

B.Sc. (Hons.) I Year
(I Semester)

Max. Marks : 100
Sessional : 30
End-Sem Exam. : 70
Credit : 04

COURSE 1: CELL BIOLOGY AND BASIC BIOCHEMISTRY

Unit I	Physico-chemical aspects: Structure, properties and biological significance of water, pH and its significance, Henderson-Hasselbalch equation, isoelectric point, buffers (inorganic and organic) and their importance. Techniques in cell biology: Principles of light and electron microscopy (TEM and SEM), cell fractionation (homogenisation and centrifugation), chromatography (paper chromatography and TLC) and spectrophotometry.	12
Unit II	Energy flow and enzymology: Laws of thermodynamics, concept of free energy transfer and redox potential, ATP-the energy currency; enzymes-nature catalytic action,; nomenclature and classification of the enzymes, cofactors and isoenzymes, factors affecting enzyme activity, effects of substrate concentration, enzyme concentration, temperature, pH and inhibitors on biochemical reactions.	11
Unit III	The Cell: Cell theory, comparative account of prokaryotic and eukaryotic cell; characteristics of archaebacteria; various stages of mitotic and meiotic cell divisions; role of centromere, kinetochore and spindle apparatus; mechanism of cell cycle control;chemical constituents of cell wall; Singer and Nicolson model of cell membrane, role of various membrane proteins, lipids and carbohydrates.	11
Unit IV	Nucleus: Ultra structure, nuclear envelope and nuclear pore complex, nucleosome and higher level of organization of chromosomes;prokaryotic, eukaryotic and organellar ribosomes and their functions. Mitochondrion and chloroplast: Organelle structure and biogenesis, organization of macromolecular complexes, variation in size, shape, number and types of plastids. Other sub-cellular organelles: Golgi complex, endoplasmicreticulum, lysosomes, peroxisomes and glyoxysomes.	11 11

Suggested Books

1. Cell Biology, Genetics, Molecular Biology, Evaluation and Ecology by Verma, P.S. and Agarwal, V.K. (2006). S. Chand and Company Pvt. Ltd., New Delhi.
2. Cell and Molecular Biology by Gupta, P.K. (2003). Rastogi Publications, Meerut.
3. Cell and Molecular Biology by Rastogi, S.C. (2003). New era International (Pvt.)Ltd., (4835/24, Ansari Road, Daryaganj New Delhi.)
4. Principles of Biochemistry by Lehninger, A.L., Nelson, D.L., and Cox, M.M. (2004). W. H. Freeman & Company, U.S.A.
5. The Cell, A Molecular Approach 5th Edition by Cooper, G.M. and Hausman, R.E. (2009). ASM Press Washington, D.C. 820 pp.

B.Sc. (Hons.) I Year
(II Semester)

Max. Marks	: 100
Sessional	: 30
End-Sem Exam.	: 70
Credit	: 04

COURSE 3: DIVERSITY AND CLASSIFICATION OF THE PLANT KINGDOM

Unit I	Plant Kingdom: Criteria of classification of living organisms into five kingdoms and the concept of three domain system. Algae: General characters, an outline classification of algae (by Fritsch, 1935 economic importance important features and life history of Chlorophyceae (<i>Chlamydomonas</i>), Xanthophyceae (<i>Vaucheria</i>), Phaeophyceae (<i>Ectocarpus</i>), Rhodophyceae (<i>Batrachospermum</i>).	11
Unit II	Fungi: General characters, important features (in brief) and life history of Mastigomycotina (<i>Phytophthora</i>), Zygomycotina (<i>Rhizopus</i>), Ascomycotina (<i>Saccharomyces</i>), Basidiomycotina (<i>Puccinia</i>) and Deuteromycotina (<i>Colletotrichum</i>). Bryophytes: Outline classification, study of morphology, anatomy and reproduction of Hepaticopsida (<i>Riccia</i>), Anthocerotopsida (<i>Anthoceros</i>) and Bryopsida (<i>Funaria</i>).	12
Unit III	Pteridophytes: A general study of morphology, anatomy, and reproductive structure of Psilopsida (<i>Psilotum</i>), Lycopsida (<i>Lycopodium</i>), Sphenopsida (<i>Equisetum</i>) and Pteropsida (<i>Dryopteris</i>); stellar evolution. Gymnosperms: General study of morphology, anatomy and reproductive structures of Cycadales (<i>Cycas</i>) and Coniferales (<i>Pinus</i>).	11
Unit IV	Angiosperms: Identification, nomenclature, classification:(Bentham and Hooker), primitive and advanced features, salient features of the International Code of Botanical Nomenclature; diagnostic features (with reference to local flora) and economic importance of Ranunculaceae, Malvaceae, Brassicaceae, Papilionaceae, Caesalpinaceae, Solanaceae, Asteraceae, Euphorbiaceae, Poaceae and Liliaceae.	

