 1996. *Hill's Economic Botany.* Tata McGraw Hill Publishing Company Ltd., New Delhi.
14. Simpson, B.B. and Conner-Ogorzaly, M. 1986 *Economic Botany- Plants in Our World* McGraw Hill, New York.
15. Steeves, T.A. and Sussex, I.M. 1989, *Patterns in Plant Development* 2nd edition. Cambridge University Press, Cambridge.
16. Tippo. O. and Stern, W.L. 1977. *Humanistic* Macmillan India. Ltd. New Delhi.

Suggested Laboratory Exercises

1. Study of organization in a flowering plant. Role of shoot and root apical meristem (using whole mounts of shoot tips of Hydrilla vertical sections Coleus or Bryophyllum, whole mount of root tip of Pistia, or vertical sections of root tip of onion, maize, aerial roots of Ficus bengalensis or Tinspora cordifolia.)
2. Study in the field of a large variety of herbaceous and perennials.

- both monocotyledonous and dicotyledonous; aquatic, mesophytic, xeromorphic plants, succulents, climbers, twiners, parasites, and trees with varied canopy architecture. Field diary to be prepared.
3. Morphology and anatomy of stems, roots, and leaves using stained hand sections or permanent slides (tapioca, carrot, radish, onion, garlic, turnip, potato, etc.)
 4. Study of vascular cambium in stem and root. Secondary growth. Examples of cambial variants and resultant secondary structures.
 5. Preparation of world maps to show Vavilov's centres of origin of cultivated plants and Zhukovsky's concept of mega centres.
 6. Preparation of maps showing the centers of primary diversity of important economic plants that originated in India and the regions of cultivation of plants introduced from the New World, Africa, Europe, Central Asia, Australia, Malaysia, China.
 7. Study of vegetative and reproductive morphology and anatomy of wheat, rice, maize, sorghum, bajra, potato and sugarcane. Also study of starch grains in these plants (except in sugarcane). Epidermal structure of sugarcane, stem and leaves. Tests for sucrose.
 8. Study of vegetative and floral morphology, pod development in chickpea and red gram. Familiarization with four fodder legumes (such as berseem, lucerne, methi, Clitoria, guar, cowpea etc.)
 9. Study of structure of oil storing tissues in sectioned seed of mustard, groundnut and soybean, coconut endosperm, using microchemical tests.
 10. Study of vegetative, floral and fruit morphology of cotton. Ontogeny of cotton fibre in young ovules and tracing the development of cotton fibre. Microscopic structure of cotton fibre. Preparation of absorbent cotton by alkali treatment. Staining of cotton with and without mordanting. Study of stem of jute showing origin and development of jute fibre. T.S. coir to show that coir is a fibrovascular bundle.
 11. Study of wood anatomy of ring-porous, diffuse, porous woods using hand sections or prepared slides. Understanding of wood anatomy using T.S., T.L.S. and R.L.S. in five timber yielding species (teak, Dalbergia, Albizzia, Gmelina, Eucalyptus, Cedrus of Pinus, Acacia, Shorea, Terminalia, Mangifera, Azadirachta, or

(57)

any other depending on the location of the institution). Preparation of a list of 10 fire wood species in your region and their properties).

12. Study of 10 whole plants (live or from herbarium specimens) used as resources of drugs; (Poppy, Rauwolfia, Adhatoda, Embilica officinalis, Terminalla bellirica, T. Chebula, Glycyrrhiza, Phyllanthus amarus (P. fraternus), garlic, Andrographis paniculata, Catharanthus rosesus, Atropa belladonna, Digitalis purpurea, Aloe barbadense, or any other important plants of your area).
13. Study of laticiferous system in the stem of Haeva brasiliensis, familiarization with whole plants (fresh or herbarium specimens of Cymbopogon sp., Eucalyptus, Jasmium, Geranium, Pandanus sp., Rosa, Vetiveria zizaniodes, Santalum ablum (or any other local sources of essential oil).
14. Study of the neem plant, Artemisia annua, Chrysanthemum cinerarifolium (pyrethrum) from live specimens.
15. Souces of dyes: Curcuma longa (turmeric), Bixa orellana (annato), Crocus sativus, Butea monosperma (palash), Indigofera (indigo), Lawsonia inermis (mehndi). Extraction of pigments.
16. Preparation of a list of trees and shrub used as ornamentals alongwith their popular and scientific names. Seasons of flowering and brief description. Calendar of seasonals grown as bed plants, potted plants house plants, flowers used for worship or ornamentation. This may be illustrated and presented as a term paper at the time of examination section. Candidates are required to attempt five questions in all selecting atleast one question from each section.

