

Madurai Kamaraj University
DIRECTORATE OF DISTANCE EDUCATION
M.Sc. BOTANY (Non - Semester)
(This will come into effective from the academic year 2013 - 2014)

REGULATIONS AND SYLLABUS

Eligibility For Admission

A pass in the B.Sc. Botany with any ancillary subject from any recognized university with minimum aggregate of 45% marks.

Duration of the course

Two years (Non-Semester Pattern).

Personal Contact Programmes (PCP)

During each academic year, there will be personal contact programmes. Theory (90 hrs) and practical (90 hrs) classes will be held on these days. The contact programmes will be conducted in the University campus. Attendance is compulsory for the contact programmes.

Examinations

The examination for the degree shall consist of theory and practicals. The practical examinations will be conducted at the end of the contact programme. The theory examinations will be conducted at the end of first year (Paper I-IV) and second year (Paper V-VIII). The candidate have to submit laboratory record notebooks for the evaluation during the practical examination. All the theory papers are of 3 hours duration each for a maximum of 100 marks with passing minimum of 50 marks. Practical examinations are also for 3 hours duration.

Classification of Candidates:

A candidate who obtains not less than 50% of total marks in each paper shall be declared to have passed in that paper.

A candidate who secures 50% or more but less than 60% of aggregate marks shall be placed in Second Class.

A candidate who secures 60% and more of aggregate marks shall be placed in First Class.

Completion of the Course:

The students have to complete their course within five years from the year of completion of the course, failing which their registration will stand automatically cancelled and they have to register afresh, if they want to continue the course subject to the availability of the programme during that time.

Failed Candidates:

A candidate who fails in any paper / papers may appear again in that paper / those papers alone as per the University rules. The marks once awarded for records, Herbarium and submission will remain the same and will be considered for any reappearance.

Other Regulations:

Besides the above, the common regulations of the University shall also be applicable to this programme.

Scheme of Examination: First year

	Name of the Paper	Duration (hrs)	Maximum Marks
Theory: Paper-I	Plant diversity	3	100
Theory: Paper-II	Taxonomy of angiosperms and economic botany	3	100
Theory: Paper-III	Microbiology and plant pathology	3	100
Theory: Paper- IV	Cell biology genetics, plant breeding and evolution	3	100
Practicals -I	For the courses I & II	3	80+20*=100
Practicals -II	For the courses III to IV	3	80+20*=100
		Total Marks	600

*For Record Note book , herbarium and submission

Scheme of Examination: Second Year

	Name of the Paper	Duration Hours	Maximum Marks
Theory: Paper-V	Plant physiology and biochemistry	3	100

Theory: Paper-VI	Plant anatomy and embryology	3	100
Theory: Paper-VII	Plant Ecology, phytogeography and biodiversity conservation	3	100
Theory: Paper- VIII	Plant biotechnology	3	100
Practicals-III	For the Papers V&VI	3	80+20* =100
Practicals-IV	For the Papers VII& VIII	3	80+20* =100
		Total Marks	600

*For Record Notebook and submission

Syllabus

First year

Paper I: PLANT DIVERSITY (Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms)

Phycology: General account (habitat, thallus organization, cell structure and reproduction). Criteria for classification: pigments, food reserves and flagella. Classification (Fritsch). Salient features of Cynophyta, Chlorophyta, Bacillariophyta, Phaeophyta and Rhodophyta. Ecological significance; Economic importance

Mycology: General characters; substrate relationship, structure, cell wall composition, nutrition, and reproduction, hetrothalism, parasexuality; recent trends in classification. General account: Mastigomycotina, Zycomycotina, Ascomycotina, Basidiomycotina Deuteromycotina. Outline of ecological significance and economical importance of fungi. Lichens - general account; economical importance.

Bryology: Morphology, structure and reproduction; distribution-Classification;. Characteristic features of Hepaticopsida, Anthocerotopsida and Bryopsida. Ecological significance; Economical importance.

Pteridology: General account: Morphology, structure and reproduction. Classification of Pteridophytes; Stelar evolution; Heterospory and orgin of seed habit. General account of fossil Pteridophytes: Salient features of Psilopsida, Lycopsida, Sphenopsida and Pteropsida.