Suggested Books

1. Fungi by Vashishta, P.C. (1992). S. Chand & Company Ltd. New Delhi.
2. Bryophyta by Vashishta, B.R., Sinha, A.K. and Kumar, A. (1992). S. Chand & Company Ltd. New Delhi.
3. Algae by Vashishta, B.R., Sinha, A.K. and Singh, V.P. (2008). S. Chand & Company Ltd. New Delhi.
4. Botany Vol. II by Pandey, S.N., Trivedi, P.S. and Mishra, S.P. (1994) Vikas Publishing House Pvt. Ltd. New Delhi
5. Angiosperm Taxonomy by Lawrance, G.H.M. (1951). The Macmillan Compnay New York, 823 pp.
6. Angiosperm Taxonomy by Pandey, B.P. (1999). S. Chand and Company, Pvt. Ltd., New Delhi, 600 pp.
7. Angiosperm Taxonomy by Singh, V. and Jain, D.K. (1981). Deep and Deep Publications, 489 pp.
8. An Introduction to Taxonomy of Angiosperms by Shukla, P. & Misra, S.C. (1991). Vikas Publishing House, Pvt. Ltd. (576, Masjid Road, Jangpura, New Delhi-110014).
9. The Gymnosperm by Bishvas, C. and Johri, B.M. Narora Publishing House, New Delhi.
10. Morphology of Gymnosperms by Sporne, K.R. Hutchinson and Company (Publisher) Ltd., London.

B.Sc. (Hons.) II Year
(III Semester)

Max. Marks : 100
Sessional : 30
End-Sem Exam. : 70
Credit : 04

COURSE 5: PLANT PHYSIOLOGY AND ECOLOGY

Unit I	Plant water relations: Diffusion, osmosis and imbibitions, elementary idea of chemical, water and osmotic potential, absorption of water by cell and root; ascent of sap, transpiration and its significance, mechanism of stomatal movement. Mineral nutrition: Criteria of essentiality of elements, macro and micronutrients, role of essential elements, mineral deficiency symptoms and plant disorders, elementary idea of nutrient uptake and transport mechanism, role of cell membrane and ion pumps, carriers and channels. Photosynthesis: Electromagnetic spectrum and light quality, photosynthetic apparatus, photosynthetic pigments, light reaction, C ₃ and C ₄ cycles, crassulacean acid metabolism, photorespiration, components of phloem and their role in translocation of photosynthates.	12
Unit II	Respiration: Aerobic and anaerobic respiration, glycolysis, TCA cycle, oxidative phosphorylation, pentose phosphate pathway, cyanide-resistant respiration. Nitrogen metabolism: Biological nitrogen fixation, reduction of nitrogen into ammonia, ammonia assimilation and nif genes. Growth and development: Definition and phases of growth, seed germination, photoperiodism, vernalisation, general aspects of phytohormones (auxins, gibberellins, cytokinins, abscisic acid and ethylene) and their roles, plant movements, biological clock.	12
Unit III	Adaptations: Concepts, ecads, ecotypes and ecoclines; adaptations in relation to soil oligotrophy. Population: Concept of density patterns, population growth and carrying capacity. Indicators and amplitude: Plant indicators and their role in environmental monitoring; ecological amplitude.	11
Unit IV	Ecosystems: Concept and structure (abiotic and biotic components, food chain, food web and ecological pyramids); ecosystem function, energy flow, ecological efficiencies and productivity concept. Ecological succession: Types and mechanism of succession. Community: Characteristics and their measurement, niche concept, species diversity (alpha, beta and gamma).	10

Suggested Books

1. Plant Physiology by Devlin, R.M. and Witham, F.H. (1983). Prindle Weber and Schmidt, 577 pp.
2. Plant Physiology by Pandey, S.N. and Sinha, B.K. (2009). Vikas Publishing House, Pvt. Ltd. New Delhi 680 pp.
3. Plant Physiology by Salisbury, F.B. and Ross, C.W. (1992). Wadsworth Publishing Company, 682 pp.
4. Ecology and Environment by Sharma, P.D. (2005). Rastogi Publications, Shivaji Road, Meerut.
5. Ecology and Utilization of Plants by Sharma, P.D. (2006). Rastogi Publications, Shivaji Road, Meerut.

B.Sc. (Hons) II Year

III Semester (Skill Enhancement Elective)

Max. Marks	: 100
Sessional	: 30
End-Sem Exam.	: 70
 Credit	 : 02

Course – 07: Methods of Environmental Analysis

- Unit I** **Techniques in Environmental Analysis:** Cell fractionation (homogenization and centrifugation), paper chromatography and spectrophotometry.
- Unit II** **Water Pollution Analysis:** Colour, conductivity, temperature, odour, turbidity, hardness, determination of calcium, carbonate, dissolved oxygen and biological oxygen demand.
- Unit III** **Air Pollution Analysis:** Analysis of aerosol, sulphur dioxide, hydrogen sulphide and ozone.
- Unit IV** **Soil Pollution:** Colour, moisture, temperature, pH, electrical conductivity, determination of magnesium, chloride, biological preparation and inoculation of culture media.

