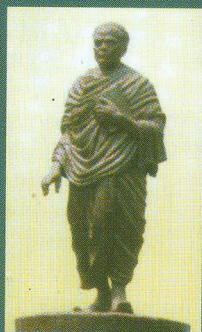


DIRECTORATE OF DISTANCE EDUCATION



SYLLABUS M.Sc. Course in Botany



VIDYASAGAR UNIVERSITY
MIDNAPORE - 721102

VIDYASAGAR UNIVERSITY

DIRECTORARE OF DISTANCE EDUCATION

MIDNAPORE



PART - I

Theoretical Course

Three papers of 100 marks each and each paper having two halves)

SYLLABUS

M. Sc. Course

in

BOTANY

Syllabus
M. Sc. Course
in
BOTANY

MARKS DISTRIBUTION

	Total Marks	Theoretical Course	Practical Course
Part-I	500	300	200
Part-II	500	300	200
Total	1000	600	400

PART -I

Theoretical Course

**(Three Papers of 100 marks each and each paper
having two halves)**

Full Marks

Paper-I : 1st Half Microbiology 50

Paper-II: 2nd Half Phycology, Mycology, Bryology, Pteridology,

Gymnosperms and Palaeobotany 50

Phycology 10

Mycology 10

Bryology 10

Pteridology 10

Gymnosperms and

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	Palaeobotany	10
Paper-II : 1st Half	Taxonomy of Angiosperms	50
Paper-II : 2nd Half	Bioinformatics and Computer Application	50
Paper-III : 1st Half	Silviculture, Silviculture System and Nonwood Forest Produce (NWFP)	50
	Silviculture	20
	Silviculture System	20
	NWFP	10
Paper-III : 2nd Half	Forest Surveying, Forest Mensuration and Forest Management	50

Practical Course

(Three papers, of which papers IV and V

Carry 80 marks each,
and

Paper VI carries 40 marks; each paper contains two halves)

Full Marks

Paper-IV : 1st Half	Microbiology (20), Phycology (10) and Mycology (10)	40
Paper-IV : 2nd Half	Bryology (10), Pteridology (10) and Gymnosperms & Palaeobotany (20)	40
Paper-V : 1st Half	Taxonomy of Angiosperms	40
Paper-V : 2nd Half	Forestry	40
Paper-VI : 1st Half	Computer Applications	25
Paper-VI : 2nd Half	Seminar Talk	15

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PART -II

Theoretical Course

(Four papers of which papers VII & VIII carry 60 marks each, paper IX carries 80 marks having 1st half for 50 marks and 2nd half for 30 marks: paper X carries 100 marks for Special paper)

Full Marks

Paper-VII	Plant Physiology and Biochemistry	60
Paper-VIII	Cytogenetics, Molecular Biology and Biotechnology	60
Paper-IX : 1st Half	Plant Ecology and Ecological Anatomy	50
Paper - IX : 2nd Half	Forest Pathology and Mycorrhizae	30
Paper-X: Special Paper		100

Practical Course

(Three general papers and one special paper)

Full Marks

Paper-XI :	Plant Physiology & Biochemistry	40
Paper - XII :	Cytogenetics and Molecular Biology	35
Paper - XIII :	Plant Ecology and Ecological Anatomy	25
Paper-XIV :	Special Paper	100

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PART-1 Courses

THEORETICAL

PAPER-1 (First Half)

MICROBIOLOGY

Full Marks - 50

1. History; discoveries and contributions; differences between prokaryotes and eukaryotes; five kingdom concept; classification of microbes; scopes and areas of microbiology (3)
2. Nutrition of Microbes; principles behind formulation of media; enrichment culture technique; anaerobic culture principles (3).
3. Principle characteristics used in the classification and identification of microbes; Bergey's manual of determinative bacteriology. (5)
4. Methods of sterilization; dry and moist heat; UV and X-ray; Food sterilization; (3)
5. Growth curve; mathematical nature and expression of growth; exponential and arithmetic growth; generation time; growth curve parameters-yield; exponential growth rate and duration of log phase; effect of nutritional concentration on growth; synchronous & continuous growth. (4)
6. Bacteria Morphology; fine structure & chemical nature of capsule; cell wall, flagella, pili, genome, cytoplasmic membrane (PLP and fluid mosaic model) and cytoskeletal elements of bacterial cell; idea of the principle of gram staining, reserve substances; endospore. (6)
7. Microbial metabolism; respiration and fermentation, fermentation pathway (ED pathway etc.); Nitrification; sulfur oxidation; nitrogen fixation. (4)