5. GEOLOGY

Scheme :

<i>Four Papers</i>	<i>Duration</i>	<i>Max. Marks</i>	<i>Min. Pass Marks</i>
Paper-I	3 hours	75	
Paper-II	3 hours	75	
Paper-III	3 hours	75	120
Paper-IV	3 hours	75	
Practical		100	40

Note : Each paper will contain nine questions having three questions in each section. Candidates are required to attempt five

questions in all selecting atleast one questions from section.

Paper-I : General Geology

Section-A

Geology—its definition, scope, subdivisions, applications & relationship with other Sciences. Solar system & its members, relations of Earth with other members. Earth-Shape, size, origin-review of the different Theories, internal Structure and composition. Age of the earth, different methods of determining the age with special reference to radioactive methods. Nature and constitution of the Earth's crust and its movements.

Weathering, Geological work of river, wind, glacier, sea and groundwater.

Section-B

Earthquakes—Causes, classification, effects, earthquake waves, Seismograph, and relationship with volcanism and crystal deformation, Seismic belts.

Significance of the earthquakes waves in the study of the interior of Earth. Volcanoes—Cause, Types, Products, effects and distribution. Mountains-kinds, origin and distribution.

Section-C

Origin & distribution of continents and oceans, Isostasy, Continental drift, Island Arcs, Geosynclines, coralreefs. Elementary ideas of Plate tectonics, Seafloor spreading.

Paper-II : Structural Geology

Section-A

Definition, scope, relationship with other branches of Geology. Dip and strike and their determination with Clinometer and Brunton Compass. Sedimentary structures and their significance, criterion for recognition of top and bottom sequence. Unconformity : Definition, classification, geological significance and recognition in the field. Joints—Classification and economic significance.

Section-B

Description, geometric and genetic classification of folds and faults. Effects of folds and faults on outcrop pattern and their economic importance. Mechanics of folding and faulting. Criterion of their recognition in the field.

Thrust, Nappe, Window Klippe, overlap and offlap, outlier and inlier.

60

Section-C

Elementary ideas of cleavages and Linear structures, Study of geological maps and sections. Plotting of linear structures on Stereonet and their significance, salt Domes.

Paper-III : Crystallography and Mineralogy

Section-A

Symmetry elements, parameter and Index system of Weiss and Miller, Classification of Crystal systems. Crystal Zones, Twinning. The use of contact goniometer.

Study of the holohedral classes of various system and hemihedral classes of the cubic and Hexagonal systems.

Section-B

Stereographic and gonomonic projections. Elementary ideas about the derivation of crystal classes and internal structure of crystals. Elements of crystal chemistry; Isomorphism, polymorphism, ionic radii, classification of Silicates.

Section-C

Physical properties of mineral—Determination of RI and birerfringence. Uniaxial and biaxial mineral, Double refraction. Quarts, wedge, retardation and accessory plates. Concept of uniaxial and biaxial indicatrix.

Uniaxial and biaxial interference figures. Optic sign and pleochroic scheme. Study of the Chemical composition, important physical and optical properties and paragenesis of the following groups; Quartz, Feldspars, Felspathoids, Amphiboles, pyroxenes, Micas, Alumino silicates, Garnet, olivine and carbonates.

Paper-IV : Palaeontology

Section-A

Definition and Subdivisions. Fossil Collection and preparation, condition necessary for preservation. Mode of preservation of fossils. Imperfection of palaeontological records and evolution indicators. Broad Classification of animal kingdom.

Section-B

Morphology and Geological distribution of the following groups :

1. Foraminifera
2. Graptoloidea
3. Trilobita
4. Anthozoa

(61)

5. Echinoidea

Section-C

Morphology, Geological distribution and recent classification of the following groups :

1. Brachiopoda
2. Mollusca
 - (a) Gasteropoda
 - (b) Vivalvia (Lamellibranchia)
 - (c) Cephalopoda—
 - (i) Nautiloidea
 - (ii) Ammonoidea
 - (iii) Coleoidea (Dibranchia)

Elementary ideas of Gondwana flora and study of Morphology of following plant fossil. Glossopteris, Gangamopteris, Vertebraria and Ptilophyllum.

