



R.K.D.F. UNIVERSITY, BHOPAL

M.Sc. (BOTANY)

REVISED SYLLABUS 2019-2020

Scheme Semester – I

No	Subject Code	Subject Title	Marks Allotted						
			Assignment Marks		Theory Marks		Practical Marks		Total Marks
			Max	Min	Max	Min	Max	Min	
1	MSB 511	BACTERIOLOGY, VIROLOGY & GENERAL MICROBIOLOGY	20	8	80	32	-	-	100
2	MSB 512	BIOLOGY AND DIVERSITY OF FUNGI AND PLANT PATHOLOGY	20	8	80	32	-	-	100
3	MSB 513	BIOLOGY AND DIVERSITY OF ALGAE, BRYOPHYTES AND LICHENS	20	8	80	32	-	-	100
4	MSB 514	BIOLOGY AND DIVERSITY OF PTERIDOPHYTES AND GYMNOSPERMS	20	8	80	32	-	-	100
5	MSB 515	PRACTICAL I (Based on MSB 511 & MSB 512)	-	-	-	-	50	20	50
6	MSB 516	PRACTICAL II (Based on MSB 513 & MSB 514)	-	-	-	-	50	20	50
Total			80	32	320	128	100	40	500



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M.Sc. (BOTANY)

Syllabus Semester – I

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.SC (Botany)	BACTERIOLOGY, VIROLOGY & GENERAL MICROBIOLOGY	MSB- 511

Unit-1

Microbiology in daily life, Characteristics and morphology of bacteria, fungi, virus, protozoa & algae. Control of micro-organisms- Growth curve; Influence of environmental factors on growth-PH, Water activity, O₂ availability, Temperature, Pressure and Radiation, General characters of *Rickettsia* and *Chlamydia*, Diseases caused by *Rickettsia* and *Chlamydia*, Mode of nutrition in bacteria; autotrophy, heterotrophy, symbiosis.

Unit-2

General account of sterilization culture media, pure culture techniques; A general idea about bacterial toxins and enzymes; Bacteriophage; Bacterial diseases: caused by *Escherichia coli*, *Shigella*.

Unit-3

General properties and evolution of viruses; Cultivation of virus and viral assay; Transmission of plant viruses and control measures, Oncogenic viruses and tumorigenesis; Viral diseases: Encephalitis, hepatitis AIDS and Rabies

Unit-4

Biological nitrogen fixation: symbiotic and non symbiotic nitrogen - fixation; Fermentation technology: principle and types of fermentation, Microbial degradation of pesticides and hydrocarbons; Mycoplasma: general account and important diseases caused by them

Unit-5

Microbial conversion of waste product with particular reference to alcohol and biogas, General account of Immunity, properties of antigens and antibodies, Allergy and types of allergies, Mycotoxins and their harmful effects. Morphology of water, air soil and sewage. Water-Microorganisms of water, total bacterial count. Air- Microorganisms in soil, nitrogen cycle. Sewage-Composition of sewage, treatment of sewage by microorganisms

PRACTICALS

1. Preparation of culture media.
2. Preparation of culture media.
3. Isolation of *Bacillus* and *Rhizobium* spp from soil and nodules.
4. Various methods of bacterial staining to study cell wall, endospore, capsule and flagella.
5. Identification of important genera by using biochemical tests: *Escherichia*, *Azotobacter*, *Staphylococcus*, *Bacillus*, *Pseudomonas*, *Rhizobium*, *Streptomyces*, *Xanthomonas*.
6. Construction of bacterial growth curve.
7. Quantitative estimation of bacteria in milk.
8. Isolation of streptomycin – resistant mutants of bacteria.
9. Sensitivity test of bacteria using different antibiotics.
10. Purification of TMV and study of thermal inactivation point and dilution point.
11. Virus concentration determination by local lesion on host.
12. Study of common vectors of plant virus: Nematodes, fungi and insects.
13. Bacteriophage isolation
14. Isolation and enumeration of bacteria: Actinomycetes and fungi from soil, rhizosphere and seed using different techniques.



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15. Use of selective media for isolating micro- organisms.
16. Fermentation of alcohol and biogas from waste materials (Demonstration)



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BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Botany)	BIOLOGY AND DIVERSITY OF FUNGI AND PLANT PATHOLOGY	MSB- 512

Unit-1

The status of fungi. Principles of important systems of classification up to the rank of classes. A study of the classes Myxomycetes, Plasmodiophoromycetes, Chytridiomycetes, Oomycetes, Zygomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes with reference to:- a. Classification upto the rank of orders. b. Range of structure and organization of vegetative and reproductive bodies. c. Ultra structure. d. Method of reproduction. e. Variation in life-cycle. f. Economic importance. Nutritional and physical requirement for growth and reproduction. Heterokaryosis, Parasexuality, Heterothallism, Hormonal control of sexual reproduction.

Unit-2

Fungal associations: i. Lichens: general account of lichens with special reference to:- a) Habitat, Structure and organization of lichens. b) Method of reproduction. c) Physiological relationship of mycobiont and phycobiont. d) Economic importance of lichens. ii. Mycorrhizae: a) Types of mycorrhizae

Unit-3

Comparative study of following sub-division; Basidiomycotina: Puccinia, Melampsora, Ustilago, Polyporus, Cyathus, Deuteromycotina: Fusarium, Cercospora, Colletotrichum. Mushroom cultivation: Mycorrhizal application in agriculture and forestry; Fungal cytology and genetics: Heterothallism, heterokaryosis, parasexual cycle, mutation.

Unit-4

Symptomatology in fungal, bacterial and viral infection of plants, Etiology and control of the following crop diseases

1. Paddy: paddy blast, paddy blight
2. Wheat: Black stem rust, Bunt of wheat
3. Bajra: green ear and Ergot
4. Sugarcane: Red rot disease of sugarcane.
5. Ground nut: Tikka disease
6. Maize Smut

Unit-5

Role of enzyme and toxins in pathogenesis; Disease control by physical, chemical and biological methods, resistant varieties; Crop rotation, plant quarantines, seed certification.

PRACTICAL

Study of the morphological characters and reproductive structures of the genera mentioned in the theory. Study of symptomatology of diseased species. Carbon and nitrogen utilization by fungi (in culture) vitamin requirement, staining techniques, induction and isolation of mutants.