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8. Organization and replication of genetic material in bacteria, plasmids; genetic recombination-conjugation transformation, and transduction & gene-mapping. (5)
9. Chemical basis of mutation; induced mutation; types of mutation and isolation of mutants; spontaneous nature of mutation. (3)
10. Genetic Engineering, vectors, restriction endonucleases, host restriction modification, gene cloning, applications of Genetic Engineering in agriculture, health, industry and environmental stability; transposons. (6)
11. Viruses; structural organization and chemistry of viruses; viral replication (TMV) and bacteriophage; assay of viruses; classification; cultivation; viruses as disease producing agents; oncogenesis; antiviral drugs; lytic and lysogenic cycle. HIV and its importance. (5)
12. Applied microbiology; production of alcohol, wine, beer, Penicillin, SUFU. (4)
13. Chemotherapy; fundamentals, chemistry, mechanism of action and therapeutic uses of penicillin, tetracycline, griseofulvin, sulfonamides, non-medical use of antibiotics, bioassay of antibiotics. (3)
14. Microscopy; gel-electrophoresis; spectrophotometry; Isolation of nucleic acids, radioactive labelling. (4)
15. Immunology; general idea of immunity; types of immunity; properties of antigen and antibodies; nature of immunological reaction; diagnostic application; monoclonal antibody, ELISA; Vaccines and their production. (7)
16. Chemistry of Protein, carbohydrate and fat; Enzyme properties; endotoxin and exotoxin. (6)

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PAPER-I (Second half)

PHYCOLOGY

Marks - 10

1. Classification of algae : a survey of classifications by different authors; criteria of classification; modern trends in classification; molecular biology as an aid to classification.
2. Salient features of different classes of algae and their phylogeny.
3. Economic importance of algae: industrial use; phycocolloids; soil reclamation; single cell protein, use in space research and in fisheries.
4. Life cycle pattern in different classes of algae. Evolutionary trends in Chlorophyceae.

MYCOLOGY

Marks - 10

1. Recent classification of fungi.
2. Sexuality in fungi - homothallism, heterothallism, parasexuality, heterokaryosis.
3. Physiology of fungi with reference to biotrophs, hemibiotrophs, symionts and nectrotrophs.
4. General characters of the subdivisions Myxomycotina, Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina.
5. General accounts of role of fungi in industries.

BRYOLOGY

Marks - 10

1. Outline classification of Bryophytes based on different criteria and with reference to representative members of major taxa.

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2. Origin and evolution of Bryophytes; primitive and advanced features of Bryophytes; differences and similarities with other divisions of plant kingdom; fossil Bryophytes.
3. General characters of phylogenetic considerations, Sphaerocarpaceae, Calobryales, Takakiales, Sphagnales and Bryales.
4. Experimental studies in Bryophytes : spore germination, bud formation, parthenogenesis, apospory and apogamy.
5. Distribution and economic importance of Bryophytes.
6. Bryophyte ecology, monitoring of environmental pollution by Bryophytes, xerophilous Bryophytes.

GYMNOSPERMS

Marks - 10

1. Recent trends in the classification of Gymnosperms.
2. Relationship of Gymnosperms with Pteridophytes, prgymnosperms and angiosperms.
3. Characteristic features and phylogenetic considerations of Cyadofilicales, Cycadales, Ginkgoales, Coniferales, Taxales and Gnetales.
4. Economic importance of Gymnosperms with special reference to medicinal values.

PALAEOBOTANY

1. Principles of stratigraphy and correlation, dating of sedimentary rocks.
2. Origin and early evolution of life; a general account of plant life through Indian Gondwana
3. Preservation of plants; plants as fossil and their methods of study.