Practicals

Study of following crystal Model in hand specimen. Garnet, Fluorite Diamond, Halites, Zircon, cassiterite, Vasuarite, appophyllite, illmenite. Olivine, sulphur, Stanealite, Barjito Topaz, Gypsum, Orthoclase, Hornblend, Autige, Epidote Albite, Barite Beryl, Calcite, Quartz.

Study of the following minerals under microscope. Quartz Orthoclase, Microcline, Plagioclase, Muscovite, Biotite, Olivine, Hornblend, Augite, Hypersthene Actionlite, tremolite, Epidote, Garnet, Staurolite, Tourmaline, Chlorite, Calcite, Kyanite, Sillimanite Nephelene. Study of the Physical properties and diagnostic features of the following minerals—quartz, Chalcedony, plagioclase, Biotite, Chlorite, Hornblende, Augite, Hypersthene. Muscovite, Invertebrate fossils and plant fossils—Nummulites, Alcolina, Assilina, Monograptus, Diplograptus Calymene, Paradoxides, Trimiceleous, Phacops Olenus. Zapherents, Calceota, Favosites, Cidaris, Stigmatophygus, Micraster Hemiaster, Schizatr. Terebratula, Phynchonella, Productives, Spirifer, Athyris, Atrypa, Lingula, Turitella, Physa, Natica, Conus, Murex, Cyprea, Trochus, Turbo, Venus, Unio, Trigonina, Pholadomya, Area, Inoceramus Lopho, Hippurites. Nautilus, Goniatites, Ceratites, Perisphinetes macrocephalites, Acanthoceras, Baculites, Belemnites Glossopteirs, Gangamopteris. glossopteris, Gangamopteris. Vertebrasia, Ptilophyllum.

62

GEOLOGY PRACTICALS

Scheme

Max. Marks : 100

Min. Pass Marks : 40

Identifications and Morphological description of important invertebrate fossils and their stratigraphic horizon with special reference to India. Clinographic projection of the crystals of the cubic systems, Identification of Crystal models corresponding to the syllabus of the theory paper. Study of simple twins. Stereographic projection of the crystals, Determination of the axialratio.

Identification in hand specimen and description of important rock forming minerals under microscope. Identification of length fast, length slow characters of minerals, determination of optic sing. Interpretation of geological maps. Completion of outcrop pattern, thickness of the strata, true and apparent dip. Stricke of the fault. Solution of true and apparent dip by the Stereographic projection. Solution of simple structural problem by stereographic projection.

Field work : Field work of atleast 10 days duration in the State of Rajasthan, covering the various disciplines of theory papers and report thereon.

6. MATHEMATICS

B.A./B.Sc. (Hons) Part-I

Teaching : 3 Hours Per Week Per Theory Paper

2 Hours per Week per Batch for Practical

(20 candidates in each batch)

Examination

Min. Pass Marks

Max. Marks

Scheme : Science : 160

400

	Duration	Max. Marks	Min. Pass Marks
Paper-I	Discrete Mathematics 3 hrs.	100	40
Paper-II	Calculus 3 hrs.	100	40
Paper-III	Three-Dimensional Geometry and Optimization Theory : 2½ hrs. Practical: 2 hrs.	68	27
Paper-IV	Theory of Numbers and Lattices 3 hrs.	32 100	13 40

(64)

Note.

1. Paper I, II & IV will be divided into Five Units. Two questions will be set from each Unit. Candidates are required to attempt Five questions in all taking One question from each Unit. All question carry equal marks.
2. Paper III will be divided into Four independent Units. Two questions will be set from each Unit. Candidates are required to attempt Four questions in all taking One question from each unit. All questions carry equal marks.
3. Common paper will be set for both the Faculties of social Science and Science. However, the marks obtained by the candidate in the case of Faculty of Social Science will be converted according to the ratio of the maximum marks of the papers in the two Faculties.
4. Each candidate is required to appear in the Practical examination to be conducted by internal and external examiners. External examiner will be appointed by the University and internal examiner will be appointed by the Principal in consultation with Local Head/head, Department of Mathematics in the college.
5. An Internal/external examiner can conduct Practical Examination not more than 100 (Hundred) candidates (20 Candidates in one batch).
6. Each candidate has to pass in Theory and Practical examinations separately.