Gymnosperms: Introduction: general characteristics, distribution, classification(Sporne) and Evolution of gymnosperms. Salient features of *Pteridospermales*, *Cycadeoidales* and *Cordaitales*. Structure and reproduction in *Cycadales*, *Ginkgoales*, *Coniferales*, *Ephedrales* *Welwitschiales* and *Gnetales*; Economical importance.

Text books:

1. Alexopolus C.J. and Mims C.W. 1979. *Introductory Mycology*. Wiley Eastern Limited, New Delhi.
2. Pandey B.P. 2001. *College Botany*. Volume I, S. Chand & Company Ltd., New Delhi.
3. Pandey B.P. 2001. *College Botany*. Volume II, S. Chand & Company Ltd., New Delhi.
4. Sharma O.P. 2001. *Textbook of Algae*. Tata Mc Graw Hill- Publishing Co.Ltd, New Delhi
5. Watson, E.V. 1979. *The structure and Life of Bryophytes*. B.I. publication
6. Biswas, C, and Johri, B.M. 1999. *The Gymnosperms*. Narosa Publishing House. New Delhi.

Reference books:

1. Fritsch, F.E., 1946. *The structure and reproduction of Algae*. Vol. I & II, Cambridge University Press, London.
2. Hale, M.E. 1983. *Biology of Lichens*. Edward Arnold, London.
3. Pandey S.N. and P.S.Trivedi, 2001. *A text book of Algae*. Vikas Publishing House Pvt Ltd, New Delhi.
4. Round, F.E. 1965. *The Biology of Algae*. Hutchinson University Press, UK.
5. Smith G.M., 1986. *Cryptogamic Botany - Algae and Fungi* (I). Tata Mc Graw Hill Publishing Co. Ltd, New Delhi.
6. Smith G.M., 1989. *Cryptogamic Botany - Bryophytes and Pteridophytes* (II). Tata Mc Graw Hill Publishing Co. Ltd, New Delhi.
7. Vashishta B.R. and A.K.Sinha., 2005. *Fungi*. S.Chand & Co. Ltd, NewDelhi,.
8. Vashishta B.R., 1991. *Algae*. S.Chand & Co, New Delhi.
9. Vashishta B.R., 2001. *Bryophytes*. S.Chand & Co, New Delhi.
10. Vashishta P.C., 2008. *Pteridophytes*. S.Chand & Co, New Delhi.
11. Chamberlain C.J., 1986. *Gymnosperms: Structure and Evolution*. CBS Publishers, Delhi.

Paper II: TAXONOMY OF ANGIOSPERMS AND ECONOMIC BOTANY

Angiosperm taxonomy: Principles- Classification – (a) Artificial – Linnaeus, (b) Natural – Bentham and Hooker, (c) Phylogenetic – Engler and Prantl . Taxonomic hierarchy – species concept- Binomial nomenclature: Principles of ICBN – Typification – Principles of Priority – Effective and valid publication – Citation – Retention and Rejection of names – Chemotaxonomy – Numerical taxonomy – Molecular taxonomy – Computer applications in systematics- Role of herbaria and Flora.

Study of the Polypetalae families: Magnoliaceae, Menispermaceae, Papaveraceae, , Polygalaceae, Tiliaceae, Geramiaceae, Mimosaceae, Myrtaceae, Meliaceae and Sapindaceae.

Study of the Gamopetalae families: Sapotaceae, Rubiaceae, Asteraceae, Apocynaceae, Convolvulaceae, Bignoniaceae, Scrophulariaceae and Verbenaceae

Study of the Monochlamydeae families: Polygonaceae, Amaranthaceae, Aristolochiaceae and Loranthaceae Study of the Monocotyledons: Hydrocharitaceae, Dioscoreaceae, Arecaceae and Cyperaceae.

Economic Botany: General account on economic botany - cultivation and utilization of selected crop plants- spices and condiments, commercial crops: Fiber, Timbers, oils and drug yielding plants- tribals: Ethnobotany.