B.Sc. (Hons) II Year

III Semester (Skill Enhancement Elective)

Max. Marks	: 100
Sessional	: 30
End-Sem Exam.	: 70
Credit	: 02

Course – 08: Techniques in Plant Breeding

- Unit I** **Hybridization:** Hybridization programme and procedure choice of parents, Evaluation of parents, Emasculation (Hand Emasculation, Suction Method, Hot water Emasculation, Alcohol treatment, Cold treatment), Bagging, Tagging, Pollination, Harvesting of F₁ seeds, Raising the F₂ generation.
- Unit II** **Procedure for Mutation Breeding:** Objectives of the programme physical and chemical mutagens, Selection of the variety for Mutagen treatment, parts of the plant to be treated, Doses of the Mutagen, Giving Mutagenic treatment, Handling of the Mutagen – treated population, Gamma Garden.
- Unit III** **Polyploidy:** Origin and production of Auto polyploidy – Spontaneous mutation, Physical & chemical agents, Regeneration *in vitro*, Colchicines treatment: Seed treatment, Seedlings, Growing Shoot apices, other chemical agents.
- Unit IV** **Field plot techniques in plant Breeding:** Principles of Experimental Designs - Replication Randomization, Complete Block & Split Plot Designs.

B.Sc. (Hons.) II Year
(IV Semester)

Max. Marks	: 100
Sessional	: 30
End-Sem Exam.	: 70
Credit	: 04

COURSE 9: DEVELOPMENT OF PLANTS AND THEIR UTILIZATION

Unit I	Organization of higher plant body and adaptive systems: Tissue systems and their functions in stems of maize and sunflower, leaf of sugarcane, root of maize and ficus, plant adaptations (<i>Nymphaea</i> as aquatic, <i>Cucurbita</i> as mesophyte, <i>Nerium</i> as xerophyte, <i>Bryophyllum</i> as succulent and <i>Rhizophora</i> as halophyte).	11
Unit II	Shoot and root apices and lateral meristems: Organization, functions and theories of shoot and root apex (apical cell theory, histogen theory, tunica corpus theory, cyto-histo-zonation theory of shoot apex; Korper-kappe theory, quiescent centre concept in root apex), origin of lateral meristems (vascular cambium and cork cambium), structure and functions of vascular cambium and their derivatives (basic structure of wood and bark components), structure and functions of periderm.	12
Unit III	Industrial use plants: General account of the natural rubber (<i>Hevea brasiliensis</i>), essential oils- lemon grass, an insecticide-neem and dyes-saffron and turmeric, extraction and uses of cotton fibre. Medicinal Plants: General account of the important plant drugs and their chief constituents used in indigenous and allopathic systems of medicines, viz. <i>Papaver somniferum</i> , <i>Rauvolfia serpentina</i> , <i>Vinca rosea</i> , <i>Catharanthus roseus</i> and <i>Atropa belladonna</i> .	11
Unit IV	Cereals, pulses and oilseeds: General account of botany, cultivation and uses of cereals (wheat and rice, a legume (Chickpea/Bengal gram) and a vegetable oil source (Mustard). Timber plants: General account of the properties and uses of teak, sal, shisham and chir woods.	11

Suggested Books

1. A hand book for field identification of fifty important timbers of India by Rao, K.R. and Juneja, K.B.S. (1971). FRI and Colleges, Dehradun.
2. Plant Anatomy by Pandey, B.P. (1994). S. Chand and Company Ltd., New Delhi, 644pp.
3. Plant Anatomy by Esau, K. (1965). John Wiley and Sons.
4. Plant Anatomy by Fahn, A. (1990). Pergamin Press.
5. Ecology and Utilization of Plants by Sharma, P.D. (2006). Rastogi Publications, Shivaji Road, Meerut.
6. Economic Botany in the tropics by Kochhar, S.L. Macmillan Publishers India Ltd.
7. Economic Botany by Pandey, S.N. and Chadha Ajanta, Vikas publishing House, Pvt. Ltd. New Delhi.
8. Economic Botany by Hill Albert, F. and Sharma, O.P., Tata Mcgraw Hill Publishing Company, Ltd.
9. Comparative Morphology of Vascular Plants by Foryter, A.S. and Giffords, Jr. E.M., VakilsFeffers and Simons Pvt. Ltd. Bombay

B.Sc. (Hons) II Year

IV Semester (Skill Enhancement Elective)

Max. Marks	: 100
Sessional	: 30
End-Sem Exam.	: 70
Credit	: 02

Course – 11: Experiments in Cytology and Genetics

- Unit I** **Chromosome Morphology:** To study generalised plant cell, cell division (Meiosis and Mitosis) (polytene chromosomes, Sex chromosomes).
- Unit II** **Chromosome Methodologies:** Prefixation, Fixation, Staining, Preparation of slide for mitotic study, Preparation of slide for meiotic study, Preparation of permanent slide.
- Unit III** Hybridization technique, Intervarietal hybridization in self pollinated crops, Estimation of pollen viability and pollen size in flowering plants, Estimation of seed viability.
- Unit IV** Monohybrid cross, Dihybrid cross, Test cross methods, Floral biology and Floral morphology, Effect of chemical / physical mutagens on seed germination and seedling growth.