4. Outline idea of continental drift.

5. Palaeoecology.

PTERIDOLOGY

Marks - 10

1. Importance of Pteridophytes as first land plants.
2. Classification of Pteridophytes by different authors including latest concept.
3. Salient features of different classes and orders of Pteridophytes and their phylogenetic significance.
4. Apogamy and apospory in ferns.
5. Telome theory and its significance; stelar, soral and prothallial evolution in Pteridophytes.
6. Evolutionary trends in ferns.

PAPER-II (First Half)

TAXONOMY OF ANGIOSPERMS

Full Marks - 50

1. **Introduction** : Definition of terms : systematics, taxonomy, classification, nomenclature, identification; history of development of taxonomy; phases of taxonomic studies; aims of taxonomy; procedures of taxonomy.
2. **Data sources** : Seedling morphology and leaf architecture; Anatomy, Embryology Phytochemistry, Cytology.
3. **Data analysis** : Numerical taxonomy, basis of kinds of similarities and relationships - phenetic, phyletic and cladistic.
4. **Biosystematics** : Definition, variation - phenotypic plasticity, principles, procedures, categories, relation with taxonomy.

5. **Classification** : History and current systems of classification: Takhtajan, Cronquist, Dahlgren & Thorne.
6. **Taxonomic structure** : Hierarchy, minor and major categories.
7. **ICBN** : History, principles, general rules and recommendations.
8. **Origin of Angiosperm** : Theories and evidences.
9. **Botanic gardens and Herbaria** : Importance in taxonomic studies; examples from India and abroad.
10. **Systematics studies** : General survey of angiosperms *sensu* Cronquist (1981) with reference to their characters, interrelationships and evolutionary trends : Magnoliales, Caryophyllales, Rosales, Asterales, Alismatales, Liliales and Cyperales.

PAPER-II (Second half)

BIO-INFORMATICS AND COMPUTER APPLICATIONS

Information Technology : Data, information, information processing cycle. Files, databases. Usage of IT in modern society.

Computer system : Block diagram and definition of CPU, memory, input, output devices and their functionality. Primary and secondary storage, ROM, CDROM. soft wares-system software and applications software. Operating system: Definition, Classification, Windows 98-desktop, taskbar, my computer recycle bin, clipboard, accessories, windows explorer, files, folder, drives.

Programming in C : Constant, variables, data types, operators and expressions, decision making and branching, arrays, characters, function, structures and unions, pointers and files in C.

Word Processing : MS word-Page set-up, fonts; paragraphs, columns,

tables, editing text, images and pictures and drawing placement in a text, mail merge, printing.

Spreadsheet Management : MS-Excell-Work book creation, entering formulae, Formatting cells, library function, charts, printing.

Biostatistics : Central tendency, measures of dispersion, measures of skew-ness and kurtosis, probability and probability distribution (Binomial, Poisson and Normal), correlation and regression, chi-square test and test of significance-their applications in Bio-informatics.

Database management : Construction of database(s) using FoxPro. (no programming)

Web-based information : Networking, Internet, WWW, information resources in the Net and their access, searching of biotechnological information through net, databases for biotechnological application.

PAPER-III (First half)

SILVICULTURE, SILVICULTURE SYSTEM AND NON-WOOD FOREST-PRODUCE

Full Marks - 50

SILVICULTURE

F.M.20

Introduction : Forest definition, Forestry as land use practice. Silviculture : Definition, scope and objective classification of forests, Farm forestry, Social forestry and Agroforestry, Factors of locality.

Climate : Light, Temperature, Classification of forest on the basis of temperature. Frost and snow sources of Moisture, characteristics of India's rainfall and its influence on forest vegetation. Bioclimate and Microclimate.

Topographic : Effect of Altitude, Aspect and Exposure on forest

vegetation.

Edaphic : Forest soil formation, Parental rock influencing the forest types. Soil profile. Special features of soil profile: Accumulation of Salts and Pan formation. Water table and available water to trees.

Biotic : Influence of plants, insects, wild animals, man and his animals.