Text books:

1. Datta, S.C. 1988. *Systematic Botany*. Wiley Eastern Ltd., Madras.
2. Davis, P.H. and Heywood V.H.D. 1963. *Principles of Angiosperm Taxonomy*. Oliver and Boyd, London.
3. Hill, A.F. 1952. *Economic Botany*, Tata McGraw Hill Book, New Delhi.
4. Lawrence G. H. 1965. *Taxonomy of vascular plants*. The Macmillon Company, New York.
5. Mitra, J.N. 1988. *An introduction to systematic Botany and Ecology*. The world press Pvt. Ltd. Calcutta.
6. Naik, V.N 1988. *Taxonomy of Angiosperms*. Tata McGraw-Hill Publishing Company Ltd, New Delhi.
7. Rendle, A.B. 1979. *Classification of flowering plants* Vol. I & II Vikas.publishing House Ltd., New Delhi.
8. Sambamurty, A.V.S.S. 2009. *Taxonomy of Angiosperms*. I.K. International Pvt., Ltd., New Delhi.
9. Sivarajan, V.V. 1991. *Introduction to the principles of plant taxonomy*. Oxford and IBH publishing Co. Pvt. Ltd., New Delhi.
10. Stace, A.C. 1980. *Plant taxonomy and Biosystematics*. Edward Arnold, London.

Reference Books:

1. Henry, A.N. and Chandra Bose, 1980. *Botanical Nomenclature*. Today and Tomorrow Publishers, New Delhi.
2. Heywood, V.H., 1976. *Plant Taxonomy*. Edward Arnold Publishing Ltd., London.
3. Lawrence, H.M., 1967. *Taxonomy of Vascular plants*. Oxford and IBH publishing Company, New Delhi.
4. Rendle, A.B., 1979. *Classification of flowering plants* vol. I & II. Cambridge University Press, London.
5. Stace, C.A., 1980. *Plant Taxonomy and Biosystematics*. Edward Arnold Publishing Limited, London.
6. Tod F. Stuessy. 2009. *Plant Taxonomy: the systematic evaluation of comparative data*. Columbia Uni. Press. N.Y.

Paper III: MICROBIOLOGY AND PLANT PATHOLOGY

Bacteriology: General characteristics - Classification (Bergey`s), Ultra structure of bacterial cell – Gram +ve & Gram –ve. Staining methods- Gram & Acid fast staining, Endospore staining, Fission and sporulation. Bacterial growth- continuous & synchronous

culture. Factors affecting growth, Determination of bacterial growth – Direct method – Haemocytometer, Viable plate count - Indirect method – Turbidity.

Virology: General characters, Classification, Structure, Multiplication. Bacteriophages- Classification Replication of DNA and RNA phages-Lytic and Lysogenic Cycle, Viruses of Eukaryotes-Animal and Plant viruses- Virioids and prions.

Cultivation of microbes: Nutritional types of microbes. Media, Sterilization –Physical and chemical sterilizing agents –Principle, Mode of action and application. culturing techniques, cultivation of bacteria, algae, fungi and viruses

General symptoms, pathogenesis Effect of environmental factors on disease development - Temperature, moisture, wind, light, soil pH, soil structure. Causative agent, transmission , symptom and control of plant diseases- Bacterial- Angular leaf spot of cotton. Fungal- Blast of paddy. Viral – Bunchy top of banana. Plant protection: Exclusion (plant quarantine), eradication, chemical protection, biological control (organisms and mechanisms), Integrated plant protection.

Defense mechanism of plants against infection – preexisting structures (wax, cuticle, epidermis etc); Anatomical – cork layer, Tyloses, abscission layer; Biochemical – phenolics, phytoalexins. Molecular biological aspects – PR proteins and avr genes. Effect of infection on the physiology of the host plant(Permeability changes, photosynthesis, respiration, enzyme activity, nitrogen metabolism, phenol metabolism).

Text books:

1. Pelczar J.M., Chan E.C.S. and Kreig. R.N. 2008. *Microbiology*. 13th Reprint Tata Mc Graw Hill Publishing Company Ltd, New Delhi
2. Govindaswamy, C.V., Alagianagalingam, M.N. 1981. *Plant Pathology* . Popular Book Dept, Madras
3. Mathews, R.E.F., 1957. *Plant Virology*. Cambridge University Press. London.