1. Study of diseased specimens of plants with reference to symptomatology.
2. Isolation, purification and single spore culture of pathogens.
3. Measurement of the activity of enzymes of fungal pathogens: Cellulase, Pectinases.
4. Laboratory testing of fungicides (systemic and non-systemic) against pathogenic fungi.
5. Demonstration of biological control of pathogenic fungi in vitro.



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Syllabus Semester – I

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Botany)	BIOLOGY AND DIVERSITY OF ALGAE, BRYOPHYTES AND LICHENS	MSB- 513

Unit-1

Comparative survey of important systems of classification of algae; Criteria for algal classification and modern trends; Diagnostic features of algal phyla, range of thallus and reproductive diversity; life history patterns, parallelism and evolution.

Unit-2

Criteria for algal classification, comparative survey of important systems of classification of algae up to the rank of class. A study of division Cyanophyta, Chlorophyta, Xanthophyta, Phaeophyta and Rhodophyta with reference to the following. a. General features. b. Range of structure and organization of thallus. c. Reproductive diversity and life cycle patterns. d. Classification up to the level of order. General characteristic of the divisions Prochlorophyta, Charophyta, Euglenophyta, Pyrrophyta, Bacillariophyta and Cryptophyta. Evolutionary tendencies in algae; parallelism in evolution. Distribution of Algae in soil, freshwater and marine environments. Economic Importance of Algae..

Unit-3

General characteristics of the division: Diophyta, Chrysophyta and Cryptophyta. Distribution of algae in soil, fresh water and marine environment, role of algae in soil fertility, productivity in fresh water and marine environment algae role in fisheries, algae in symbiotic association, algae in polluted habitats, algae as indicator of pollution, fossil algae, algae in biotechnology.

Unit-4

Criteria and recent trends in the classification of Bryophytes. Origin and evolution of bryophytes. Diversity in Bryophytes: Habit and Habitat; Developmental morphology and organization of gametophyte and sporophyte bodies. A comparative study of morphology, anatomy, life history, classification and phylogeny of the following groups (with special reference to Indian forms.): Takakiales, Calobryales, Monocleales, Sphaerocarpaceae, Marchantiales, Jungermanniales, Anthocerotales, Sphagnales, Andreaeales and Bryales. Fossil history of Bryophytes. Ecological significance and economic importance of Bryophytes.

Unit-5

Experimental studies in Bryophytes, Spore germination, Protonemal differentiation, bud formation, Parthenogenesis, apogamy, apospory and regeneration; Bryogeographical regions of India with reference to central India; Lichens: General account, structure and reproduction.

PRACTICAL

1. Collection and study of algae mentioned in theory, identification up to generic level using algal monographs.
2. Preparation of synthetic medium and cultivation of algae, unialgal and axenic culture and their maintenance.
3. Collection, preservation of algal herbarium (10 specimens).
4. Preparation of pigments.
5. Staining techniques of cytology studies.
6. Morphology and structural study of representative member of the following group using cleared whole amount preparation, dissection and section: Jungermanniales – *Pellia* and *Porella* (or any other leafy liverwort); Marchantiales-*Plagiochasma*, *Dumortiera*, *Fimbriaria*, (*Astralla*, *Reboulia*, *Targionia*, *Conocephalum*/ *Weisnerella*, Sphagnales/ *Sphagnum*/ Bryales
7. Experiments to study spore germination, formation of protonema and bud development.
8. Study of Bryophytes in their natural habitats



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Syllabus Semester – I

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Botany)	BIOLOGY AND DIVERSITY OF PTERIDOPHYTES AND GYMNOSPERMS	MSB- 514

Unit-1

Classification and origin of Pteridophytes. 2. The vegetative sporophyte; Microphyll and megaphylls; Stellar theory; Telome theory. The fertile sporophyte: sporangia: position, ontogeny types, structure. Heterospory: Occurrence, causes and significance. The gametophytes: Germination of fern spore, Development of fern prothallus. Comparative study of Psilopsida, Lycopsida, Sphenopsida and Pteropsida.

Unit-2

Comparative organography, systematics; reproduction and phylogeny of the following: Psilophytales, Rhyniales, Zosterophyllophytales; Psilotales; Lycopdiales, Lepidodendrales Sphenophyllales Ophioglossales, Osmundales, Filicales, Marsiliales, Salviniiales.

Unit-3

Speciation and evolutionary trends in ferns; Cytology; Polyploidy and hybridization; Pteridophytic life – cycle, apospory, vegetative apomixes; Recent trends in the classification of Gymnosperms

Unit-4

Morphology and anatomy of vegetative and reproductive organs, fossil representatives and interrelationship of Cycadales, Ginkgoales, Coniferales, Taxales, Ephedrales, Welwitschiales and Gnetales.

Unit-5

Structure and evolution of archegonium in Bryophytes, Pteridophytes and Gymnosperms Distribution of living and fossil Gymnosperm in India; Economic importance of Gymnosperms.

PRACTICALS

1. Study of morphology and anatomy of vegetative and reproductive tissues and organs using cleared whole mounts, dissections, sections, macerations and permanent preparations of living and fossil forms covered under theory.
2. Experiments on spore germination of prothallus, induction of sporophytes.
3. Preparation of models (Plasticine/ thermocol) to demonstrate stellar evolution.
4. Study of Pteridophytes in their natural habitats
5. Comparative study of the anatomy of vegetative and reproductive parts of Ginkgo, Cedrus, Abies, Picea, Cupressus, Cryptomeria, Taxodium, Podocarpus, Cephalotaxus, Araucaria, Agathis, Taxus, Ephedra and Gnetum.
6. Study of the important reproductive stages through specimens and permanent slides.
7. Preparation of models (Plasticine/ thermocol) to demonstrate the position and structure of microsporangia of Cycas, Pinus, Taxus, Ephedra, Gnetum. Seed-scale complex in female cone of Pinus, embryo of Pinus.