B.Sc. (Hons) II Year

IV Semester (Skill Enhancement Elective)

Max. Marks	: 100
Sessional	: 30
End-Sem Exam.	: 70
Credit	: 02

Course – 12: Study of Plant Diseases and Their Management

- Unit- I** A. Plant Viruses – Structure of Viruses, Viral Parasitism and Morphological Symptoms
- B. Disease caused by Viruses and their Management:
- Yellow Vein Mosaic of Okra
 - Leaf Roll of Potato
- Unit- II** A. Plant Pathogenic Bacteria – Structure of Bacterium, Mode of Infection, Symptoms of Bacterial Diseases
- B. Bacterial Diseases of Plant and their Management:
- Citrus Canker
 - Scab of Potato
- Unit- III** A. Plant Pathogenic Fungi – Structure of Fungal Cell, Mode of Infection, Symptoms of Fungal Diseases
- B. Fungal Diseases of Plant and their Management:
- Stripe Rust of Wheat
 - Early Blight of Potato
- Unit- IV** A. Plant Parasitic Nematodes – Structure of Nematode, Mode of Infection, Symptoms Caused by Nematodes
- B. Nematodes Diseases of Plant and Their Management:
- Root Knot Disease of Tomato
 - Molya Disease of Wheat

B.Sc. (Hons) II Year

IV Semester (Open Elective Course)

Max. Marks	: 100
Sessional	: 30
End-Sem Exam.	: 70
Credit	: 02

Course – 13: Basic Concept in Botany

- Unit I** Plant Kingdom, Classification; Bentham & Hooker Diagnostic features and economic importance of Solanaceae & Poaceae.
- Unit II** Economic importance of cereals (Wheat), oils (Mustard), Pulse (Pea), Fibres (Cotton) and medicinal plants (Opium poppy).
- Unit III** Characterization of algae bryophyte pteridophytes and Gymnosperms Eukaryotic cell structure, chemical composition or protoplasm, cell wall, plasma membrane, Mendel's laws of Inheritance.
- Unit IV** Environmental and Plant Physiology: Pollution (Air, Water, Soil, Noise & Radioactive), elementary concept of photosynthesis respiration.

B.Sc. (Hons.) III Year
(V Semester)

Max. Marks	: 100
Sessional	: 30
End-Sem Exam.	: 70
Credit	: 04

COURSE 14: BIOLOGY OF CRYPTOGAMS

Unit I	Algae: Occurrence, distribution, range of thallus organization, cell organization levels, pigmentation and storage products in algae, Classification of algae (by Fritsch 1935), general characteristics of major classes; structure, reproduction and life cycle of different genera of algae belonging to Cyanophyceae (<i>Nostoc</i>), Chlorophyceae (<i>Volvox</i>), Xanthophyceae (<i>Vaucheria</i>), Charophyceae (<i>Chara</i>), Rhodophyceae (<i>Batrachospermum</i>) and Phaeophyceae (<i>Ectocarpus</i>); role of algae in human welfare.	12
Unit II	Fungi: Occurrence, ultrastructure of fungal cell, cell wall composition, classification of fungi (by Alexopoulos & Mims 1973), nutrition and reproduction in fungi (asexual and sexual). Fungal plant diseases: Symptoms, causal organism and management of major plant diseases (stem rust and loose smut of wheat, white rust of crucifers, late blight of potato, Tikka disease of groundnut and red rot of sugarcane.)	11
Unit III	Bryophytes: General characters, comparative account of morphology, anatomy and reproduction of <i>Marchantia</i> , <i>Anthoceros</i> and <i>Funaria</i> , evolution of sporophyte (developmental stages not included), bryophytes as water and air pollution bioindicators.	11
Unit IV	Pteridophytes: Primary vascular plants, outline classification, comparative account of morphology, anatomy and reproduction in <i>Rhynia</i> , <i>Selaginella</i> , <i>Equisetum</i> , <i>Marsilea</i> , Telome theory, heterospory and seed habit.	11

Suggested Books

1. Plant Pathology 5th Edition by Agrios George, N. (2006). Elsevier Academic Press, London, 922 pp.
2. An Introduction to Pteridophyta by Rashid, A., Vikas Publishing House, Pvt. Ltd., New Delhi.
3. Pteridophyta (Vascular Cryptogams) by Vashishta, P.C., S. Chand and Company Pvt. Ltd. New Delhi.
4. Introductory Mycology IVth Edition by Alexopoulos, C.J., Mims, C.W. and Blackwell, M. (1996). John Wiley and Sons Inc, USA.
5. Algae by Vashishta, B.R., Sinha, A.K. and Singh, V.P. (2008). S. Chand and Company Pvt. Ltd.
6. Plant Diseases 6th Edition by Singh, R.S., Oxford and IBH Publishing Company, Pvt. Ltd.,
7. Plant Pathology by Mehrotra, R.S., Aggarwal, A., Tata Mcgraw Hill Publishing Company, New Delhi.
8. Bryophyta by Vashishta, B.R., Sinha, A.K. and Kumar, A. (1992) S. Chand and Comp. Pvt. Ltd. New Delhi.
9. An Introduction to Embryophyta 5th Edition by N.S., Parihar (1965). Central Book Depot, Allahabad, India .
10. Bryophytes: Morphology growth and differentiation by Mrs. PremPuri., Atma Ram and Sons, Delhi, 370 pp.