Reference books:

1. Agrios G.N. 2005. *Plant Pathology*. 5th Edition , Elsevier Amsterdam
2. Atlas R.M. 2000. *Microbiology – Principles of Microbiology*. Mosby Year Book Inc, Missouri.
3. Black J. 2007. *Microbiology – Principles and Explorations*. 7th Edition, Prentice Hall International, Inc, New York.
4. Brock T.D. 2000. *Biology of Microorganisms*. 9th edition, Southern Illinois University, Carbondale.
5. Prescott L.M., Harley J.P. and Klein D.A. 1996. *Microbiology*. 3rd Edition, W.M.C. Brown Publishers, Chicago.
6. Salle A.J. 1997. *Fundamental Principles of Bacteriology*. 7th Edition, Tata Mc Graw Hill Publishing Company Ltd, New Delhi

Paper IV: CELL BIOLOGY GENETICS, PLANT BREEDING AND EVOLUTION

Structural Organization: Prokaryotic and Eukaryotic cell. Cell wall- Primary and Secondary structure, model and function. Plasma membrane – Channels, Pumps and

Receptors; Plasmodesmata. Cell organelles - structure and functions; Ultra structure and semi autonomous nature of Chloroplast and mitochondria.

Structure and function of Organelles- Nucleus, ER, Golgi complex, ribosome, lysosome, chromosome- Lampbrush, polytene. Microscopy – light microscope, compound microscope, Electron microscope, dark field microscope, Phase Contrast Microscope. Cell cycle and cell division.

Identification of DNA as genetic material – Watson and Crick model of DNA, RNA, si RNA & mi RNA. DNA replication – Transcription – Prokaryotic RNA Polymerase – types, Initiation, elongation, Termination-Genetic code and Protein synthesis- Post translational modifications.

Operon Concept – Mechanism of gene regulation. Lac, ara & trp regulation in prokaryotes, Gene regulation in Eukaryotes. Cytogenetics of polyploidy & aneuploids. Mutations – spontaneous and induced. Molecular basis of mutation; DNA damage and repair mechanism.

Plant breeding: Introduction and scope, Pure line selection - Mass selection pedigree method, Bulk method, Back cross method and Clonal selection and hybridization

Origin of life - theories of evolution – Lamarckism, Darwinism, Mutation theory, modern synthetic theory - types of evolution and evolution in action - Speciation – types and mechanism of speciation – adaptation, polymorphism and co-evolution

Text books

1. De Robertis, E.D.P. and Robertis, E.M.C. 2004. *Cell Biology*. B.I. Waverly Pvt., Ltd., New Delhi.
2. Freifelder, D. 2000. *Molecular Biology*. II Edn., Narosa Publishing House, New Delhi
3. Gupta, M.I. and Jangir, M.L. 2003. *Cell Biology: Fundamentals and Applications*. Agrobios, Jodpur.
4. Singh, B.D. 2001. *Principles of Plant Breeding*. Kalyani Publishers, Ludhiana

Reference Books:

1. Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K. and Watson, J.D. 1999. *Molecular Biology of the Cell* (3rd Edition). Garland Publishing, Inc., New York.
2. De, D.N. 2000. *Plant Cell Vacuoles: An Introduction*. CSIRO Publication, Collingwood, Australia.
3. Lewin, B. 2000. *Genes VII*. Oxford University Press, New York.
4. Rost, T. et al. 1998. *Plant Biology*. Wadsworth Publishing Co., California, USA.
5. Wolfe, S.L. 1993. *Molecular and Cellular Biology*. Wadsworth Publishing Co., California, USA.

Practical - I - (Paper I & II)

Paper I: Plant Diversity

1. **Phycology:** Structure, reproduction and identification characteristics of: *Oscillatoria, Spirulina, Desmid, Diatoms, Ulva, Caulerpa, Sargassum, Polysiphonia* and *Gracilaria*.
2. **Mycology:** Structure, reproduction and identification characteristics of: *Rhizopus, Mucor, Pilobolus, yeast, Aspergillus, xylaria, Penicillium, Trichoderma, Fusarium, Curvularia, Alternaria, Agaricus, Polyporus* and *Peziza*.
3. **Lichens:** Study of the thallus structure of Crustose, Foliose and Fruticose lichens.
4. **Bryology:** Structure, reproduction and identification characteristics of: *Marchantia, Porella* and *Pellia, Funaria*.
5. **Pteridology:** Structure, reproduction and identification characteristics of: *Equisetum Lygodium, Pteridium, Marsilea*
6. **Gymnosperms:** Structure, reproduction and identification characteristics of: *Cycus, Cupressus, Podocarpus, Araucaria* and *Gnetum*