Paper-I : Discrete Mathematics

Teaching : 3 Hours Per Week

Duration of Examination : 3 Hours

Max. Marks : 100

Note : This paper divided into Five Units. Two questions will be set from each Unit. Candidates are required to attempt Five questions in all taking one question from each Unit. All questions carry equal marks.

Unit 1 Sets and Propositions—Cardinality, Principal of inclusion and exclusion. Mathematical induction.
Relations and Functions—Binary relations, Equivalence relations and Partitions, Partial ordered relations and Lattices. Chains and Antichains, Pigeon Hole principle.

65

- Unit 2** Algebraic structures—Groups, Rings, Integral domains. Fields (Definitions, simple examples and elementary properties only.)
Boolean Algebras—Lattices and Algebraic structure, Duality, Distributive and Complemented Lattices. Boolean Lattices, Boolean functions and expressions.
- Unit 3** Computability and Formal languages—Ordered sets, Languages, Phrase, Structure, Grammars, Types of Grammars and Languages. Finite State Machine—Equivalent machines, Finite State Machines as language recognizers.
Discrete numeric functions and Generating functions. Recurrence relations and Recursive Algorithms—Linear Recurrence relation with constant coefficients. Homogeneous solutions. Particular solution. Total solution. Solution by the method of generating functions.
- Unit 4** Graphs—Basic terminology, Multigraphs, Weighted graphs, Paths and circuits, Shortest paths, Eulerian paths and Circuits. Travelling Salesman problem. Union, Join, Product and composition of graphs. Planar graphs and Geometric dual graphs.
- Unit 5** Trees—Properties, Spanning tree, Binary and Rooted tree. Digraphs—Simple digraph, Asymmetric digraphs, Symmetric digraphs and complete digraphs. Digraph and Binary relations, Matrix representation of graphs and digraphs.

Paper-II : Calculus

Teaching : 3 Hours per week

Duration of Examination : 3 Hours

Max. Marks : 100

Note : This paper divided into Five Units. Two questions will be set from each Unit. Candidates are required to attempt Five questions in all taking One questions from each Unit. All questions carry equal marks.

Unit 1 Series—Infinite series and Convergent series. Tests for convergence of a series—Comparison test. D'Alembert's

ratio test. Cauchy's n-th root test. Raabe's test. De-Morgan-Bertrand's test, Cauchy's condensation test. (Derivation of tests is not required). Alternating series. Absolute convergence. Taylor's theorem. Maclaurin's theorem. Power series expansion of a function. Power series expansion of $\sin x$, $\cos x$, e^x , $\log_e(1+x)$, $(1+x)^n$.

- Unit 2** Derivative of the length of an arc. Pedal equations. Curvature. Various formulae, Centre of curvature and Chord of curvature. Partial differentiation. Euler's theorem for homogeneous functions. Chain rule of partial differentiation. Differentiation of implicit functions.
- Unit 3** Envelopes, Maxima and Minima of functions of two variables. Lagrange's method of undetermined multipliers. Asymptotes. Multiple points. Curve tracing of standard curves (Cartesian and Polar curves).
- Unit 4** Rectification, Areas, Volumes and Surfaces of solids of revolution.
- Unit 5** Double integrals in Cartesian and Polar Coordinates, Change of order of integration. Triple integrals. Application of double and triple integrals in finding areas and volumes. Dirichlet's integral.

**Paper-III : Three-Dimensional Geometry and Optimization
Theory**

Teaching : 3 Hours per week

Duration of Examination : 2½ Hours **Max. Marks : 68**

Note : (i) This paper divided into Four Units. Two Questions will be set from each Unit. Candidates are required to attempt Four questions in all taking One question from each Unit. All questions carry equal marks.

(ii) Non-Programmable Scientific Calculators are allowed.

Unit 1 Sphere, Cone and Cylinder

Unit 2 Central Conicoids—Ellipsoid, Hyperboloid of one and two sheets, Condition of tangency for a plane, Director sphere, Normals. Generating lines of hyperboloid of one sheet and its properties. Reduction of a general equation of second

67

degree in three dimensions to standard forms.