B.Sc. (Hons.) III Year
(V Semester)

Max. Marks	: 100
Sessional	: 30
End-Sem Exam.	: 70
Credit	: 04

COURSE 15:	SYSTEMATICS OF ANGIOSPERMS AND ENVIRONMENTAL BIOLOGY	11
Unit I	Systematics: (aims and components of systematics, introduction, identification, nomenclature and classification), systematics in practice (importance of herbarium specimens and their preparation; role of herbaria), taxonomic hierarchy (taxonomic categories, taxonomic groups, concepts of species), International Code of Botanical Nomenclature (principles and rules; ranks and names, type method), systems of classification (Bentham & Hooker's system, Engler and Prantl's system).	
Unit II	Angiosperme Families: Study of families of dicots (Ranunculaceae, Papaveraceae, Rutaceae, Cucurbitaceae, Apiaceae, Rubiaceae, Apocynaceae, Asclepiadaceae, Convolvulaceae, Acanthaceae, Lamiaceae and Euphorbiaceae) and monocots (Arecaceae and Poaceae) with special reference to local flora and plants of economic value.	12
Unit III	Introduction to environmental biology: Interrelationship between the living world and environment, the components and dynamism, homeostasis, relevance to man. Earth as a system and environment: the biosphere and lithosphere; components within biosphere (biomes). Soil general account and its adaptations. The living world-biotic components of environment, types of biotic interactions.	11
Unit IV	Ecosystem: Concept of ecosystems and their types, structure and organization of ecosystem, functions and processes within ecosystem. Transfer of energy and minerals via grazing and detritus chains and role of microorganisms; concept and types of productivity. Human ecology: ecological management; renewable and non renewable resources and their management conservation of biodiversity endangered species.	11

Suggested Books

1. Angiosperm Taxonomy by Lawrance, G.H.M. (1951). The Macmillan Company, New York, 823 pp.
2. Angiosperm Taxonomy by Pandey, B.P. (1999). S. Chand and Company, Pvt. Ltd., New Delhi, 600 pp.
3. Angiosperm Taxonomy by Singh, V. and Jain, D.K. (1981). Deep and Deep Publications, 489 pp.
4. An Introduction to Taxonomy of Angiosperms by Shukla, P. and Misra, S.C. (1991). Vikas Publishing House Pvt. Ltd., New Delhi.
5. Ecology and Environment by Sharma, P.D. (2005). Rastogi Publications, Shivaji Road, Meerut.
6. Ecology and Utilization of Plants by Sharma, P.D. (2006). Rastogi Publications, Shivaji Road, Meerut.

**B.Sc. (Hons.) III Year
(V Semester)**

Max. Marks : 100
Sessional : 30
End-Sem Exam. : 70

Credit : 04

Course 19: MICROBIOLOGY AND PLANT PATHOLOGY

Unit I	Microbiology: Systematic position of microorganisms in biological world as proposed by Whittaker. General characteristic features and classification of bacteria (Bergey's Manual of Determinative Bacteriology, 1974), brief account of prokaryotic and eukaryotic microorganisms (bacteria and yeast), viruses (properties and classification, bacteriophage T4), general account of viroids, phytoplasma and actinomycetes.	12
Unit II	Genetic recombination in prokaryotes: Conjugation, transformation and transduction, biological nitrogen fixation. Industrial application of microorganisms: Organic acids, alcohol, preservation of foods, milk products, antibiotics and biopesticides.	11
Unit III	Pathological methods: Sterilization methods in plant pathology, isolation of fungi and bacteria from soil and infected plant material. General account of plant diseases: Symptoms, causal organisms and management of little leaf of brinjal, tobacco mosaic virus, citrus-canker, ear-cockle of wheat, root-knot of okra, early blight of potato, stem gall of coriander.	11
Unit IV	Defence mechanism in plants against pathogens: Physical and biochemical aspects, brief account of plant disease management (Chemical, Biological), IPM systems, elementary idea of transgenics, Symptoms caused by micro-organisms. Nematodes: An elementary idea about the structure of nematode, importance of nematodes as agricultural pest.	11

Suggested Books

1. Fundamentals of Microbiology 5th Edition by Alcamo, I. Edward. Wesley Longman Inc.
2. Introductory Microbiology by Heritage, J., Evans, E.G.V. and Killington, R.A., Cambridge University Press.
3. Wastewater Microbiology by Bitton Gabriel., Wiley Lics A John Wiley & Sons Inc.
4. Microbiology by Pelezar Michael, J., Chan, E.C.S. and Krieg Noel, R., Tata Mcgraw Hill Publishing Company, Ltd.
5. Plant Pathology 2nd Edition by Mehrota, R.S., Aggarwal Ashok. (2003) Tata Mcgraw Hill Publishing Company, Ltd.
6. Plant Diseases 7th Edition by Singh, R.S. (1998) Oxford & IBH Publishing Company Pvt. Ltd.
7. Introductory Mycology by Alexopoulos Constantine John, Mims, C.W. and Blackwell, M. John Wiley & Sons, Inc.
8. Plant Parasitic Nematodes by Zuckerman, B.M., Mai, W.F. and Rohde, R.A., Academic Press New York San Francisco London.