Paper II: Taxonomy of Angiosperms and Economic Botany

1. **Taxonomy:** Detailed study of the families mentioned in the theory with representative species from a. local flora.
b. Identification of the families using punch-cards
2. Calculation of taxonomic distances based on numerical taxonomy
3. Chemotaxonomic identification of plants using starch grains and Raphides
Identification of stored/preserved and herbarium specimens.
4. **Economic Botany:**
Identification of family, genus, species and morphology of the economically useful parts
Note: Submission of 30 herbarium sheets

Practical - II - (Paper III & IV)

Paper III: Microbiology and Plant Pathology

Microbiology

1. Acid fast staining.
2. Gram positive staining.
3. Gram negative staining
4. Preparation of culture media
5. Serial dilution techniques
6. Isolation of microbes from soil and water
7. Root nodule studies-Isolation of Rhizobia, Frankia and Glomus

Plant Pathology

8. Isolation of plant pathogens from infected plant materials.
9. Study of diseased plant materials – Rust by Puccinia.
10. Red rust and white rust.
11. Leaf spot of groundnut.
12. Mildew and Leaf spot of Banana.

Paper IV: Cell Biology, Genetics, Plant Breeding and Evolution

Cell Biology

1. Study of mitosis and meiosis- squash and smear technique
2. Chromosomal aberrations
3. Special types of chromosomes- permanent slides

Genetics

4. Genetic problems:
 - a) Gene interaction
 - b) quantitative inheritance
 - c. multiple alleles
 - d) Sex linkage
 - e) Genetic maps

Plant Breeding

1. Vegetative propagation techniques
 - a) Cutting
 - b) Layering
 - c) Budding
 - d) Grafting

Evolution

1. Experiment to prove Hardy Weinberg equilibrium
2. Demonstration of Natural selection in species evolution

Note: Collection of plant pathology specimens – 10 sheets.

Paper V: PLANT PHYSIOLOGY AND BIOCHEMISTRY

Water and plant relations: Cell water relations. Soil, Plant, Atmosphere continuum concept. Mechanism of water uptake and transport; movement and loss of water in plants; transpiration and evapotranspiration-Stomatal physiology and mechanism of stomatal movement. Absorption of mineral salts – mechanism. Mechanism of organic solute transport: pressure flow mechanism, phloem loading and unloading.

Photosynthesis: Structure and function of chlorophylls and other pigments – mechanism of light absorption – photosystem I and II -light reaction - Z-scheme of photosynthetic electron transport chain and Photophosphorylation- Carbon assimilation: C₃, C₄ and CAM pathways- Photorespiration and its significance. Respiration: Glycolysis and TCA cycle – Oxidative Phosphorylation.

Plant growth regulators: Structure, physiological role and mode of action (in brief) of Auxins, Gibberellins, Cytokinins, Ethylene, Abscisic acid and Brassinosteroids– Phytochromes- Photoperiodism - Vernalization.

Dormancy: Seed, bud, and tuber dormancy. Seed germination – hormonal regulation of germination and dormancy- Fruiting- mechanism of fruiting – hormonal control of fruiting – climacteric rise -Stress Physiology: Classification stress –biotic and abiotic stress factors- response of plants to salt, drought, freezing, heat.

Enzymes: classification, nomenclature-mechanism of enzyme action-Michaelis constant-enzyme inhibitors- competitive and non-competitive, allosteric control of enzymes.

Carbohydrates – classification and general properties mono, di and polysaccharides- biosynthesis of carbohydrates (outline)- Lipids - Classification, structure and properties. Fatty acids- saturated and unsaturated fatty acids: biosynthesis and degradation

Proteins: primary – secondary - tertiary and quaternary structure - super secondary structures - Ramachandran plot; General reactions of amino acid metabolism. Nucleic Acids - Biosynthesis and degradation of purine and pyrimidine nucleotides and its regulation.

Text books:

1. Kumar, A. and Purohit, S.S. 2005. *Plant Physiology*. Agrobios (India), Jodhpur.
2. Mukherji, S. and Ghosh, A. K. 2005. *Plant Physiology*. First Central Edition. New Central Book Agency (P) Ltd., Kolkata.
3. Nelson.D.L, Cox. M. M. 2008. *Lehninger Principle of Biochemistry*. 5th ed. W.H. Freeman.
4. Noggle, G.R. and Fritz, G.J. 1986. *Introductory Plant Physiology*. Prentice – Hall India Pvt. Ltd., New Delhi.
5. Salisbury, F.B. and Ross, C.N. 2003. *Plant Physiology*. CBS Publishers and Distributors, New Delhi.
6. Taiz. L. and Zeiger, E. 2003. *Plant Physiology*. Third Edition. Panima Publishing corporation, New Delhi.