Fire : Natural and Manmade, types, advantages and disadvantages. control.

Regeneration : Natural regeneration, seed production, seed years, germinative capacity and plant percent, seedling establishment period. Dying back of Sal seedlings. Artificial regeneration : Reforestation, afforestation, objective. Application of Silviculture in afforestation of difficult sites: Denuded hill slopes, Revine lands, shifting sands (shelter belts), saline alkaline soil.

SILVICULTURE SYSTEM

F.M. 20

Introduction : Definition, Scope, Objective.

Classification of Silviculture system:

Clear felling system : Definition. felling of mature crops, clear strip and alternate strip system. Artificial regeneration by Taungya and/or departmental plantation.

Uniform system : General shelter wood system, kinds and pattern of felling: Seedling felling and final felling. The Indian irregular shelter wood system.

The Group system : Definition, pattern of felling, character of crop produced.

The selection system : Definition, pattern of felling and character of crop.

The Coppice system : Simple coppice, coppice with sandard and coppice with Reserve system.

Conversion and Choice of Silviculture system.

NON-WOOD FOREST PRODUCE (NWFP) F.M. 10

Fibre and Flosses, Grass, Oil, Oil Seeds, Grasses bamboos and Canes, Dyas, Gum, Resins and Oleo resins. Animal, mineral and Miscellaneous Products. Drugs, spices, edible products and poisons.

PAPER-III (Second half)

FOREST SURVEYING, FOREST MENSURATION

Full Marks - 50

FOREST SURVEYING :

Introduction, surveying definition, object and scope. Primary and secondary classification of surveying. Two great principles of executing surveying.

Scales: Classification characteristics of good graphical scale, Diagonal scale.

Linear measurement : Methods, Chain survey.

Angular measurement: Measurements of angles and bearings.

Prismatic compass, W.C.B. Quadrantal Bearing, Back and Fore bearing.

Plane table survey: Limitations, advantages and disadvantages.

FOREST MENSURATION :

Introduction : Mensuration definition, object and scope.

Diameter of girth : Measurement of diameter and girth, Breast height, Dia and girth classes

Height of tree: Geometric principles of similar triangle and trigonometric

principles used for height measurement, instruments of height measurement.

Form factor : Quotient.

Volume : Measurement of volume of felled tree and standing tree. Volume table.

Age of tree : Determination of age of the trees.

Crop measurement : Determination of diameter and height of a crop, top height.

Concept of Forest inventory, stand table and remote sensing.

FOREST MANAGEMENT

Introduction : Definition, Object and Scope.

Legal classification of Forests. Reserve Forests, Protected forests and unclassed Forests. Territorial classification of forest. Block, compartment and sub-compartment.

Management classification : Working circle, Felling series, cutting sections, coupes and periodic blocks.

Felling series in Uniform system (P B.), Felling cycle in selection forests. Sustained yield and Progressive yield.

Roation (Production period) : Types, objective and applications.

Normal Forest : Basic factors of normality and kinds of abnormality. Normality in irregular/uneven aged forests.

Increment : Current annual increment (C.A.I) and Mean Annual increment (M.A.I).

Growth stock : Normal growing stock (N.G.S.), N.G.S. in clear felling system (a) based on MAI and (b) yield table.

Yield regulation : In clear felling system (a) Annual Coupes by gross area, (b) Annual coupes by Reduced area method. Yield regulation in regular shelter wood system

PRACTICAL

PAPER-IV (First half)

MICROBIOLOGY & MYCOLOGY

Full Marks - 30

Microbiology : 20

Mycology: 10

1. Methods of sterilization, idea about microbiological instruments and laboratory.
2. Negative staining technique.
3. Gram staining.
4. Study of curd-organisms and spore staining.
5. Flagella staining.
6. Isolation of spore producers from bacteria, PDA for fungi & media for algae.
7. Sterilization of media glass goods.
8. Inoculation techniques.
9. Study of morphological characters and reproductive structures of some genera (*Clavaria*, *Puccinia*, *Peziza*, *Erisphyae*, *Alternaria*, *Fusarium*, *Cercospora*, *Saprolegnia*, *Albugo*, *Perenospora*).
10. Use of some fungicides to study their effect on fungal spores.
11. Isolation of yeasts from some fruits.
12. Bioassay of antibiotics.
13. Isolation of bacteria from mixed culture.
14. Use of some fungicides to study their effect on fungal spores.
15. Local tour for collection of Fungi.