Unit 3 The linear programming problem. Problem Formulation L.P.P. in matrix notation. Graphical solution of linear programming problems. Basic solution. Some basic properties of convex sets. Theorems based on convex sets., Fundamental theorem of L.P.P. Application of the Simplex method for solution of a L.P.P. to simple problems.

Unit 4 Duality, Fundamental theorem of duality, Properties and Simple problems of duality, Assignment problems, Transportation problems.

PRACTICAL

Teaching : 2 Hours per week per Batch
(20 Candidates in each Batch)

Examination : Duration : 2 Hours

Scheme

Min. Marks : 32

Min. Marks : 13

Distribution of Marks :

Two Practicals one from each group

10 Marks each	=	20 Marks
Practical Record	=	06 Marks
Viva-Voce	=	06 Marks
Total Marks	=	32 Marks

Group A : Modelling of industrial and engineering problems into mathematical LPP and its dual and their solution by Simplex Method.

Group B : Modelling of industrial and engineering problems into (i) Assignment Problems and (ii) balanced and unbalanced Transportation Problems and their solution.

Note :

1. Problems will be solved by using Scientific Calculators.
2. Candidates must know about all functions and operations of scientific Calculator.
3. Each Candidate (Regular/non-Collegiate) has to prepare his/her practical record.
4. Each Candidate has to pass in Practical and Theory examinations separately.

68

Paper-IV : Number Theory

Teaching : 3 Hours per Week

Duration of Examination : 3 Hours

Max. Marks : 100

Note : This paper divided into Five Units. Two questions will be set from each Unit. Candidates are required to attempt Five questions in all taking One question from each Unit. All questions carry equal marks.

- Unit 1** Divisibility—Division Algorithm, g.c.d. the Euclidean algorithm. l. c.m., Prime, Infinitude of primes, Fundamental theorem of Arithmetic. Fibonacci sequence.
- Unit 2** Congruence—Linear congruence, Fermat, Little and Wilson's theorems. Chinese remainder theorem. Fermat's last theorem, Euler's factorization, Mersenne's factorization.
- Unit 3** Number theoretic functions, π and σ -functions, the Mobius function, Greatest integer function, Euler Phi function and the properties of Phi function. Application to Cryptography.
- Unit 4** Diophantine equations— $ax+by = c$, $ax+by+cz = d$, $x^2+y^2 = z^2$, $x^4+y^4 = z^4$. General Integers solution of the equation $x^2+y^2+z^2 = w^2$ ($x,y,z,w = 1$)
- Unit 5** Quadratic residues, Quadratic reciprocity. Quadratic congruence. Primitive roots for primes, Composite numbers having primitive roots. Theory of indices.

(69)

12. PSYCHOLOGY (HONS.) Pt-I-201A

Scheme :

Four Theory Papers	Duration	Max. Marks	Min. Pass Marks
Paper-I	3 hours	75	
Paper-II	3 hours	75	
Paper-III	3 hours	75	120
Paper-IV	3 hours	75	
Practical	3 hours	100	40

Note : There will be 4 theory papers in subject Psychology in B.A. Honours Part I. There will be common papers for Arts and Sciences.

Question No. 1 will be compulsory and will cover the entire course contents of the paper. Question I will contain two parts A & B. A part of I question will contain 20 questions of multiple choice. Each question will be of 3/4 mark. Thus A part will be of 15 marks. B part will contain 10 questions to be answered in the limit of 20 words. Each question of B part will be of 1½ marks. Thus B Part will be of 15 marks. Separate question paper for this objective type will be provided to each student and answers will be given in this question paper only in the space provided for this purpose in the objective type question paper. Candidates will be given one hour to attempt this first compulsory question out of three hours in total time allotted for this paper.

In the second part of the question paper, three questions of essay type will be attempted selecting at least one from each section. Each question will be of 15 marks. This objective type question will be compulsory to attempt in all four theory papers.