Reference Books:

1. Bidwell, R.G.S. 1979. *Plant physiology*, 2nd ed, McMillan Publishers, New York.
2. Goodwin, F.W. and Mercer, F.I. 1983. *Introduction to Plant Biochemistry*, 2nd ed, Pergamon Press, New York.
3. Hopkins, W.G. 1995. *Introduction to Plant Physiology*. John Wiley & Sons Inc., USA.
4. Park. S. Nobel. 2009. *Physicochemical and environmental plant physiology*. 4th ed. Academic press. U.K.
5. Voet, D. and Voet, J.G..2011. *Biochemistry*. 4th ed. John Wiley, USA.
6. Wilkins, M.B. 1984. *Advanced Plant Physiology*. Pitman Publication Limited, London.
7. Murray. R.K, Granner. D.K, Mayes. P. A, Rodwell. V. W. *Harper Biochemistry*. 27th ed. McGraw Hill, 2006.

PAPER VI: PLANT ANATOMY AND EMBRYOLOGY

Anatomy: Ultra structure of cell wall. Theories of organization of meristems- variations, phylogenetic affinity of xylem and phloem – Vascular differentiation in the primary body of stem, root and leaf- Secondary cambium- origin and classification of cambial activity- wound healing and grafting- nodal anatomy- anomalous growth types.

Anther: Structure and development. Anther wall & Tapetum: Origin, cytology and function. Pollen: Ultra structure of wall, storage and germination. Pollen-pistil interaction
Ovule: Structure and development. Female gametophyte: Ontogeny of embryo sac, nutrition and morphology of embryo sac.

Fertilization: Ultra structural studies on fertilization- sexual incompatibility- Endosperm: Types, Haustorial organization and cytology-Xenia and Metaxenia- Ruminant endosperm.

Embryo: Proembryo, primitive embryo, one example of advanced embryo in dicot and monocot, views on monocot embryo, grass embryo - agamospermy and polyembryony.

Culture methods: Prospects and significance of anther, ovary, ovule, nucellus, embryo and endosperm culture - Isolation and culture of protoplast- Fruit :Biochemical,Physical factors in fruit development-structure of pericarp and parthenocarpy.

Role of IAA in differentiation-factors influencing morphogenesis: polarity, - Plant Galls: Classification, types- Plant tumours: General features.

Text books

1. Bhojwani, S.S and Bhatnagar, S.P.1992. *The Embryology of Angiosperms*. Vikas Publishing Housing Pvt.Ltd., New Delhi.
2. Maheswari P. 1985. *An Introduction to the Embryology of Angiosperms*. Tata McGraw-Hill Publishing Company, New Delhi.
3. Varghess, T.M.1984. *An introduction to experimental and applied embryology of angiosperms*. Oxford and IBH publishing Company, New Delhi.
4. Fahn, A. 1979. *Plant Anatomy*. Pergamon Press, Oxford, New York.
5. Esau, K. 1972. *Plant Anatomy*. Wiley, New York.

Reference Books:

1. Cutler, D.F., Botha, T., Stevenson. D.Wm. 2008. *Plant Anatomy: An Applied Approach*. Wiley-Blackwell, USA.
2. Dickison, W. C. 2000. *Integrative Plant Anatomy*. Academic Press, U.K
3. Swamy, B.G.L. and Krishnamurthy, K.V. 1980. *From Flower to fruit*. Tata McGraw Hill Publishing Company, New Delhi.
4. Wardlaw, C.W. 1955. *Embryogenesis in plants*. Methuen and Company Ltd., London.

PAPER VII: PLANT ECOLOGY, PHYTOGEOGRAPHY AND BIODIVERSITY CONSERVATION

Ecosystem: Ecosystem concept and scope – Abiotic and biotic components, Concept of food chain and food web – community organization – Concept of habitat, functional role and concept of niche – ecotone – edge effect – ecological succession- seral communities- climax vegetation

Population biology: Basic concepts, survivorship curves, life table, self regulating mechanisms. Species interaction - inter-specific competition, competition coexistence, Negative interaction: predation, herbivory, parasitism - Positive interaction - commensalisms and mutualism.