PHYCOLOGY

Marks - 10

Work out and identification of different algal genera from different groups with reference to their systematic positions and structures.

PAPER-IV (Second half)

BRYOLOGY

Marks-10

1. Collection and preservation of Bryophytes.
 2. Study of morphology and anatomy of the gametophytes and sporophytes of members from different groups of Bryophytes; Identification upto generic level.
 3. Study of rhizoids, gemma cup, peristome teeth of Arthrodonia and Nematodonia.
- Students are required to submit field and laboratory records preserved and/or dried specimens.

GYMNOSPERMS AND PALAEOBOTANY

Marks - 20

1. Identification with reasons of different vegetative and reproductive parts of living and fossil members of gymnosperms. Permanent slides of different fossil plant parts of gymnosperms and pteridophytes.

PTERIDOLOGY

Marks - 10

1. Work out of stelar structures of stem and/or rhizome of different genera and their evolutionary comments.

2. Work out reproductive structures in different genera and evolutionary comments.

PAPER-V (First half)

TAXONOMY OF ANGIOSPERMS

Full Marks - 40

1. Work out of plant specimens for vegetative and reproductive morphology of selected groups.
2. Exercise on identification of unknown plants of keys and matching.
3. Field study (excursions) for familiarity and study of floras and vegetation of India including the preparation of morphological notes.
4. Submission of field and laboratory records including herbarium specimens.

PAPER - V (Second half)

FORESTRY

Full Marks - 40

1. Study of Scales: Preparation of diagonal scales.
2. Study of equipments : Chian, Pegs, Ranging rods, Arrows, U Forks, Aledade, Spirit level and trough compass.
3. Changing of survey line - linear measurement.
4. Study of Prismatic compass - measurements of bearings.
5. Measurement of hight of the trees by Abney's level.
6. Measurement of girth and diameter of a tree.
7. Study of defects in timber.
8. Surveying by plane table method.

Besides lab. practical s there will be academic excursions to study

the vegetational changes and management of Protected Areas, Soil Conservation Practices and Forestry Institutes.

Paper - VI (First half)

COMPUTER APPLICATIONS

Full marks - 25

Basic operation of computer - DOS, WINDOWS; Data entry, Printing of programmes, results, Programming with BASIC (or FORTRAN) for solving biological problems:

- a. Characterization of plants.
- b. Numerical taxonomy.
- c. Species/Genera mapping in a area.
- d. Study of different physiological parameters, e.g., growth rate of plants, transpiration rate, stomatal index, osmotic pressure.
- e. Arrangement of biological data-ascending order, descending order, highest value, lowest value.
- f. Statistical analysis of biological data-Mean, SD, SE, t-test, correlation coefficient, percentile values etc.

Computer graphics - graph plotting, bar diagram, pie diagram for representing biological data.

Construction of biological data base by dBase/FoxPro.

PAPER - VI (Second half)

SEMINAR TALK

Full Marks - 15

Students are required to submit a write-up on a selected topic usually related to curriculum and to deliver a talk on that topic.

**PART - II COURSE
THEORETICAL**

PAPER - VII

PLANT PHYSIOLOGY & BIOCHEMISTRY

Full Marks - 60

Plant Physiology

1. **Bioenergetic principles:** Concept of free energy, exergonic and endergonic reactions, biological redox systems, oxidative phosphorylation, energy currency in plant system.
2. **Photosynthesis:** Flourescence, phosphorescence, chemiluminescence, photochemical reactions, photophosphorylation, path of carbon in photosynthesis, regeneration of RuBP in dark reaction, regulation of photosynthesis, photosynthetic inhibitors and promoters.
3. **Photorespiration :** Compartmentalization of photorespiratory reactions in subcellular particles, experimental evidences of the occurrence of photorespiration, special characters of photorespiring plants, crassulacean acid metabolism.
4. **Plant growth substances :** Definition and present concept of phytohormones and plant growth regulators (PGRs), members of phytohormone family, growth promoting and retarding chemicals; a general account of auxins, gibberellins, cytokinins, ethylene and abscisic acid with reference to their chemistry physiological roles and bioassay.