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**Scheme
Semester – II**

No	Subject Code	Subject Title	Marks Allotted						
			Assignment Marks		Theory Marks		Practical Marks		Total Marks
			Max	Min	Max	Min	Max	Min	
1	MSB 521	ANGIOSPERM ANATOMY, EMBRYOLOGY AND PALYNOLOGY	20	8	80	32	-	-	100
2	MSB 522	ANGIOSPERM MORPHOLOGY AND TAXONOMY	20	8	80	32	-	-	100
3	MSB 523	WATER RELATIONS, GROWTH AND DEVELOPMENT	20	8	80	32	-	-	100
4	MSB 524(a)/524(b)/524(c)	CYTOLOGY AND MOLECULAR BIOLOGY OF PLANTS/ Ecology and Phytogeography/ Taxonomy of Angiosperms and Economic Botany	20	8	80	32	-	-	100
5	MSB 525	PRACTICAL III (Based on MSB 521 & MSB 522)	-	-	-	-	50	20	50
6	MSB 526	PRACTICAL IV (Based on MSB 523 & MSB 524)	-	-	-	-	50	20	50
Total			80	32	320	128	100	40	500



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Syllabus
Semester – II

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Botany)	ANGIOSPERM ANATOMY, EMBRYOLOGY AND PALYNOLOGY	MSB- 521

Unit-1

Origin, growth, differentiation and ultra structure of cell and tissue, fine structure of plasmodesmata, microtubules, microfibrils and secondary structure; Apical, lateral and intercalary meristems- their ultra structure and histochemistry, organogenesis; Ontogeny, phylogeny, ultra structure and function of primary and secondary xylem; wood anatomy; Ontogeny, phylogeny, ultra structure and function of primary and secondary phloem; Structure variability in leaves, leaf histogenesis, leaf meristem, origin, development ultra structure of trichomes and stomata.

Unit-2

Nodal anatomy-nodal types and evolutionary consideration, Vascular cambium vs. cork cambium factors controlling their activity, periderm, lenticles, abscission, wound healing; Anatomy of monocotyledons and dicotyledonous seed and fruits, seed appendages, their anatomy structure and function; Anatomy in relation to taxonomy; Contemporary plant anatomy: current trends and prospects.

Unit-3

Microsporangium- structure and function of wall layers, ultra structure change in tapetum and meiocytes during Microsporogenesis, role of tapetum, pollen development, anther culture and haploid plants; Pollen wall morphogenesis-microspore pollen mitosis; division of generative cell; pollen fertility and sterility; pollen storage viability and germination; Megasporogenesis, various types of embryosacs, their development and fertilization.

Unit-4

Embryology and taxonomy; diagnostic embryological characters, primitive and advanced characters, comparative embryology of hybrids dysfunction of endosperm, arrested development of embryo.

Unit-5

Development and evolution of pollen types; stereo and ultrastructure of exine, apertures, furrow. Palynology and taxonomy; Aerobiology and its application. Aeropalynology, methods of aerospora survey and analysis, pollen allergy and pollen calendars system approach for allergy. Mellitopalynology: general account Paleopalynology: role in coal and oilgenesis.



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PRACTICALS

1. Use of paraffin method of microtechnique .
2. Acquaintance with ultratome: use of wood microtome and common and anatomy and histochemical methods.
3. Learning techniques of making temporary and permanent microscopic preparation.
4. Knowledge and use of photomicrography in anatomical studies.
5. Knowledge and use of the principles and working of electron microscopes.
6. Learning to use simple experimental method in anatomical studies.
7. Laboratory work planned on the basis of topic listed under theory.
8. Preparation of dissected whole mount of endothecium, tapetum, ovule, endosperm and embryo, squash preparation of tapetum, microspore mother cell, dyads, tetrads, pollinia, massulae.
9. Study of seed appendages from dissection, structure of seed coat from section and macerations.



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Syllabus Semester – II

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Botany)	ANGIOSPERM MORPHOLOGY AND TAXONOMY	MSB- 522

Unit-1

General concept of morphology, origin and evolution of flower. Co-evolution of flower, vis a vis pollinators; Origin and evolution of polypetal, sympetal, apetal; monoc, dioc. Monocot flower.

Unit-2

Stamens: origin and evolution from foliar to reduced condition, extension of connective beyond anthers; mono di and polyadephy; nectaries and nectar; Carpels: evolution, conduplicate, involute and other types, validity of the concept of foliar origin of carpel: alternative concepts and approaches ; specialized carpels; poly and syncarpy; superior, semiinferior and inferior ovary; appendicular and receptacler concepts; evolution of types of placentations.

Unit-3

Role of floral anatomy in interpreting the origin and evolution of a flower and floral parts. Floral anatomy and taxonomy; Experimental study on flower.

Unit-4

Botanical exploration-historical perspective, brief account of botanical exploration in south east Asia with special reference to India. Botanical survey of India, its organization and role; Principles of plant classification with emphasis on modern tools of taxonomy; molecular systematics; utility of taxonomy; biosystematics; Phylogenetic systems of classification ; Cronquist, Takhtajan, AGP III

Unit-5

Botanical nomenclature! ICBN, principles, articles, recommendation and amendments of code; Familiarity with botanical literature, monographs, icons and floras, important periodicals with emphasis on Indian floristics, methods of literature consultation; Threat assessment, different categories of threat, IUCN, Red Data Book. Important threatened plants of India.

PRACTICALS

1. Preparation of cleared whole mounts of floral parts of polypetalae, sympetalae and monocots for vasculature.
2. With the help hand section and dissection prepare longitudinal and transverse sections of flower.
Examination of:
 - a. Transmitting tissue/ canal in stigma and style.
 - b. Various types of ovaries and placentations.
 - c. Special types of flowers with emphasis on vasculature of androecium and gynoecium.
3. Preparation of models (plasticine/thermocool) of vascular skeleton of flower and placentaion.
4. Any other laboratory work based on theory syllabus.
5. Description of specimen.



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Syllabus
Semester – II

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Botany)	WATER RELATIONS, GROWTH AND DEVELOPMENT	MSB- 523

Unit-1

Water relations of plants: Unique physio-chemical properties of water, chemical potential , water potential. Apparent free space, bulk movement of water, soil plant atmosphere, contuum (SPAC), stomatal regulation of transpiration, hormonal and energy dependent hypothesis; Inorganic nutrition, physicochemical aspects of solute transport, diffusion and facilitated diffusion, passive and active transport; Nernst equation and Donnan's potential. Role of ATPase as a carrier, co-transport (symport) and counter transport (antiport). Ion channels, role of calmodulin. Importance of foliar nutrition and use of chelates.