Phytogeographical regions of the world, island biogeography theory, continental drift, continuous and discontinuous distribution, endemic distribution - floristic regions World. Forest geography - factors influencing the distribution of forest – productivity and nutrient cycling, forests and environment.

Biodiversity - definition - patterns of diversity: Genetic diversity, Species diversity, Ecosystem diversity, Guild diversity - Ecosystem stability; equilibrium and non equilibrium - succession - patterns of specie richness during succession – biotic interaction and succession. Species richness gradients - abiotic and biotic theories, Global species richness, rarity and abundance, Biodiversity hot spots - indicator species - keystone species.

IUCN categories of extinction - red data book - Causes for species extinction – Conservation: *In situ* Conservation - Biosphere reserve - National Parks - Wild life sanctuaries; *Ex situ* conservation - cryopreservation - Germplasm conservation, gene bank, seed bank, pollen bank, tissue culture, community gene bank; *In situ* On farm conservation - Community gardens, home gardens; Ecotourism.

Text books

1. Krishnamurthy, K. V.2003. *Text Book of Biodiversity*. Science Publishers Inc., USA.
2. Kumar, H.D. 1999. *Biodiversity and sustainable conservation*. Oxford and IBH publishing company, New Delhi.
3. Mackenzie, N., Ball, A.S. and Virdee, S. R. 1999. *Instant notes in Ecology*. Viva Books Pvt. Ltd. New Delhi.
4. Meffe, G.K. and Carrol, R.C. 1994. *Principles of Conservation Biology*. Sinauer Associates, Inc., Publishers, Saunders.
5. Melchias,G.2001. *Biodiversity and Conservation*. Oxford and IBH publishing company Pvt, Ltd, New Delhi.
6. Odum, E.P. 1996. *Fundamentals of Ecology*. Nataraj Publishers. Dehradun.
7. Sagreta, K.P. 2000. *Forests and Forestry*. National Book Trust India, New Delhi

Reference Books

1. Burton, L.D. 2000. *Introduction to Forestry Science*. Delmer Publishers, London.
2. Gurevitch, J. Scheiner,S.M. and Fox,G.A. 2002. *The Ecology of Plants*. Sinauer associates,inc., Publishers. Massachusetts.
3. Puri,G.S. Mehar-Homji,V.M., Gupta, R.K. and Puri,S. 1960. *Forest ecology*. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
4. Ravindranath, N.H. Murali, K.S. and Malhotra, K.C. 2000. *Joint Forest Management and community forestry in India*. Oxford & IBH Publishing Pvt. Ltd. New Delhi.
5. Sagreta, K.P. 2000. *Forests and Forestry*. National Book Trust India, New Delhi.
6. Stiling, P. 2002 *Ecology: theory and applications*.Prentice Hall of India, New Delhi.

PAPER VIII: PLANT BIOTECHNOLOGY

Plant cell-totipotency, culture of plant cells- tissue and organs; scope, historical review. Aseptic techniques; Culture media: preparation and composition. Methods of sterilization; methods to overcome phenolic oxidation; inoculation, incubation and hardening.

Cell and organ differentiation; Clonal propagation or micropropagation (artificial seeds, virus free plants); Somaclonal variation; Overcoming crossing barriers (Pre fertilization and post fertilization barriers including in-vitro pollination/fertilization and embryo rescue); Other uses of tissue culture (endosperm, nucellus culture, anther culture, ovule culture and bulbosum technique, germplasm storage including cryopreservation).

Isolation of protoplasts; Purification of protoplasts; Visibility and plating density of protoplasts; Protoplast culture and regeneration of plants; Protoplast fusion and somatic hybridization (techniques of fusion, selection of fused protoplasts, chromosome status of fused protoplasts, uses of somatic hybrids); Cytoplasmic hybrids or Cybrids; Genetic modification of protoplasts.

Target cell for crop improvement; vectors for gene transfer (based on Ti and Ri plasmids; co integrate, intermediate and helper plasmids; binary vectors; viruses as vectors); gene transfer techniques using *Agrobacterium*; selectable and scorable markers (genes); Agroinfection and gene transfer; Physical delivery methods.

Transgenic plants for crop improvement (dicots and monocots including maize, rice, wheat, oats, etc.; resistance to herbicide, insecticide, virus and other diseases; transgenic plants for molecular farming; transgenic plants to regulated gene expression, Chloroplast and Mitochondrion engineering.