70

B.A./ B.Sc. Honours Part-I

Paper-I: Advanced General Psychology

Section-A

1. **Introduction to psychology: Nature, Methods and Recent Trends.**
2. **Learning: Classical conditioning, Operant Conditioning- Reward, Punishment, Avoidance and Escape Procedures, Theories (Thorndike, Hull, Skinner).**
3. **Verbal learning and Concept learning- Verbal learning-Nature, Material and Experimental Method, Serial Position Curve, Clustering, Coding. Concept learning- Definition, Paradigm, Determinants and Theories.**

Section-B

4. **Perception- Analysis of Perceptual Process, Determinants of Perception, Gestalt view of perception, Illusion, Depth perception.**
5. **Retention and Forgetting-Levels of memory processing, STM, LTM, Proactive and Retroactive inhibition, Causes of Forgetting, Forgetting curve.**
6. **Transfer of training- Experimental design and measures of transfer, non-specific transfer, warm up, specific transfer, similarity relations.**

Section-C

7. **Motivation and Emotion-Motivation-Nature and Types, Emotion- Elements: Physiology, Expression and Subjective Experience; Physiological correlates of**

Mansur 11/2 (71)

test

Emotion, Theories (James-Lange, Cannon Bard, Activation theory).

8. **Intelligence-** Nature, Determinants, Measurement and Theories.
9. **Personality-** Nature, Theories, Determinants, Measurement.

Reference Books:

1. Morgan, King & Robinson- Introduction to Psychology, 1986.
2. Atkinson-Introduction to Psychology
3. Wood worth, R.S. & Scholosberg, H- Experimental Psychology, Indian Edition, Oxford & I.B.H. publication, Calcutta, 1971.
4. Baron. R.A. (2003). Psychology. Allyn and Bacon. New Delhi Prentice Hall India.
5. Gerrig, R.J. and Zimbardo, P.G. (2005). Psychology and Life. New Delhi. Pearson Education.
6. Ciccarelli, S.K. and Meyer, G.E. (2006). Psychology. New Delhi, Pearson Education.
7. सिंह. अरुण कुमार (2002). आधुनिक सामान्य मनोविज्ञान. नई दिल्ली, मोती लाल बनारसीदास

Paper-II: Psychopathology

Section-A

1. **Abnormal Behaviour: Nature and Concept.** Vulnerability, Resilience and Coping Paradigm. Mental Health: Meaning and Components.
2. **Theoretical Perspectives: Biological, Psychodynamic, Behavioural, Cognitive, Humanistic, Existential, Community – Cultural, Interactional.**
3. **Symptomatology and Etiology of abnormal behaviour.**

(72)

Manshu

HR

for

Section-B

4. **Classification and Assessment:** The latest classification system of APA and WHO. Interview and Psychometric assessment: Personality, Behavioural, Cognitive, Relational, Bodily Assessment.
5. **Somatoform and Anxiety disorders:** Nature and Clinical Picture of Pain, Somatization, Conversion-disorders and Hypochondriasis. Nature and Clinical Picture of Generalized Anxiety, Panic, Obsessive-Compulsive and Post-Traumatic Disorder and Phobias.
6. **Personality disorders:** Classification, Nature and Clinical Picture.

Section-C

7. **Schizophrenia and other Psychotic disorders:** Nature, Clinical Picture and Types.
8. **Mood disorders and Substance related disorders:** Nature and clinical picture of Depression, Depressive and Bipolar Disorders. Nature of Substance-use and Substance-induced Disorders. Clinical Picture of Alcohol-related, Nicotine-related and Sedative-Hypnotic or Anxiolytics-Related Disorders.
9. **Treatment and prevention:** Psychotherapies-Client Centered, Cognitive, Psychoanalytic, Behavioural. Prevention: Levels, Situation-Focused and Competency-Focused, Sites of Prevention.

(73)

Manish
AC

Asm

Reference Books:

1. Sarason, I.G. and Sarason, B.R. (2005) Abnormal Psychology. Delhi, Pearson Education
2. Lamm, A (1997): Introduction to Psychopathology N.Y. Sage.
3. Buss, A.H. (1999): Psychopathology, N.Y. John Wiley.
4. Arun Kumar Singh (2002), Adhunik Asamanya Manovigyan, Delhi, Motilal Banarsidas.