5. **Nitrogen fixation :** Symbiotic and nonsymbiotic nitrogen fixing agents, nodulation process, biochemistry of nitrogen fixation.
6. **Flowering and photoperiodism :** Definitions, hormonal concept of flowering, experimental evidence to prove the mobile nature of flowering stimulus, classification of plants on the basis of photoperiodic responses, role of phytohormones in flowering.
7. **Germination and dormancy :** Definitions, important events of seed germination process, types of seed dormancy, mechanism of dormancy, physical and chemical methods of breaking seed dormancy.

Plant Biochemistry

1. **Elementary principles of chemistry :** Chemical bonds, reaction orders, laws of mass action, pH, buffer, entropy.
2. **Carbohydrates:** Classification, chemical constituents, structures of monosaccharides, oligosaccharides and polysaccharides.
3. **Amino acids :** Protein and nonprotein amino acids, classification and structures of protein amino acids. essential amino acids.
4. **Proteins :** Classification, primary and higher order structures of protein, formation of peptide bonds, properties and purification of proteins.
5. **Fats and fatty acids :** Definitions of fats. lipids, oils, saponification number, saturated and unsaturated fatty acids; classification of lipids, β -oxidation.

6. **Enzymes:** Classification, definitions of isozymes, allosteric enzymes, feedback inhibition, competitive and non-competitive inhibition of enzymes, mechanisms of enzyme action, enzyme kinetics.

7. **Instrumentation :** Colorimetry, Spectrophotometry, Centrifuges (ordinary and ultra), Thin layer chromatography (TLC), Gas liquid. chromatography, Electrophoresis and other instruments.

PAPER-VIII

CYTOGENETICS, MOLECULAR BIOLOGY AND BIOTECHNOLOGY

Full Marks - 60

Cell organelles (mitochondrion, chloroplast, ribosome, lysosome and others) - structures and functions.

Nucleus - ultrastructures.

Cell cycle, mechanics of cell division; microtubules and cytoskeleton. Eukaryotic chromosome - different parts (telomere, centromere, NOR), organisation, euchromatin, heterochromatin, nucleosome, synaptonemal complex.

Chromosome banding; polytene chromosome, lampbrush chromosome and B chromosomes.

DNA- chemistry, types and topology, RNA-types and structures. Mendelism - a review, gene interaction and deviation of Mendelism. Linkage and crossing over - a review; chromosome mapping. Multiple allelism - definition and example.

Genetics of metric characters (definition with examples and their characteristic features only; oligogene and polygene).

Extranuclear inheritance - types, explained with examples.

Sex determination and sex linked inheritance, dosage compensation. Transposable elements - IS, Ty, P and Copia, Ac-Ds, spm-dspm, a brief account of their individual structure and properties.

Fine structure of gene, coding and non-coding sequence.

DNA replication (outline of procedure).

General organization of transcriptional units; mechanism of transcription (prokaryotes and eukaryotes), RNA processing (basic process only), protein synthesis.

Regulation of gene expression in prokaryotes and eukaryotes (basic steps only).

Population genetics; Hardy Weinberg genetic equilibrium, factors affecting allele frequency in population (mutation, migration, natural selection, genetic drift, inbreeding, non-random mating).

Genetic polymorphism and selection. The law of DNA constancy and c-value paradox.

Restriction enzymes; RFLP, RAPD, DNA fingerprinting, chromosome walking, chromosome jumping: Cloning. Vector - its characteristics, a few examples; PCR; Gene targeting.

Plant breeding - objectives, breeding methods for auto - and allogamous species, composites, synthetics, heterosis, self-incompatibility and male sterility.

