SYLLABUS

MASTER OF SCIENCE

BOTANY

JODHPUR NATIONAL UNIVERSITY

JODHPUR

MSc BOTANY

PREVIOUS

PAPER I	**PLANT ECOLOGY**
PAPER II	**CYTOGENETICS**
PAPER III	**BIOLOGYAND DIVERSITY OF LOWER PLANTS CRYPTOGAMS**
PAPER IV	**TAXONOMY AND DIVERSITY OF SEED PLANTS**

FINAL

PAPER V	**MICROBIOLOGY AND PLANT PATHOLOGY**
PAPER VI	**PLANT DEVELOPMENT AND REPRODUCTION**
PAPER VII	**CELL AND MOLECULAR BIOLOGY OF PLANTS**
PAPER VIII	**BIOTECHNOLOGY, GENETIC ENGINEERING, PLANT BREEDING AND BIOMETRY**
PAPER IX	**INDUSTRIAL BASED ENVIRONMENTAL STUDIES**

PAPER I PLANT ECOLOGY

UNIT I

Climate, soil and vegetation patterns of the world: Life zones, major biomes, and major vegetation and soil types of the world. Environment– Holistic environment, factors and their interactions, animals and man.

UNIT II

Vegetation organization: Concepts of community and continuum, analysis of communities (analytical and synthetic characters), community coefficients, interspecific associations, ordination, concept of ecological niche. Vegetation development: Temporal changes (cyclic and non- cyclic), mechanism of ecological succession (relay floristic and initial floristic composition, facilitation, tolerance and inhibition models), changes in ecosystem, properties during succession.

UNIT III

Ecosystem organization: Stucture and functions, primary production (methods of measurement, global pattern, comtrolling factors), energy dynamics (trophic organization, energy flow pathways, ecological efficiencies), litter fall and decomposition (mechanism, substrate quality and climatic factors), global biogeochemical cycles of C, N, P and S, mineral cycles (pathways, processes, budgets) in terrestrial and aquatic ecosystems. Biological diversity : Concept and levels, role of biodiversity in ecosystem functions and stability, speciation and extinction, IUCN categories of threat, distribution and global patterns, terrestrial biodiversity hot spots, inventory.

UNIT IV

Air, water and soil pollution: Kinds, sources, quality parameters, effects on plants and ecosystems.Climate change : Greenhouse gases (CO_2, CH_4, N_2O, CFCs : sources, trends and role), ozone layer and ozone hole, consequence of climate change (CO_2 utilization, global warming, sea level rise, UV radiation), carbon sequenstration.

UNIT V

Ecosystem stability: Concept (resistance and resilience), ecological perturbations (natural and anthropogenic) and their impact on plants and ecosystems, ecology of plant invasion, environmental impact assessment, ecosystem restoration. Ecological management : Concepts, sustainable development, sustainability indicators, role of International Union for Conservation of Nature & Natural

Resources (IUCN), World Wide Fund for Nature (WWF), UNEP, UNESCO, IGBP etc.

Suggested Readings

1.Smith, R.L. 1996. Ecology and Field Biology, Harpr Collins, New York
2.Muller-Dombois, D. and Ellenberg, H., 1974. Aims and Methods of Vegetation Ecology, Wiley, New York.
3.Begon, M. Harper, J.L. and Townsend, C.R. 1996. Ecology, Blackwell Science, Cambrodge, U.S.A.
4.Ludwig. J. nad Reynolds, J.F. 1988, Statistical Ecology. John Wiley & Sons.
5.Odum, E.P. 1971. Fundamentals of Ecology, Saunders, Philadelphia.

PAPER II CYTOGENETICS

UNIT I

Chromatin organization: Chromosome structure and packaging of DNA, molecular organization of centromere and telomere, nucleolus and ribosomal RNA genes, euchrommatin and heterochromatin, karyotypes of chromosomes, polytene, lampbrush, B- chromosomes and sex chromosome, molecular basis of chromosome pairing.

Structural and numerical alterations in chromosomes: Origin, meiosis and breeding behaviour of duplication, deficiency, in version and translocation heterozygotes, Origin, occurrence, production and meiosis of haploids, aneuploids and euploids, origin and production of autopolyploids, chromosome and chromatid segregation, allopolyploids, types, genome constitution and analysis, evolution of major crop plants, induction and characterization of trisomics and monosomics.

UNIT II

Genetics of prokaryotes and eukaryotic organelles: Mapping the bacteriophage genome, phage phenotypes, genetic recombination in phage, genetic transformation, conjugation and transduction in bacteria, genetics transformation, conjugation and transduction in bacteria, genetics of mitochondria and chloroplasts, cytoplasmic male sterility.