Paper-III: Developmental Psychology

Section-A

1. **Human Development: Nature and Scope: Domains and Periods of Development: Basic Issues: Longitudinal and Cross-Sectional Researches.**
2. **Foundations of Human Development: Biological, Socio-environmental and Cultural Factors: Types of Influences: Internal and External, Normative and Non-Normative, Contexts and Timing of Influences.**
3. **Self and Identity: Self Awareness, Self Concept and Self-Esteem- Cognitive Social and Cultural Influences. Identity: Construction and Influences on Identity Development, Identity Statuses.**

Section-B

4. **Psychoanalytic and Psychodynamic Theories of Development: Freud's Psychoanalytic, Erikson's Psycho-social, Bowlby's Ethological Theory of Attachment.**

(74)

M. G. ...
R.

Test

5. **Social Learning and Cognitive Theories of Development:** Bandura's Social Learning Theory, Piaget's Cognitive - Stage Theory, Vygotsky's Socio-Cultural Theory, Information Processing and Language Development.
6. **Emotional and Moral Development:** Functions of Emotions, Development of Emotional Expression, Temperament and Development. Moral Development: Piaget's and Kohlberg's Theories. Influences on Moral Reasoning.

Section-C

7. **Problem of Adulthood and Aging:** Marriage, Family and Work. Gerontology and Theories of Aging: Damage Theories, Genetic Clock Theories and Bio-Psychosocial Model, Aging Disabilities: Physical and Mental.
8. **Developmental Psychopathologies:** Learning Disabilities, Conduct Disorder, Autism, ADHD, MR.
9. **Stress and Health:** Nature and Types of Stress, Physiology of Stress, Causes and Consequences of Stress, Stress Management.

Reference Books:

1. Berk, L.E. (2003) Child Development. Delhi, Pearson Education.
2. Santrock, J.W. (1999), Lifespan Development. New York, McGraw Hill.
3. Hurlock, E. (2003) Developmental Psychology. Delhi, Tata McGraw Hill
4. Papalia, S. and Feldman, C. (2002) Adult Development and Aging. Delhi, Tata McGraw Hill.
5. Berk, L.E.(2010) Development through the Life Span. Delhi, Pearson Education.

(75)

Mamta

1007

6. Sigelman, C.K. and Rider E.A. (2003) Life Span Human Development. Thomson- Wadsworth.
7. Mishra, G. (1999) Psychological Perspectives on Stress and Health, New Delhi, Concept.

Paper-IV: Statistical Foundations of Psychological Research

Section-A

1. Overview of experimentation- (i) Problem, (ii) Hypothesis, (iii) Experimental Plan, (iv) Experimental control, (v) Dependent and independent variables.
2. Designs- (i) Factorial (ii) Randomised groups.

Section-B

3. Descriptive Statistics - (i) Setting of Frequency of Distribution, (ii) Frequency Polygon and Histogram, (iii) Measures of Central Tendency- Mean (grouped data), Assumed Mean, Median, Mode, (iv) Measures of Variability - Range, QD, AD and SD, (v) Co-efficient of Variation.
4. Inferential Statistics- (i) Normal Distribution- Meaning, Importance and Properties, (ii) Standard Error Formula- Mean, Median, SD, (iii) Sampling.

Section-C

5. Test of Significance- (i) Chi-Square Test (Equal and Normal Probability), (ii) Null Hypothesis, (iii) Mean Difference ('t' test), (iv) Significance of Difference of SD, (v) Significance of Difference of Percentages, (vi) One-way Analysis of Variance.

76

Mawla

for

6. Correlation- Meaning, Product Moment Method, Correlation by Rank.

Reference Books:

1. Aron, A. Aron, E. and Coups, E. (2007). Statistics for psychology. (IV edition). New Delhi, Pearson Education.
2. Garrett, H. (1981) Statistics in psychology and education. Mumbai: Vakil febber and Simons.
3. Guilford, J.P. (1975) Fundamental statistics in psychology and education. New York: McGraw Hill
4. Siegel, S. (1988) Nonparametric Statistics for Behavioural Sciences. New York, McGraw Hill.

Practicals:

1. Method of Average Error- Muller Lyer Illusion.
2. Figure Ground Reversal
3. Serial Position Effect
4. Assessment of Anxiety
5. Assessment of Mental Health
6. Measurement of Personality
7. IQ Assessment.
8. Bilateral Transfer of Training
9. Concept Formation
10. Maze Learning
11. Social Maturity
12. Parent Child Relationship Scale

77

Mansur

B

Asan