Unit-2

Photosynthesis: Energy pathway in photosynthesis, chloroplast as an energy transducing organelle; Composition and characterization of photo systems, I and II , electron flow through cyclic, non cyclic and pseudo cyclic photophosphorylation. Pathways of CO₂ fixation. Differences between C₃ and C₄ fixation and different kinds of C₄ pathways.

Unit-3

CAM pathway: Occurrence, biological events and adaptive advantage; Photorespiration : Mechanism and regulation of photorespiration; Introductory studies on water stress and its tolerance mechanisms.

Unit-4

Enzymes: Classification, mode of action, Km value; Industrial application, immobilized enzymes, their preparation and application; Enzyme regulation : Competitive and non-competitive , allosteric enzymes.

Unit-5

Chemical control of growth and morphogenesis; Hormonal effects on growth and development; Bioassay of plant growth regulators and mode of action with reference to auxins; Gibberellins, cytokinins, abscisic acid and ethylene; Phytochrome: Chemistry and photo morphogenetic effects and role in flowering; Genetic study of secondary metabolites such as alkaloids (only types of wide occurrence.) Dormancy: Seed and bud dormancy; hormonal regulation.



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PRACTICALS

1. Study of physical and chemical characteristics of soil by rapid field test.
2. Determination of pH of water.
4. Determination of dissolved oxygen in water
5. Extraction of amylase and determination of its activity.
6. Determination of K_m and V_{max} of Amylase or phosphorylase
7. Determination of soil profile , texture, colour, consistence.
8. Determination of chlorophyll-a chlorophyll-b, total chlorophyll (Arnon's method).
9. Determination of chlorophyll-a chlorophyll-b, ratio in C_3 and C_4 plants.
10. Determination of height of the tree.
11. Determination of light penetration under water by Sechii dish.
12. Determination of gibberellic acid by half seed (cereal) method. Demonstration of effects of auxin on abscission, cytokinin on senescence and abscissic acid on stomatal regulation.
13. Determination of carotenoids.



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Syllabus Semester – II

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Botany)	CYTOLOGY AND MOLECULAR BIOLOGY OF PLANTS)	MSB- 524(a)

Unit-1

The plant cell: structure, organization, cell cycle mechanism and its molecular basis, cytokinesis;
Nucleus: structure, nucleolus organization; Generalized structure of plant cell organelles.

Unit-2

Chromosome: structure, molecular basis of Chromosome structure. Eukaryotic genome .
organization, prokaryotic genome organization, variation in Chromosome and its significance.

Unit-3

DNA: packaging of DNA, nucleosome, nuclear membranes, C-value paradox, cot curves, chemical structure. genetic code; DNA replication in prokaryotes and eukaryotes; Transcription, RNA splicing; Translation: Prokaryotic and eukaryotic gene regulation (Operon concept).

Unit-4

Meiosis: origin and molecular events during meiosis; Mitosis: origin and molecular events during mitosis; Chromosomal aberrations: Heteroploidy, structural changes in chromosomes.

Unit-5

Transposable elements and its molecular basis; Membrane structure and function, ATPase sites; Membrane transport with reference to transport protein; Signal transduction: on overview.

PRACTICALS

1. Staining.
2. Study of the microscope.
3. Study of the size and shape of the cell.
4. Staining and study of flagellum.
5. Vital staining.
6. Study of mitosis by squash and smear.
7. Study of meiosis.
8. Study of chromosome aberration like ring, anaphase bridges etc.
9. Collection, fixation and preparation of paraffin blocks of materials.
10. Microtomy and staining of the slides by various methods.



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BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Botany)	Ecology and Phytogeography	MSB- 524(b)

Unit I

Introduction to ecology, and environmental terminology, population dynamics, vegetation organization and development: population characteristics, population growth forms, density dependent and density independent controls, population structure (distribution, aggregation, isolation territoriality) energy partitioning , r - and k-selection, concept of carrying capacity; Wild life sanctuaries, botanical gardens

Unit II

Concepts of community and continuum, analysis of communities (analytical and synthetic characters), community coefficients, competition, ecological niche, succession, mechanism of ecological succession (relay floristic and initial floristic composition facilitation, tolerance and inhibition models), concept of climax

Unit III

Ecosystem organization, structure and function: primary production (methods of measurement), energy dynamics (tropic organization, energy flow pathway, energy quality, ecological efficiencies), biogeochemical cycles

Unit IV

Pollution and climate change: kinds, sources and effects of pollution, heavy metals (Pb, Cd, Hg), green house gases (CO₂, CH₄, N₂O, CFCs), Green-house effect and global warming, ozone layer depletion and ozone hole, acid rain

Unit V

Environmental impact assessment, threatened and endangered plant species, role of diversity in ecosystem stability, general account of remote sensing and its application, sustainable development. Major terrestrial biomes, biogeographical area of India, major vegetations



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List of Experiments

1. Study of instruments used to measure microclimatic variables: Soil thermometer maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter
2. Determination of pH, and analysis of two soil samples for carbonates, chlorides, nitrates sulphates, organic matter and base deficiency by rapid field tests
3. Comparison of bulk density, porosity and rate of infiltration of water in soil of three habitats
4. (a) Study of morphological adaptations of hydrophytes and xerophytes (four each).
(b) Study of biotic interactions of the following: Stem parasite (Cuscuta). Root parasite (Mimosa pudica). Epiphytes. Predation (Insectivorous plants)
5. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus by species area curve method. (Species to be listed)
6. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law.
7. Study of vegetative and floral characters of the following families (Description. V.S flower, section of ovary. floral diagram/s, floral formulae and systematic position according to Bentham & Hooker's system of classification):
Brassicaceae-Brassica, Alysiaceae-Iberis; Malvaceae-Hibiscus, Rosaceae-Rosa; Asteraceae-Sonchus, Lamiaceae-Lamium/Vernonia, Ageraceae-Eragrostis, Euphorbiaceae-Euphorbia, Solanaceae-Datura/Withania; Liliaceae-Lilium, Alliaceae-Allium
8. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book),



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BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Botany)	Taxonomy of Angiosperms and Economic Botany	MSB- 524(c)

Unit I

Latin diagnosis, definition and use of Taxonomic terms, History of Plant Taxonomy, in India, History of Plant Classification, Need and aim of classification, Units of classification, delimitations of taxa and their practical consideration, Artificial, Natural and Phylogenetic system classification, a critical study of Takhtajan, Modern system of classification, An introduction of angiosperm Phylogeny Group (APG), Characteristics and phylogeny of orders