Principles and methods of genetic engineering. Vector mediated DNA transfer methods - particle gun, electroporation, microinjection, macro-injection, liposome mediated transfer, Blotting techniques procedures and uses; DNA sequencing (Maxam and Gilbert's method only). its utility.

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- Bioreactor (basic concepts only).
- Plant tissue culture - a brief history, basic requisites, laboratory procedure, media, different compositions, role of different compositions, role of different constituents.
- Definitions, outline procedures and objectives of callus culture, organogenesis, micropropagation, embryo culture, haploid culture, somatic embryogenesis, protoplast isolation, culture and somatic hybridization (for short questions only). Prospects of tissue culture in forestry.
- Transgenic plant - prospects and achievements (an outline approach; only mentioning the fields with one or two examples of each of them).

PAPER - IX (First half)

PLANT ECOLOGY AND ECOLOGICAL ANATOMY

Full Marks - 50

Plant Ecology

1. Significance and scope of Ecology, current concepts in Ecology.
2. Structure and functions of ecosystem - primary production, energy flow, ecological pyramids, ecological efficiency, food chain, food web, biogeochemical cycles, development of ecosystems.
3. Plant succession - types and climax concept.
4. Plant Adaptation.
5. Population ecology, carrying capacity, population regulation, r-strategy and K-strategy.
6. Coastal vegetation with special reference to Sunderbans (India) and aquatic vegetation - their importance.
7. Indian forest types; deforestation - causes, status of Indian forests.

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8. Environmental pollution -air, water and soil, effects of environmental pollutants on ecosystems.
9. Acid rain, ozone depletion, green house effect and climate change.
10. Environmental problems in India and World.
11. Environmental debates - Eucalyptus and Dams.
12. Shifting cultivation.
13. Biodiversity and wildlife conservation.
14. Properties and classification of soils, soil conservation and watershed management.

Ecological Anatomy

Ecological anatomy of root, stem and leaves with reference to environmental adaptation and functions.

PAPER - IX (Second half)

FOREST PATHOLOGY AND MYCORRHIZAE

Full Marks - 30

Forest Pathology

Introduction: Disease and symptoms; Infectious and non-infectious diseases, Koch's rule.

Disease development in plants: Inoculation. penetration, infection, role of enzymes and toxins in pathogenesis.

Defence Mechanism: Pre-existing, and induced structural and biochemical defence.

Control of forest diseases : General principles, quarantine, integrated control in perennial crops.

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Decays in Timber : Types, factors of decay, decay resistance, decay in storage, preservative treatment to control decay.

Etiology and control of the following tree diseases :

- Sal : Root rot
Teak : Bacterial wilt, root rot diseases and decay in coppies
Sissoo : Wilt, root rot and physiological diseases.
Khair : Root rot diseases
Sandal wood : Spike diseases
Casuarina : Stern wilt, physiological diseases.
Eucaoyptus : Pink diseases and gummosis.

Mycorrhizae

Definition, occurrence, types, function, role of VAM in agriculture and forestry.

Ectomycorrhiza : Structure and characterization. Introduction of Ectomycorrhiza and VAM in forest nurseries. Mycorrhiza and disease control.

PAPER - X (Special Paper)

ENVIRONMENTAL BOTANY

Full Marks -100

GROUP-A

Environment, plant and soil (20 marks)

Environmental stresses and plant growth, development, flowering and seed viability, mechanism of overcoming environmental stresses, stress and agriculture, physicochemical properties of soil.

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GROUP - B

Enironmental Microbiology (20 marks)

Microbiology of air, water and soil, microbes and recycling of nutrients, nutrient overload, biofertilizer, microbes and waste management, microbial leaching and bioremediation, microbes and environmental disease, antibiotic and pesticide resistance, use of bio-pesticides and application of cloning technology.

GROUP -C

Environment and Forest (20 marks)

Deforestation and desertification, causes of deforestation, status of forests in India, forest conservation and management, forest and wild life, habitat management, conflicts in wild life management: artifical plantation, plantation in problematic (wasteland) lands, deserts, water-logged and mined out areas; the application by mycorrhiza in reclamation of waste land.