UNIT III

Gene Structure and expression: Genetic fine structure, cis trans test, fine structure analysis of eukaryotes, introns and their significance, RNA splicing, regulation of gene expression in prokaryotes and eukaryotes, Panoply of operon, catabolite repression, attenuation and antitermination.

Mutations :Spontaneous and induced mutations, physical and chemical mutagens, molecular basis of gene mutation.

UNIT IV

Transposable elements in prokaryotes and eukaryotes, mutation induced by transposons, site- directed mutagenesis, DNA damage and repair mechanisms, inherited diseases and defects in DNA repair, initiation of cancer at cellular level, protooncogenes and oncogenes. Sex determination, sex linked inheritance, sex limited characters and sex reversal, multiple allele's and blood groups in man.

UNIT V

Alien gene transfer through chromosome manipulations: Transfer of whole genome, examples from wheat, Arachis and Brassica, transfer of individual chromosomes and chromosome segments, methods for detecting alien chromatin, production, characterization and utility of alien addition and substitution lines, genetic basis of inbreeding and heterosis, exploitation of hybrid vigour.

Suggested Readings

1.Albert B. Bray, D., Lewis, J., Raff, M., Robert, K. and Watson, J.D. 1989., Molecular Biology of the Cell (2nd edition), Garland Publishing Inc., New York.
2.Atherly, A.G., Girton, J.R. and McDonald, J.F. 199. The Science of Genetics. Saunders College Publishing, For Worth, USA.
3.Burnham, C.R. 1962. Discussions in Cytogenetics. Burgess Publishiong Co. Minnesota.
4.Busch, H. and Rothblum, J. 1982. Volume X. The Cell Nucleus rDNA Part. A. Academic Press.
5.Hartl, D.L. and Jones, E.W. 1998. Genetics : Principles and Analysis (4th edition). Jones & Bartlett Publishers, Massachusetts. USA.

PAPER III BIOLOGYAND DIVERSITY OF LOWER PLANTS CRYPTOGAMS

Unit I

Phycology : Algae in diversified habitats (terrestrial, freshwater, marine) thallus organization, cell ultrastructure, reproduction (vegetative, asexual, sexual) criteria for classification of algae; pigments, reserve food, flagellar, modern classification, salient features of Protochlorophyta,Chlorophyta, Charophyta, Xanthophyta, Bacillariophyta. Phaeophyta and Rhodophyta, with special reference to Microcystis, Hydrodictyon, Drapernaldiopsis, Cosmarium, algal blooms, algal biofertilizers: algae as food, feed and use in industry

Unit II

Mycology : General character of fungi, substrate relationship in fungi, cell ultrastructure, unicellular and multicellular organization, cell wall compsition, nutrition (sapropili, biotrophic, symbiotic), heterothallism, heterokaryosis, parasexuality, recent trends in classification, phylogeny of fungi.

Unit III

General account of Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina, with special reference to Pilobolus, Chaetomium, Morchella, Melampsora, Polyporus, Drechslera & Phoma, fungi in industry medicine and as food, fungal diseases in plants and humans, Mycorrhizae, fungi as biocontrol agents.

Unit IV

Bryophyta :Morphology, structure, reproduction and life history, distribution, classification, general account of Marchantiales, Jungermanniales, Anthocerotales, Sphagnales, Funariales and Polytrichales, with special reference to Plagiochasma, Notothylus and Polytrichum, economic and ecological importance.

Unit V

Pteriodophyta: Morphology, anatomy and reproductionl classification; evolution of stele; heterospory and origin of seed habit; general account of fossil pteriodophyta; introduction to Psilplosida, Lycopsida, Sphenopsida and Pteropsida; with special reference to Lycopodium, Gleichenia, Pteris, Isoetes & Ophioglossum.

PAPER IV TAXONOMY AND DIVERSITY OF SEED PLANTS

Unit I

Introduction: Gymnosperms, the vesselless and fruitless seed plants varying in the structure of their sperms, pollen grains, pollen germination and the complexity of their female gametophyte, evolution of gymnosperms. Classification of Gymnosperms and their Distribution in India. Economic Importance of Gymnosperms.

Unit II

Origin of intrapopulation variation: Population and the environment, ecads and ecotypes, evolution and differentiation of species, various models.

The species concept: Taxonomic hierarchy, species, genus, family and other categories, principles used in assessing relationship, delimitation of taxa and attribution of rank. Salient features of the International Code of Botanical nomenclature.

Unit III

Taxonomic evidence: Morphology, anatomy, palynology, embryology, cytology, phytochemistry, genome analysis and nucleic acid hybridization.
Taxonomic tools: Herbarium, floras, histological, cytological, phytochemical, serological, biochemical and molecular techniques computers and GIS.
Systems of angiosperm classification: Phenetic versus phylogenetic systems, cladistics in taxonomy, relative merits and demerits of major systems of classification, relevance of taxonomy to conservation.