Unit II

Need and aim of nomenclatures, International rules of Botanical Nomenclature, Concept of species, genus and family with special reference to the type concept

Unit III

Interrelationship of plant taxonomy with morphology, anatomy, embryology, palynology, cytology, genetics, Biosystematics, biochemical and molecular systematics, Numerical taxonomy, Phytogeography and phytochemistry

Unit IV

Indigenous flora of India with special reference to local flora (Uttar Pradesh), A general knowledge of Herbarium, and Botanical garden of the world and India, Identification keys

Unit V

An introduction to plant utilization, Economic importance of plant for food (cereals, pulses, vegetables, fruits, oils sugar, spices and condiments), non-alcoholic beverages (Tea, coffee, cocoa), medicines, fiber, timber, rubber, tannins and dyes, masticatories, fumicatories, contribution of plants in the development of industries

Practicals

1. Description of flowering plant in botanical terms
2. Study of plant families (any four)
3. Study of ecological adaptations in Hydrophytes with any two examples
4. Study of ecological adaptations in Xerophytes with any two examples
5. Study of vegetation by list count quadrat method.
6. Study of tools of taxonomy and ecological instruments (any four each)



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Scheme

Semester – III

No	Subject Code	Subject Title	Marks Allotted						
			Assignment Marks		Theory Marks		Practical Marks		Total Marks
			Max	Min	Max	Min	Max	Min	
1	MSB 531	BIOCHEMISTRY AND METABOLISM IN PLANTS	20	8	80	32	-	-	100
2	MSB 532(a)/532(b)/532(c)	PLANT BREEDING/ Plant Physiology/ Mycology and Plant Pathology	20	8	80	32	-	-	100
3	MSB 533	PLANT BIOTECHNOLOGY: IN VITRO CULTURE, GENETIC ENGINEERING AND IPR ISSUE	20	8	80	32	-	-	100
4	MSB 534	HERBAL TECHNOLOGY	20	8	80	32	-	-	100
5	MSB 535	PRACTICAL V (Based on MSB 531 & MSB 532)	-	-	-	-	50	20	50
6	MSB 536	PRACTICAL VI (Based on MSB 533 & MSB 534)	-	-	-	-	50	20	50
Total			80	32	320	128	100	40	500



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Syllabus
Semester – III

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Botany)	BIOCHEMISTRY AND METABOLISM IN PLANTS	MSB- 531

Unit-1

Lipid: General structure, classification; Synthesis of fatty acid; β -Oxidation; Synthesis of carbohydrates from fatty acids; Protein: Amino acid structure and Biosynthesis; protein conformation, protein synthesis.

Unit-2

Secondary plant products: General structure of important phenolic compound groups in plants; Shikimic acid pathway and phenolic compound synthesis; General structure and synthesis of alkaloids from amino acids; Growth regulators: structure and biosynthesis of Ethylene, Jasmonates and Brassinolides.

Unit-3

Cell wall components; Cellulose: structure and model for biosynthesis, structure and operation of the model for synthesis at plasma membrane level; Lignin: structure and biosynthesis in plants. Cyanogenesis: a general account of cyanogenic compounds as glycosides.

Unit-4

Nucleic acids as genetic information carriers: experimental evidence, DNA structure: historical aspects and current concepts, melting of DNA. DNA replication: general principles, various modes of replication, isolation and properties of DNA polymerases. Asymmetric and dimeric nature of DNA polymerase, exonuclease activity in eukaryotic DNA polymerases. mechanism of action of topoisomerases.

Unit-5

Nitrate metabolism in plants; Nitrogen fixation, Nitrogenase system; Ammonium assimilation. GS-GOGAT system;

References :

1. Jaibala, S. and Balakrishnan, G. (1975). A Hand book of common remedies based On Siddha system of Indian medicines. St. Louis Institute Press, Chennai.
2. Natkarni, K.M. (1998). Indian Materia Medica (Vol. I-III). Popular Prakasam, New Delhi.
3. Raychaudri, S.P. (1991). Recent advances in Medicinal, Aromatic and Spice crops (Vol. I). Today & Tomorrow publication, New Delhi.
4. Johnson, T (1999). CRC Ethnobotany desk Reference , CRC press ,New York



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Practicals:

1. Estimation of total nitrogen by kjaldahl method.
2. Principles of colorimetry, spectrophotometry and fluorimetry.
3. Estimation of titrable and total acidity.
4. Estimation of protein by Biuret and Lowry's method.
5. Estimation of seed germination as affected by red and Infrared radiation.
6. Determination of gibberellic acid by half seed (cereal) method. Demonstration of effects of auxin on abscission, cytokinin on senescence and abscissic acid on stomatal regulation.
7. Extraction and estimation of starch.
8. Determination of reducing sugars in fruits.
9. Identification of different kinds of sugars (spot tests).
10. Estimation of amino acids by ninhydrin.
11. Identification of proline, sulphur-containing amino acids with aromatic ring (spot test).
12. Separation and identification of sugars by paper chromatography.
13. Separation of soluble protein by gel electrophoresis.



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Syllabus
Semester – III

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Botany)	PLANT BREEDING	MSB- 532(a)

Unit-1

Introduction: Objectives of plant breeding, important achievements and future prospects. Genetic variability and its role in plant breeding. Domestication and centers of origin of cultivated plants.

Unit-2

Systems of reproduction in plants: Reproductive systems and pollination control mechanisms; Sexual reproduction - Cross and self pollination; asexual reproduction, Incompatibility and Male sterility, their types.

Unit-3

Hybridization: Hybridization - role and methods, Inter-varietal, inter specific and inter generic crosses. Back-cross breeding. Heterosis, Inbreeding depression.

Unit-4

Breeding for resistance: Breeding for biotic (disease) and abiotic (drought) stresses; loss due to diseases, disease development, disease escape, disease resistance, vertical and horizontal resistances of biotic stress; methods of breeding for disease resistance.

Unit-5

Mutation breeding: Mutagens and crop improvement. Spontaneous and induced mutations, effects of mutation. Physical and chemical mutagens; principles and working of Gamma gardens, methods of mutation breeding, mutations in oligogenic traits, mutations in polygenic traits, limitations of mutation breeding, achievements of mutation breeding. Role of mutations in Plant Breeding; Modern trends in plant breeding.