Text Books:

- 1.Gupta,P.K. 1999. *Elements of Biotechnology*. Rastogi Publications,Meerut.
- 2.Ignacimuthu, S.J. 1997. *Plant Biotechnology*. Oxford and IBH Publishing Company,New Delhi.
- 3.Kumar H.D. 2001. *A textbook on Biotechnology*. East-west Press, New Delhi.
- 4.Dubey, R.C.2002. *A textbook of Biotechnology*. S. Chand and Company, New Delhi.

Reference Books

1. Bhojwani, S.S. and Razdan, M.K. 1996. *Plant Tissue Culture: Theory and Practice*. Elsevier Science Publishers, New York, USA.
2. Bojwani, S.S. 1990. *Plant Tissue Culture: Applications and Limitations*. Elsevier Science Publisher, New York, USA.
3. Khasim, S.M. 2002. *Botanical Microtechnique: Principles and Practice*. Capital Publishing Company, New Delhi.
4. Vasil, I.K. and Thorpe, T.A. 1994. *Plant Cell and Tissue Culture*. Kluwer Academic Press, The Netherlands.
5. Razdan, M.K. 1994. *An Introduction to Plant Tissue Culture*. Oxford & IBH Publishing Company Private Limited, New Delhi.
- 6.. Chawla, H.S. 2003. *Introduction to Plant Biotechnology*. Oxford & IBH, New Delhi

Practical III (Paper V and VI)

Paper V: Plant Physiology and Biochemistry

Plant Physiology

1. Water potential by gravimetric method.
2. Water potential by falling drop method.
3. Osmotic potential by plasmolytic method.
4. Quantitative estimation of total chlorophyll content in leaves.
5. Quantitative estimation of carotenoid content in flowers.
6. Absorption spectrum of chlorophylls
7. Absorption spectrum of β - carotene.
8. Estimation of proline content in normal and senescent leaves.
9. Measurement of Stomatal Index.
10. Effect of light on photosynthesis

Biochemistry

1. Preparation of buffer solution
2. Quantitative estimation of carbohydrates
3. Qualitative test for amino acids
4. Separation plant pigments – paper chromatography
5. Estimation of protein – calorimetric method
6. Quantification of enzyme activity- Nitrate reductase

Paper VI: Plant Anatomy and Embryology

Plant Anatomy

1. Dissection of apical meristem
2. Maceration techniques
3. Peeling techniques
4. Micro-preparation of monocot stem& root, dicot stem& root
5. Anamalous secondary growth
 - a) *Aristolochia*
 - b) *Bougainvillaea*
 - c) *Boerhavia*
6. Different types of pits
7. Different types of nodes

Embryology

1. Micro-preparation (by using locally available specimens):
 - a) anther
 - b) embryo
 - c) endosperm
 - d) polyembryony
 - e) endosperm haustoria

2. Dissection of embryo

a) *Tridax* b) *Crotalaria* c) *Cleome*

Practical IV (Paper VII and VIII)

Practical IV (Paper VII & VIII)

Paper VII: Plant Ecology, Phytogeography and Biodiversity conservation

Plant Ecology

1. Vegetation analysis in different communities
 - a) Quadrat method
 - b) Transect method
2. Calculation of density, frequency, basal area and Importance value Indices
3. Diversity and dominance indices
4. Identification of plants adapted to various habitats: hydrophytes, xerophytes and succulents
5. Diagnostic features of forest types
6. Analyses of soil physico-chemical characteristics
 - a) particle size classification b) bulk density c) pH d) organic matter
 - e) available nitrogen f) available phosphorus g) Potassium

Plant Biotechnology

1. General introduction and laboratory organization
2. Tissue culture media (composition and preparation).
3. Role of plant hormones in tissue culture.
4. Surface sterilization of explants for culture initiation
5. Initiation and maintenance of callus and suspension culture
6. Micro-propagation techniques
7. Isolation of genomic DNA

Question paper pattern

Maximum marks: 100

Time: 3 hours

Part A (10×2=20)

10 Questions (Answers need to be given for all questions; Two questions from each unit)

Part B (7×5=35)

(Total questions 10, out of which any seven questions need to be answered)

Part C (3×15=45)

(Total questions 5, out of which any three questions need to be answered)