GROUP - D

Environment and Ecology (40 marks)

Significance and scope of Ecology, current concepts of Ecology: structure and functions of forest, grassland, aquatic and mangrove ecosystem: energy flow and biogeographical cycles: air water and soil borne environmental hazards (biological, chemical and physical), corrosive, metabolic, mutagenic, terratogenic and nautrotoxic poisons; biomonitoring the state

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of environment with microbes and plants; climatic change, ozone depletion, biodiversity loss, acid rain, green house effect, nuclear issues and wars, 'population and poverty, urbanization, changing environment and changing human health: environment and development a few case studies; environmental disasters (forest fire, floods, cyclones, drought, Elnino, industrial accidents; environmental diary (Ramsar convention, Stockholm congress, Montreal protocol, Basel convention, Earth summit, Kyoto treaty), biodiversity - definition types, significance and conservation strategies.

PRACTICAL COURSES

PAPER-XI

PLANT PHYSIOLOGY & BIOCHEMISTRY

Full Marks-40

1. Determination of percentage seed viability of TTC test.
2. Effect of respiratory promoters/inhibitors on the rate of aerobic respiration.
3. Effect of photosynthetic promoters/inhibitors on the rate of photosynthesis.
4. Determination of isotonic concentration and osmotic pressure of cell sap.
5. Isolation of chloroplasts and demonstration of Hill reaction.
6. Determination of isoelectric points of protein.
7. Extraction and comparative study of chlorophyll levels in leaves of different chronological ages.
8. Preparation of a standard curve for proteins and determination of protein levels in unknown samples using Folin-phenol reagent.

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9. Preparation of a standard curve for amino acid and determination of amino acid levels in unknown samples using ninhydrin reagent.
10. Preparation of a standard curve for carbohydrates and determination of carbohydrate levels in unknown samples using anthrone reagent. Preparation of a standard curve for IAA and determination of IAA levels in unknown samples using Salkowsky reagent.
12. Comparative study on the activities of catalase enzymes in different plant samples.
13. Comparative study on the activities of amylase enzymes in different plant samples.
14. Studies on paper chromatography of amino acids.

PAPER - XII

CYTOGENETICS AND MOLECULAR BIOLOGY

Full Marks-35

1. Study of mitotic division with an emphasis on delimiting the start and end points of prophase, prometaphase, early and late anaphase, early and late telophase.
2. Meiotic study in flower buds of different species and identification of different stages.
3. Study of orcein induced breakage of chromosome.
4. Study of the effect of the acid fume on chromatin.
5. Study of abnormality of chromosomes and cell division.
6. A brief knowledge on karyotyping with any suitable example (demonstration).
7. Chi-square tests for different purposes.

8. Study of correlation and analysis of coefficient of correlation.

PAPER - XIII

PLANT ECOLOGY AND ANATOMY

Full Marks -25

1. Study of Raunkier's life forms and biological spectrum of a given area.
2. Study of frequency, abundance and density of plants of a given area.
3. Ecological study on plant adaptations including anatomy.
4. Ecological field study of given area(s) and preparation of records, including the studies of environmental impacts of plants.
5. Submission of field records and laboratory notebooks.

PAPER - XIV (SPECIAL PAPER)

ENVIRONMENTAL BOTANY

Marks - 100

1. To study physiochemical characteristics of soil.
2. Study of vegetation.
3. Study of plant productivity.
4. Study of plant adaptation (Anatomical & physiological characteristics).
5. Ecological study of selected areas.
6. Effects of different chemical pollutants on chromosomes.
7. Extraction and estimation of protein in normal and stress induced plants.

8. Analysis of total dehydrogenase activity in normal and plants under stress.
9. Evaluation viability status seeds experiencing normal and adverse environmental storage conditions.
10. Estimation of IAA (By Colorimeter)
11. Microbial examination of water to examine portability.
12. Isolation of pathogens from plant materials.
13. Isolation of Pathogens, and characterise from soil.
14. Study of mycorrhiza from different forest types.
15. VAM inoculation technique.
16. Visit to some research institutes, industries and forests.

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