References

1. Allard R W (1995). *Principles of Plant Breeding*. John Wiley and Sons, Inc.
2. Ghahal G S and Gosal S S (2002). *Principles and procedures of Plant Breeding*. Narosa Publishing House.
3. Sharma J R (1994). *Principles and practices of Plant Breeding*. Tata McGraw-Hill Publishers Company Ltd.
4. Singh B D (1996). *Plant Breeding: Principles and methods*. Kalyani Publications.

Practical:

1. Determination of probability of tossing for one coin.
2. Determination of probability for the throw of dice.
3. Determination of probability for tossing of two coins.
4. χ^2 test as applied to the result of above three experiments.
5. Determination of size of the leaves on a specific size of two population of a species and calculation of standard deviation and standard error.
6. Permutation and combination.
7. Correlation analysis.



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8. Determination of genotype from the data provided.
 9. Determination of linkage values from data (BOTANY) and preparation of chromosome map.
 10. Determination of various mendelian ratio by cheker board as well as by binomial equation.
 11. Study of gene frequency in the populations.
 12. Use of Anderson's scatter diagrams in the differentiation of the genetic population.
- Emasculation of flower.



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M.Sc. (BOTANY)

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Botany)	Plant Physiology	MSB- 532(b)

Unit I

Plant water relations: Transport and translocation of water and solutes, water potential and components, mechanism of water transport, mineral nutrition, nutrient uptake, solute transport, phloem loading and unloading.

Unit II

Nitrogen metabolism, respiration and lipid metabolism: Biological nitrogen fixation, nodule formation and nod factors, mechanism of nitrate uptake and reduction, ammonium assimilation, Interaction of nitrogen assimilation with carbon metabolism. Glycolysis, TCA cycle, electron transport and ATP synthesis, pentose phosphate pathway, Cyanide resistant respiration, Lipid metabolism

Unit III

Photochemistry and photosynthesis: History of photosynthesis, photosynthetic apparatus, photoreceptor, light reaction of photosynthesis, photo oxidation of water mechanism photophosphorylation, Structure and function of Rubisco and PEP Carboxylase, carbon assimilation, Calvin cycle, photorespiration and its significance, C₄ cycle, CAM pathway

Unit IV

Plant growth substances and signal molecules: Chemical structure, physiological effects and mechanism of action of auxin, gibberellins, cytokinins, ethylene abscisic acid. Growth regulating nature of Polyamines, Jasmonic acid Salicylic acid and Brassinosteroids, systemin, secondary metabolite and plant defense

Unit V

Growth and Development Aspects: Metabolic changes during seed germination, factors affecting seed germination and dormancy, breaking of dormancy, biochemistry of flowering: initiation and development of flower, induction of flowering- vernalization, physiology and biochemistry of leaf abscission and senescence. Sensory photobiology: Phytochromes and cryptochromes and their photochemical and biochemical properties, photo physiology of light- induced responses, cellular localization, molecular mechanism of action of photomorphogenic receptors, signaling and gene expression



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Plant Physiology Practicals

1. Determine water holding capacity (WHC) and pH of soil (pH by pH meter.)
2. Study of plasmolysis in suitable plant material
3. Determination of Diffusion Pressure Deficit (DPD).
4. Determine rate of transpiration under different conditions of Sunlight, Shade and wind
5. Demonstration Experiments. (Compulsory Practical)
 - a. Curling Experiment
 - b. Imbibition in seeds
 - c. Arc Auxanometer
 - d. Effect of auxins on rooting
 - e. Transpiration pull
 - f. Spectrophotometer
 - g. Portable leaf area meter
 - h. Conductivity meter
 - i. Centrifuge
6. Assessing seed viability by TTC method
7. Demonstration of separation of plasmid DNA by agarose gel electrophoresis (01 P)
8. Demonstration of enzyme immobilization



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M.Sc. (BOTANY)

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Botany)	Mycology and Plant Pathology	MSB- 532(c)

Unit I

Introduction to fungi and their significance to humans, general characteristics of fungi, Fungal Cell, fungal cell walls and fungal organelles, systematics, molecular methods of fungal taxonomy, reproduction and spores in fungi, heterothallism, parasexual cycle and sex hormones in fungi. Biology, general characteristics and importance of Plasmodiophora, dictyosteliomycota, acrasiomycota and myxomycota. Biology, general characteristics, classification and brief introduction of –Mastigomycotina-Chytridiomycetes, Hypochytridiomycetes and Oomycetes Zygomycotina - Mucorales, Endogonales, Glomales, Entomophthorales and Zoopagales with special reference to evolutionary tendencies in thallus, asexual and sexual reproduction

Unit II

Ascomycotina- General characteristics and brief introduction of Taphrinales, Schizosaccharomycetales, Saccharomycetales, Eurotiales, Hypocerales, Melanosporales, Phyllachorales, Ophiostomatales, Dioporthales, Xylariales, Sordariales, Meliolales, Rhytismales, Helotiales, Pezizales, Dothidiales, Pleosporales and Erysiphales with special reference to evolutionary tendencies in asexual and sexual reproduction. Basidiomycotina- General characteristics of Agaricales, Lycoperdales, Sclerodermatales, Phallales, Nidulariales, Aphyllophorales, Uredinales, Ustilaginales, Auriculariales and Tremellales, Deuteromycotina- Hyphomycetes, Coelomycetes.

Unit III

Introduction to lichens, the symbiotic relationship and classification of lichens, methodology for lichens taxonomy, morphology and anatomy of thallus, reproduction, physiology, ecological aspects and chemistry, conservation, culture, bioprospection and economic importance of lichens.

Unit IV

General introduction to Plant Pathology, History of Plant Pathology, Classification of Plant Diseases, Kinds and amount of losses, chemical weapons of pathogens – Enzymes and toxins; Role of growth hormones in plant diseases, Preexisting structural and chemical defense, induced structural and chemical defense, hypersensitive reaction, role of phytoalexins and other phenolic compound., how the pathogen affects plant physiological functions. Parasitism and disease development, symptoms, effect of environmental factors on the plant disease development, plant disease epidemiology

Unit V

Some important diseases caused by fungi, bacteria, viruses and mycoplasma. Control of plant diseases, quarantines and inspection, physical, chemical, cultural and biological methods of disease control, integrated pest management.