**B.Sc. (Hons.) III Year
(V Semester)**

Max. Marks : 100
Sessional : 30
End-Sem Exam. : 70

Credit : 04

Course – 20: Fundamentals of normal and anomalous plant anatomy

- Unit I** **General account of normal stem and root anatomy:** Primary and secondary body; different zones in a transverse section of stem and root; types of vascular bundles (radial, collateral, bi-collateral, endarch, exarch, amphicribal, amphivasal, and open and closed). Root-stem transition.
- Unit II** **Stem: Primary anomalous structure:** Scattered vascular bundles in dicots (*Podophyllum*). Vascular bundles in a ring in monocots (*Triticum*). Cortical bundles (*Casuarina*). Medullary bundles (*Aralia racemosa*). Intraxylary or included or internal phloem (*Solanum tuberosum*). Separate xylem and phloem bundles (*Rumex crispus*). Vesselless xylem (*Trochodendron*). Polystelic condition (*Dianthera*).
- Unit III** **Abnormal secondary growth:** Abnormal behaviour of normal cambium: (*Aristolochia*). Abnormal behaviour of abnormal cambium: (*Thinouia ventricosa*). Formation of accessory cambial rings: (*Boerhavia*). Formation of interxylary phloem: (*Leptadenia*).
- Unit IV** **Anatomy of leaf:** Bifacial/dorsiventral leaves, unifacial leaves , equifacial or isobilateral leaves. Stomata: general structure, position and types (Anomocytic, Anisocytic, Paracytic, Diacytic, Actinocytic and cyclocytic. Kranz anatomy.

**B.Sc. (Hons.) III Year
(V Semester)**

Max. Marks	: 100
Sessional	: 30
End-Sem Exam.	: 70
Credit	: 04

Course – 21: Techniques in Tissue Culture

- Unit I** **History of Plant Tissue Culture, Composition of Culture Media** viz; Knops's Solution, Hogland's Solutions, white's Medium (1953), Murashige & Skoog Medium (1962), B5 Medium (1968), Nitsch's Medium (1969), N6 Medium (1978), Linsmaier & Skoog Medium (1965), Woody Plant Medium (1981), Ngata & Takebe Medium (1971), Different types of plant growth regulations used in tissue culture.
- Unit II** **Preparatory Steps in Plant Tissue Culture;** Preparation of Stock Solution, Explants Collection, Types of Steriliants and Surface Sterilization of explants, Autoclaving, Bead Sterilization, Filter Sterilization, Sterilization of Culture Room and Laminar air flow.
- Unit III** **Types of Culture;** Leaf, Shoot tip, Nodal Segment, Embryo Culture and Rescue, Callus Culture, Isolated Cell Culture, Cell Suspension Culture, Endosperm Culture and Triploid Plant Production, Nucellus Culture, Anther Culture for Haploid Plant, Diplodization of Haploids, Problems Associated with Haploid Production.
- Unit IV** **Aspects of Tissue Culture;** In vitro Pollination and Fertilization, Totipotency, Differentiation, dedifferentiation and redifferentiation, Cytodifferentiation, Organogenesis, Somatic Embryogenesis, Virus Free Plant Production, Somaclonal Variation, Industrial Application of Plant Tissue Culture.

Suggested Books:

1. Introduction to Plant Tissue Culture by M. K. Razdan
2. Plant Biotechnology by H. S. Chawala
3. Plant Tissue Culture: Theory and Practice by S. S Bhojwani and M. K. Razdan

B.Sc. (Hons.) III Year
(VI Semester)

Max. Marks : 100
Sessional : 30
End-Sem Exam. : 70
Credit : 04

COURSE 22: GENETICS AND PLANT BREEDING

Unit I	Mendelian inheritance: Principles of inheritance, back cross and test cross; gene interactions and modified dihybrid ratios, epistatic factors; complementary, supplementary and duplicate genes; multiple alleles and self incompatibility in plants; quantitative traits and multiple factor hypothesis (wheat kernel colour).	12
Unit II	Linkage, recombination and genetic makeup: Coupling and repulsion hypothesis; two and three point test crosses with their significance in chromosome mapping, changes in chromosome structure; origin types and effects of duplications, deletions, inversions and translocations. Sex determination and non Mendelian inheritance; Mechanisms of sex determination, balance concept of sex determination in <i>Drosophila</i> , sex linked inheritance in <i>Drosophila</i> and man. Maternal influence (Shell coiling in snails), kappa particles in <i>Paramecium</i> , cytoplasmic inheritance in yeast (mitochondria) and <i>Mirabilis jalapa</i> (plastids).	12
Unit III	Types of plant reproduction: Vegetative, sexual and apomixis, their effects on generating and fixing genotypic variation. Methods of plant improvement: Plant introduction, pureline and mass selection, hybridization-types, techniques and importance.	11
Unit IV	Mutations: Spontaneous and induced mutations, mutagen-types, transitions, transversions, and frameshift mutations, applications of mutations in crop improvement. Polyploidy: Origin, types and effects of auto and allopolyploidy, applications of polyploidy in crop improvement.	11