Unit IV

Concepts of phytogeography:Endemism, hotspots and hottest hotspots, plant explorations, invasions and introductions, local plant diversity and its socio-economic importance.Sustainable utilization of bioresources.

Unit V

Phylogeny of Angiosperms: Ancestors of Angiosperms, time and place of origin of Angiospersms, Habit of Angiosperm, Primitive living Angiosperms, Interrelationship among the major groups of Angiosperms.

PAPER V MICROBIOLOGY AND PLANT PATHOLOGY

Unit I

Important landmarks in the history of microbiology arch-aebacteria and eubacteria: General account, ultrastructure, nutrition and reproduction, biology and economic importance, cyanobacteria- salient features and biological importance.
Viruses: Classification, characteristics and ultrastructure of isolation and purification of viruses, chemical nature, replication, transmission of viruses, cyanophages, economic importance.
Phytoplasma: General characteristics and role in causing plant diseases.

Unit II

Scope and application of microbes in agriculture, industry, pollution and biological control of pests. General account of immunity, allergy, properties of antigens antibodies. Antibody structure and function, affinity and anti body specificity.

Monoclonal antibodies and their uses, antibody engineering, serology, types of vaccines. Preliminary account of Biofilms, biochips, biosensors and biosurfactants.

Unit III

History and scope of plant patholog: General account of diseases caused by plant pathogens. Pathogen attack and defense mechanisms Physical, physiological, biochemical and molecular aspects.

Plant disease management: Chemical, biological, IPM systems, development of transgenics, biopesticides, plant disease clinics.

Unit IV

Symptomology, identification and management of following plant diseases.

Fungal diseases: Wheat (Rust, Smut, Bunt), Bajra (Greenear, ergot and smut), crucifer (rust). Paddy (Paddy blast), Cotton (Wilt), Grapes (Downy mildew and powdery mildew).

Unit V

Preliminary account of application of Biotechnology in plant pathology.Bacterial disease: Wheat (Tundu),Soft rot of vegetables.

Viral disease: Tobacco mosaic, Bhindi yellow mosaic.

Phytoplasma disease: Little leaf of brinjal.

Nematode disease: Root- knot of vegetables.

PAPER VI PLANT DEVELOPMENT AND REPRODUCTION

UNIT I

Introduction: Unique features of plant development, differences between animal and plant development.

Seed germination and seedling growth: Metabolism of nucleic acids, proteins and mobilization of food reserves, tropisms, hormonal control of seedling growth, gene expression, use of mutants in understanding seedling development.

UNIT II

Root development: Organization of root apical meristem (RAM), cell fates and lineages, vascular tissue differentiation, lateral roots, root hairs, root- microbe interactions.

Shoot development: Organization of the shoot apical meristem (SAM), cytological and molecular analysis of SAM, control of cell division and cell to cell communication, control of tissue differentiation, especially xylem and phloem,

secretory ducts and laticifers, wood development in relation to environmental factors.
Leaf growth and differentiation: Determination, phyllotaxy, control of leaf form, differentiation of epidermis (with special reference to stomata and trichomes) and mesophyll.

UNIT III
Reproduction :Vegetative and sexual reproduction, flower development, genetics of floral organ differentiation, homeotic mutants in Arabidopsisand Antirhinum, sex determination.
Male gametophyte: Structure of anthers, microsporogenesis, role of tapetum, pollen development and gene expression, male sterility, sperm dimorphism and hybrid seed production, pollen germination, pollen tube growth and guidance, pollen storage, pollen allergy, pollen embryos.
Female gametophyte: Ovule development, megasporogeneis, organization of the embryo sac, structure of the embryo sac cells

UNIT IV
Pollination, pollen- pistil interaction and fertilization: Floral characteristics, pollination mechanisms and vectors, breeding systems, commercial considerations, structure of the pistil, pollen- stigma interactions, sporophytic and gametophytic self incompatibility (cytological, biochemical and molecular aspects), double fertilizatiom, in- vitro fertilization.

UNIT V
Latent life– dormancy: Importance and types of dormancy, seed dormancy, overcoming seed dormancy, bud dormancy.3
Senescence and programmed cell death (PCD): Basic concepts, types of cell death, PCD in the life cycle of plants, metabolic changes associated with senescence and its regulation, influence of hormones and environmental factors of senescence.

PAPER VII CELL AND MOLECULAR BIOLOGY OF PLANTS

Unit I
The dynamic cell: Structural organization of the plant cell, specialized plant cell types, chemical foundation, biochemical energetics.
Cell wall: Structure and functions, biogenesis,growth.
Plasma membrane: Structure, models and functions, sites for ATPases, ion carriers, channels and pumps, receptors.