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List of practicals

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1. Study of epidermal tissue system – non-glandular and glandular trichomes, multilayered epidermis, typical stomata (dicot and monocot).
2. Study of mechanical tissues and their distribution in root, stem and leaves.
3. Study of normal secondary growth in dicot stem – Annona /Moringa.
(Double stained temporary preparation)
4. Study of anomalous secondary growth in Bignonia and Dracaena stem.
(Double stained temporary preparation).
5. Study of tetrasporangiate anther and types of ovules.
6. Study of dicot and monocot embryo.
7. Demonstration of fermentation and fermentation products



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Syllabus Semester –III

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Botany)	PLANT BIOTECHNOLOGY: IN VITRO CULTURE, GENETIC ENGINEERING AND IPR ISSUE	MSB- 533

Unit-1

Concept and scope of Biotechnology; Techniques of tissue culture, cell culture and organ culture; Sterilization, culture media; In-vitro auxorrophs, disease resistance, salt and drought resistance, nutritional quality and herbicide resistance.

Unit-2

Micropropagation; Production of haploids: anther culture and pollen culture Somatic embryogenesis, somaclonal variation; Protoplast culture: isolation, culture and fusion of protoplast; IPR-general idea about patents. Copyright, trademark and geographical indication.

Unit-3

Biotransformation: production of useful compounds through cell culture; factors affecting yield: bioreactors; Strategies of microbial strain improvement; The recombinant DNA concept and principle of cloning; Isolation and purification of DNA.

Unit-4

Restriction endonuclease : properties and types; Blotting southern, northern and western; Selection and screening of recombinant clone; Cloning vehicles salient features: plasmid , cosmid & Tiplasmid.

Unit-5

Single stranded DNA viruses CaMV Lambda phage vectors M13 vectors; Expression vectors; Cloning construction of genomic and DNA libraries; Application of- r- DNA technology in plant improvement.

References:

1. Jaibala, S. and Balakrishnan, G. (1975). A Hand book of common remedies based On Siddha system of Indian medicines. St. Louis Institute Press, Chennai.
2. Natkarni, K.M. (1998). Indian Materia Medica (Vol. I-III). Popular Prakasam, New Delhi.
3. Raychaudri, S.P. (1991). Recent advances in Medicinal, Aromatic and Spice crops (Vol. I). Today & Tomorrow publication, New Delhi.
4. Johnson,T (1999). CRC Ethnobotany desk Reference , CRC press ,New York

PRACTICAL

1. Selection of salt tolerance / amino acid analogue resistance through cell culture.
2. Isolation and culture of protoplast.
3. Isolation and screening of industrially important microorganism.
4. Isolation of plant DNA, plasmid DNA, bacteriophage DNA.
5. Genetics colonization and tumour induction Agrobacterium Tiplasmid.
6. Restriction analysis and molecular weight DNA.
7. Sequencing and polymerase Chain Reaction.



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Syllabus
Semester – III

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Botany)	HERBAL TECHNOLOGY, INDUSTRIAL MICROBIOLOGY	MSB- 534

Unit-1

History of Medicinal plants. Traditional Medicinal systems: Ayurvedha, Siddha, Unani and Naturopathy. Definition of Drug - Classification of natural drugs, (Alphabetical, Morphological, Pharmacological, Chemical and Chemo taxonomical). Traditional and Folklore medicines - Native medicine.

Unit -2

Pharmacognosy - Definition and Scope. Drug adulteration, Drug evaluation, Chemical evaluation, Physical evaluation and Biological evaluation. Phytochemical investigations,

Unit -3

Cultivation, collection and preparation of natural drugs - Macroscopic characters (Physical and Organoleptic characters), therapeutical and pharmaceutical uses of the following medicinal plants: *Adathoda vasica*, *Aloe vera*, *Centella asiatica*, *Syzygium aramoticum*, *Datura metel*, *Piper nigrum*, *Allium sativum*, *Azadiracta indica*, *Ocimum sanctum* and *Vinca rosea*.

Unit –4

General concepts of industrial microbiology, Primary and secondary screening, Strain development strategies, Sterilization of fermentor, media and air.

Fermentor Design- Types of fermentations processes, Design of typical batch fermentor, Factors affecting fermentor design, Control of agitation, aeration, pH, temperature and dissolved oxygen, Types of fermentors. Inoculum development, Scale up of fermentation process, Raw material for media preparation, Harvesting and product recovery. Production of antibiotics- Penicillin and semi-synthetic penicillins, Production of enzymes- Amylase, Immobilization of enzymes and applications of immobilized enzymes.

Unit –5

Ethnobotany – definition-Major tribes of South India and their ethno botanical and ethnobiological heritage. Ethno Medicines. Ethnobotany and conservation of plants with special reference to India – mythology and conservation of ecosystems, conservation of selected plant species: sacred groves, forestry and unique ecosystems and their ethnobiological values, plants and animals in art, tradition and ethnography: Ethnobotanical field methods.

Text books

1. John Jothi Prakash, E. (2003). Medicinal Botany and Pharmacognosy. Page 41 of 96 JPR Publication, Vallioor, Tirunelveli.
2. Gokhale, S.B., Kokate, C.K. and Purohit, A.P. (2003). Pharmacognosy. Nirali Prakashan, Pune.
3. Prajapathi, Purohit, Sharma and Kumar. (2003). A Hand book of Medicinal plants. Agrobios Publications, Jodhpur.
4. Kumar, N.C (1993). An Introduction to Medical Botany and Pharmacognosy.



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Reference Books

1. Anonymous, (1999). Pharmacognosy of Indigenous Drugs (Vol. I-III). Central Council for Research in Ayurvedha and Siddha, New Delhi.
2. Anonymous, (2004). Cultivation of Selected Medicinal Plants. National Medicinal Plants Board, Govt. of India, New Delhi.
3. Bhattacharjee, S.K. (2004). Hand Book of Medicinal plants. Pointer Publishers, Jaipur.
4. Biswas, P.K. (2006). Encyclopedia of Medicinal plants (Vol. I-VII). Dominant Publishers, New Delhi.
5. Chaudhuri, A.B. (2007). Endangered Medicinal Plants. Daya Publishing House, New Delhi.
6. Chopra, R.N. (1980). Glossary of Indian Medicinal plants. CSIR, New Delhi.
7. Handa, S. S. and V. K. Kapoor, (1993). Pharmacognosy. Vallabh Prakashan. New Delhi.
8. Harbourne, J. B. (1998). Phytochemical methods: A Guide to Modern Techniques of Plant Analysis (3rd edition). Chapman and Hill Co., New York.