Suggested Books

1. Principles and Methods of Plant Breeding by Borojevic, S. (1990). Elsevier New York.
2. Principles of Plant Breeding by Allard, R.W. (1960). John Wiley and Sons Inc, New York, 485 pp.
3. Problem Facing Plant Breeding by Vijendra Das, L.D. (2000). Jain for CBS Publishers and Distributors.
4. Genetics and Genomics 1st Edition by Waseem Ahmad, Fareedi (2013). Pearson Education Dorling Kindersley (India) New Delhi.
5. Genetics 9th Edition by Verma, P.S. and Agarwal, V.K. (2009). S. Chand and Company Ltd. Ramnagar, New Delhi.

**B.Sc. (Hons.) III Year
(VI Semester)**

Max. Marks	: 100
Sessional	: 30
End-Sem Exam.	: 70
Credit	: 04

COURSE 23: BIOCHEMISTRY, MOLECULAR BIOLOGY AND BIOTECHNOLOGY

Unit I	Nucleic acid: Composition of nucleic acid; DNA structure (A, B, and Z forms of DNA); different forms of RNA and their roles. Amino acid and protein metabolism: General characteristics of amino acids; GS/GOGAT cycle; transamination; peptide bond and polypeptide chain; primary, secondary, tertiary and quaternary structure of proteins; protein biosynthesis and its regulation; post translational modification of proteins; protein targeting; protein degradation.	12
Unit II	Carbohydrate metabolism: Characteristics of monosaccharides, disaccharides, polysaccharides, isomerism; biosynthesis of sucrose. Lipid metabolism: Saturated and unsaturated fatty acids, oxidation of fatty acids; glyoxylate cycle.	11
Unit III	Gene structure expression and regulation: Gene organization in prokaryotes and eukaryotes; operon concept; gene regulation in prokaryotes and eukaryotes; inducible, repressible, positive and negative gene regulation; RNA splicing. Recombinant DNA technology: Restriction endonucleases; prokaryotic cloning vectors, cDNA libraries, Southern and Northern analysis, DNA fingerprinting, chromosome walking; polymerase chain reaction; DNA sequencing.	11
Unit IV	Plant Biotechnology: Cellular differentiation and totipotency, clonal propagation; protoplast isolation and culture; somatic hybridization; genetic engineering of plants; vectors for gene delivery; methods of gene delivery; <i>Agrobacterium</i> the natural genetic engineer.	11

Suggested Books

1. Plant Physiology by Salisbury, F.B. and Ross, C.W. (1992). Wadsworth Publishing Company, 682 pp.
2. Plant Physiology by Pandey, S.N. and Sinha, B.K. (2009). Vikas Publishing House Pvt. Ltd. New Delhi, 680 pp.
3. Plant Physiology by Devlin, R.M. and Witham, F.H. (1983). Prindle Weber and Schmidt, 577 pp
4. Plant Physiology, Biochemistry and Biotechnology by Srivastava, H.S. (2005). Rastogi Publications, Meerut.
5. Plant Physiology by Jain, V.K. (2008). S. Chand and Company Ltd. (Ram Nagar, New Delhi).
6. Plant Physiology 4th Edition by Lincoln Taiz and Eduardo Zeiger (2006). Sunderland, Massachusetts: Sinauer Associates, Inc. Publishers

B.Sc. (Hons.) III Year
(VI Semester)

Max. Marks : 100
Sessional : 30
End-Sem Exam. : 70

Credit : 04

Course 27: BIOLOGY OF SEED PLANTS

Unit I	Gymnosperms: General characters, economic importance and outline classification (by Sporne, 1965). Cycadales: Vegetative organography and anatomy, reproductive cycle, sporophytes and sporangia, gametophytes, fertilization, embryogeny and seed development with special reference to <i>Cycas</i> .	12
Unit II	Coniferales: General organography and anatomy, foliage leaves, strobili and sporangia, reproductive cycle-sporogenesis, gametophytes, fertilization, embryogeny and seed development with special reference to <i>Pinus</i> Gnetales: Vegetative organography and anatomy, reproductive cycle- the strobili, sporogenesis, male and female gametophytes, pollination, fertilization and embryogeny with special reference to <i>Ephedra</i> .	10
Unit III	Phanerogams: General characteristics and types. Angiosperms: Organography and anatomy, histology venation; nodal and wood anatomy, general concepts of floral anatomy.	
Unit IV	Alternatives of reproduction: . Concept of flower as a modified determinate shoot; Genetic control of floral organs; Functions of flower; Pollen germination; Development of endosperm Pollination (mechanisms and agencies), Types of pollination, microsporogenesis (development of male gametophyte), mega sporogenesis (development of female gametophyte); Development of embryo in monocotyledons; Development of embryo in dicotyledons; Seed dormancy; Methods of overcoming (breaking) seed dormancy; Seed germination; Fruit maturation; Ripening of fruits; Parthenocarpy; Fruit dispersal.	11 12

Suggested Books

1. Morphology of Gymnosperms by Sporne, K.R. Hutchinson and Company (Publishers) Pvt. Ltd., London.
2. The Gymnosperms Structure and Evolution by Biswas, C. and Johri, B.M., Narora Publishing House, New Delhi.
3. An Introduction to the Embryology of Angiosperms by Maheshwari, P. (1950). McGraw Hill Book Company, New York, 453 pp.
4. The Embryology of Angiosperms by Bhojwani, S.S. and Bhatnagar, S.P. (2008). Vikas Publishing House, Pvt. Ltd., New Delhi, 352 pp.
5. Reproductive Biology of Plants by Johri, B.M. and Srivastwa, P.S. (2001)., Narosa Publishing House, New Delhi, 320 pp.

**B.Sc. (Hons.) III Year
(VI Semester)**

Max. Marks : 100
Sessional : 30
End-Sem Exam. : 70

Credit : 04

Course 28: Introduction to Mycology

Unit I General characteristic features of fungi: Habitat; Mode of life; Thallus organization; Appressoria; Haustoria; Cell structure; Fungal flagella; Aggregation and modification of the hyphae. Reproduction: Vegetative, Asexual and Sexual. Fungi as biocontrol agents with special reference to mycophagous, entomophagous and nematophagous fungi.

Unit II **Diagnostic features of taxa:**
Subdivision – Haplomastigomycotina
Classes–Chytridiomycetes, Hyphochytridiomycetes and Plasmodiophoromycetes. Occurrence, somatic phase and life cycle of *Plasmodiophora brassicae*.
Subdivision – Diplomastigomycotina
Class – Oomycetes – Sporangiophores in the members of Peronosporaceae. Occurrence, somatic phase and life cycle of *Albugo candida* and *Pythium debaryanum*.
Subdivision – Zygomycotina
Classes – Zygomycetes and Trichomycetes – Evolutionary tendencies of the Zygomycetes. Occurrence, somatic phase and life cycle of *Mucor mucedo*.

Unit III: Diagnostic features of taxa:
Subdivision – Ascomycotina

Class–Ascomycetes

Subclasses–Hemiascomycetidae, Loculoascomycetidae, Plectomycetidae, Laboullenomycetidae, Pyrenomycetidae and Discomycetidae. Taxonomic Characters based on Chasmothecia/Cleistothecia of Erisiphaceae members. Occurrence, somatic phase and life cycles of *Taphrina deformans*, *Talaromyces vermiculatus*, *Phyllactinia dalbergiae* and *Venturia inaequalis*.

Unit IV: Diagnostic features of taxa:
Subdivision – Basidiomycotina,
Class – Basidiomycetes
Subclasses – Phragmobasidiomycotidae, Holobasidiomycetidae and Teliomycetidae. Teliospores of various rust genera. Occurrence, somatic phase and life cycle of *Melampsora linii* and *Ustilago tritici*.

Diagnostic features of taxa:
Form-Subdivision – Deuteromycotina,
Form-Class – Deuteromycetes

Form-Subclasses – Blastomycetidae, Coelomycetidae and Hyphomycetidae. Occurrence, somatic phase and life cycle of *Alternaria solani* and *Rhizoctonia solani*.

BOOKS RECOMMENDED:

- | | |
|--|---|
| 1. <i>Introductory Mycology, Fourth Edition.</i> | Alexopoulos, Mims and Blackwell |
| 2. The Fungi (An Introduction) - 3rd ed. | Mehrotra, Brahma Swarup |
| 3. Introduction to Fungi (2nd ed.) | Webster, John |
| 4. Comparative Morphology of Fungi | Gaumann, Ernst Albert, Dodge, Carroll William |
| 5. Text Book of Fungi | Massee George |
| 6. A Manual of Soil Fungi | Gilman Joseph C |

**B.Sc. (Hons.) III Year
(VI Semester)**

Max. Marks	: 100
Sessional	: 30
End-Sem Exam.	: 70
Credit	: 04

Course – 29: Introduction to Environment

- Unit I** **Introduction and history:** What is environment?, environment vs. ecology. Rachel Carson's Silent Spring and its influence. Stockholm Conference. Amendments to the constitution of India following Stockholm Conference.
- Unit II** **Current environmental Issues:** Species invasion: definition, brief introduction to mechanism and impact on biodiversity, important invasive plant species in India. Brief introduction to biomagnification. Deforestation causes and its impact on biodiversity.
- Unit III** **Current Environmental Issues:** Urbanization: rate of urbanization, megacities of world and India, ecological footprints, thermal islands, environmental impact. Cultural eutrophication. Impact of tourism on environment.
- Unit IV** **Control of environmental degradation:** Biodiversity conservation, brief idea of CITES and TRAFFIC. Phytoremediation (biochemical mechanism and genetic basis of phytoextraction and phytoaccumulation not required). Hotspot concept and criteria (students will be expected to know the current number and names of terrestrial hotspots and the number of endemic vascular plants in each. Detailed study of each hotspot is not required). IUCN categories of threat and criteria.