Practical:

1. Visit to tribal area and study of plant material used tribals.
2. Identification and description of important plants of ethno botanical importance.
3. Identification of important aromatic plants of the locality.
4. Extraction of active ingredients of plant and plant parts.
5. Extraction of perfumes of aromatic plants.
6. Pharmacognostic method of identification of drugs.
7. Methods of preparation of Kwath, Churra, Ark, Saiva Asav.
8. Diseases of some common medicinal plant of the locality.
9. Identification and description of 10 plants used by tribal for household purpose.
10. Isolation and identification of bacteria, yeast and fungi from today, bakeries and fermenters of distilleries.
11. Isolation and identification of different types of fungi and bacteria from curd, rotten fruits and Vegetables.



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**Scheme
Semester – IV**

No	Subject Code	Subject Title	Marks Allotted						
			Assignment Marks		Theory Marks		Practical Marks		Total Marks
			Max	Min	Max	Min	Max	Min	
1	MSB 541	CROP PATHOLOGY	20	8	80	32	-	-	100
2	MSB 542	ECOLOGY-I CLIMATOLOGY, SOIL SCIENCE AND AUTECOLOGY	20	8	80	32	-	-	100
3	MSB 543	DISSERTATION	-	-	-	-	250	125	250
4	MSB 544	PRACTICAL VII (Based on MSB 541 & MSB 542)	-	-	-	-	50	20	50
Total			40	16	160	64	300	145	500



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Syllabus
Semester – IV

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Botany)	CROP PATHOLOGY	MSB- 541

Unit-1

Introduction to crop pathology: Classification of plant diseases based on; (a) Major causal agents - biotic and abiotic, (b) General symptoms.

Unit-2

Process of infection and pathogenesis: (a) Penetration and entry of pathogen into host tissue – mechanical, physiological and enzymatic. (b) Host-parasite interaction, enzymes and toxins in pathogenesis.

Unit-3

Defense mechanism in plants: Pre-existing structural and biochemical defense mechanisms, lack of essential nutrients. Induced structural and biochemical defense mechanisms, inactivation of pathogen enzymes and toxins, altered biosynthetic pathways.

Unit-4

Transmission of plant disease: Spread and transmission of plant diseases by wind, water, seeds and vectors.

Plant disease management: Exclusion, eradication and protection. Chemical means of disease control – common fungicides, antibiotics and nematicides. Biological means of disease control. Biotechnological approaches to disease resistance: Fungi in agricultural biotechnology, control of fungal plant pathogens by mycofungicides; Transgenic approaches to disease resistance.

Unit-5

Major diseases in plants

- Cereals: Rice - blast disease, bacterial blight; Wheat - black rust disease.
- Vegetables: Chilly - leaf spot; Ladies finger - vein clearing disease.
- Fruits: Banana - bacterial leaf blight, leaf spot; Mango - Anthracnose; Citrus - bacterial canker; Papaya – mosaic.
- Spices: Ginger - rhizome rot; Pepper - quick wilt; Cardamom - marble mosaic disease.
- Oil seeds: Coconut - grey leaf spot, bud rot disease.
- Rubber yielding: *Hevea brasiliensis* - abnormal leaf fall, powdery mildew.
- Sugar yielding: Sugarcane - red rot; root knot nematode.
- Cash crops: Arecanut - nut fall disease.
- Beverages: Tea - blister blight; Coffee - rust.



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References

1. K S Bilgrami, H C Dube. *A text book of modern plant pathology*.
2. Gareth Johnes. *Plant pathology: principles and practice*.
3. R S Mehrotra. *Plant Pathology*.
4. M N Kamat. *Practical plant pathology*.

Practical

1. Make suitable micropreparations and identify the diseases mentioned with due emphasis on symptoms and causative organisms.
2. Isolation of pathogens from diseased tissues (leaf, stem and fruit) by serial dilution method.
3. Collection and preservation of specimens from infected plants. Submit 5 herbarium sheets/live specimens along with a report.
4. Tests for seed pathology – seed purity test.
5. Calculation of Spore load on seeds using Haemocytometer.



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Syllabus Semester – IV

BRANCH	SUBJECT TITLE	SUBJECT CODE
M.Sc (Botany)	ECOLOGY- CLIMATOLOGY, SOIL SCIENCE AND AUTECOLOGY	MSB- 542

Unit-1

Definition, scope and concept of plant ecology; History of ecology and relation of ecology with other disciplines. Principles of ecology; Concept of environment, habitat and ecological niche. The environment we live in.

Unit-2

Light and temperature as ecological factors; Precipitation and Relative Humidity as ecological factors; Measurement and analysis of light, temperature, Precipitation and relation Humidity; Importance of water as an important factor on the life of plants.

Unit-3

Origin, development and formation of soil. Soil profile; Classification of soil; Effects of soil environment of plants; Chief soil types of India.

Unit-4

Biotic components of an ecosystem; Interrelation of various organisms; Population ecology, Natality, Mortality, Age distribution; Concept of carrying capacity.

Unit-5

Morphological, anatomical and physiological relation of plants with their environment; Plant indicators; Ecotypic and Ecadic differentiation; Physical and physiological dryness; Genecology

References:

1. V K Gupta, T S Paul. *Fungi and Plant disease*.
2. Malhotra, Aggarwal Ashok. *Plant Pathology*.
3. Rangaswamy, A Mahadevan. *Diseases of crop plants in India*.
4. B P Pandey. *Plant Pathology*.
5. George N Agrios (2006). *Plant pathology* (V Edn). Elsevier Academic Press.

PRACTICAL

1. Study of physical and chemical characteristics of soil by rapid field test.
2. Determination of moisture constant of soil.
3. Determination of pH of water.
4. Determination of dissolved oxygen in water
5. Determination of following data.
 - a. Solar energy
 - b. Atmospheric temperature
 - c. Relative Humidity
6. Determination of soil profile.



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7. Determination of soil texture, colour, consistence.
8. Determination of height of the tree.
9. Determination of light penetration under water by Secchi dish.

Paper III & IV: DISSERTATION AND PROJECT