J.S. UNIVERSITY
MAINPURI ROAD, SHIKOHABAD (FIROZABAD)

REVISED SYLLABUS

SESSION-2017-2018

M.Sc.

DEPARTMENT OF BOTANY

Vision of Department

Students are able to reach on top position after completing B.Sc., M.Sc. and research work in the field of Botany and play important role in development of country.

Mission of Department

To offer basic, competitive, modern, wide, skill oriented, quality education of theoretical and practical field of diversity of morphology, anatomy of reproductive and vegetative parts of plants, cytology, genetics, physiology, ecology, economic botany, biotechnology, genetic engineering, taxonomy and molecular pathology of plants and develop quality of social awareness, faithfulness, honesty and uplift to scholar for facing challenges in life easily and carve their own future. Efforts for research in taxonomical and ecological and other fields are also done.

Program Educational Objectives (PEO's) -

PEO1: Students will inculcate strong fundamentals on modern and classical aspects and develop a conceptual understanding of the principles and importance of the subject. Students would be benefited with the knowledge of core subjects like plant diversity, plant diseases and their management, conservation techniques, plant taxonomy, ecology and environment, plant tissue culture, functional plant physiology, biochemistry, molecular biology and plant biotechnology and genetics and cytogenetic etc. which are offered in these courses and would help to enable students to choose research for their career development.

PEO2: Students will learn about different laboratory techniques for the detailed study of plant cell structure, modes of reproduction, anatomy, breeding techniques, plant tissue culture, plant stress management through physiological tools like PGRs and nutrient management. Maintain a high level of scientific excellence through selection and application of appropriate research techniques, resources and modern technology in multidisciplinary mode. Students will learn about designing experiments, data recording, analysis and its interpretation to reach to a substantial conclusion.

Programme Outcomes (POs) – After completing Master of Science in Botany, the students are able to;

Po1 - Critical Thinking – Take informed action after identifying assumptions that frame our thinking and action, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational and personal) from different perspectives.

PO2 - Effective communication – Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language and make meaning of the world by connecting people, ideas, books, media and technology.

PO3 - Social Interaction – Elicit views of others, mediate disagreements and help reach conclutions in group settings.

PO4 – Develop a conceptual understanding of principles and importance of Botany. Students would be benefited with knowledge of core subjects like plant diversity, physiology and biochemistry, cytogenetics, molecular biology, plant development, biotechnology and genetic engineering and molecular plant pathology etc. which are offered in these subjects modules.

Floristic, phytosociological taxonomical, ecological and medicinal plants studies would make them obtain skills that help in doing research.

PO5 – Learn about practical technique in lab for detail study of plants cell structure, reproduction, anatomy, breeding procedures for hybridization. Maintain a high level of scientific excellence in botanical research with specific emphasis on the role of plants. Creat, select and apply appropriate techniques, resources and modern technology in multidisciplinary way. Practice of subject with knowledge to design experiments, analyze and interpret data to reach to an effective conclusion.

PO6 – They would identify, formulate and analyze the complex problems with reaching a substantial conclusion. Logical thinking with application of biological, physical and chemical sciences. Learning that develops analytical and integrative problem- solving approaches.

PO7 – Students would perform functions that demand higher competence in national/ international organizations with sporty and helping sprits. Prepare the students for many competitive exams like UPSC, NET, SET, IFS.

PO8 – Best problem – solving skills in students would encourage them to carry out innovative research projects thereby making them to use knowledge creation in depth. Enable the students to be resourceful in identifying the plants.

PO9 – Knowledgeable, disciplined students with good values, ethics and kind heart will help in nation building globally. Students should be aware of ethical issues and regulatory considerations while addressing society needs for growth with honesty.

M. Sc. Previous

Class – M.Sc (Previous)
Subject Name - Botany
Subject code - 05
Paper Number – I
Paper name – Cell and Molecular Biology of Plants
Paper code – MSBO-101

Course Outcomes (COs): After completion of this course students will be able to;

CO-1: Demonstrate the knowledge of common and advanced. Laboratory practices in cell and Molecular biology.

CO-2: Exhibit clean and concise communication of scientific data.

CO-3: Describe Basic methods in cell biology- relate basic knowledge in cell and molecular biology to bioinformatics, immunology, micro biology and Molecular Medicine.

CO-4: Integrate basics Knowledge in cell and Molecular biology with the other disciplines in cell and Molecular biology.

CO-5: Utilize the scientific vocabulary used in communicating information in cell and molecular biology.

SYLLABUS

- **The dynamic cell** – Structural organization of the plant cell. Specialized DNA plant cell types; chemical foundation; biochemical energetic.
- **Cell Wall-** Structure and functions; biogenesis; growth.
- **Plasma membrane–** Structure; model and functions; sites for ATPases, Ion carriers, channels and pumps; receptors.
- **Plasmodesmata –** Structure; role in movement of molecules and macromolecules; comparison with gap junctions.
- **Chloroplast–** Structure; genome organization; gene expression; RNA editing; nucleo-chloroplastic interactions.
- **Mitochondria –** Structure; genome organization; biogenesis.

- **Plant vacuole –** Tonoplast membrane; ATPases; transporters; as storage organelle.
- **Nucleus –** Structure, nuclear pores; nucleoside organization; DNA Structure; A, B and Z Form; replication, damage and repair, transcription; plant promoters and transcription factors; splicing; RNA transport; nucleolus; rRNA biosynthesis.
- **Ribosomes –** Structure site of protein synthesis; mechanism of translation, initiation, elongation and termination; structure and role of tRNA.
- **Protein sorting –** Targeting of protein to organelles.
- **Cell shape and motility–** The Cytoskeleton; organization and role of microtubules and microfilaments; motor movements; implication in flagellar and other movements.
- **Cell cycle and apoptosis–** Control mechanisms; role of cyclin and cyclin-dependent kinases; retinoblastoma and E2F proteins; cytokines is and cell plate formation; mechanisms of programmed cell death.
- **Other cellular organelles–** Structure and functions of microbodies, Golgi apparatus, lysosomes, endoplasmic reticulum.
- **Techniques in cell biology–** Immunotechniques; in-situ hybridization to locate transcripts in cell types; FISH; GISH confocal microscopy.

Class – M.Sc (Previous)
Subject Name - Botany
Subject code - 05
Paper Number – II
Paper name – Cytology, Genetics & Cytogenetics
Paper code – MSBO-102

Course Outcomes (COs): After completion of this course students will be able to;

CO-1: Understand the Structure and organization of cell and cell membrane.
CO-2: Explain the cell cycle and cell division (mitosis and meiosis).
CO-3: Understand Mendelian and Neo-mendelian genetics.
CO-4: Define and explain gene structure and expression.
CO-5: Understand the phenomenon of genetic/chromosome mapping.
CO-6: Understand the different types of genetic interaction, incomplete dominance, co-dominance, inter allelic genetic interactions, multiple alleles and quantitative inheritance etc.

SYLLABUS

Cytology:

- **Chromatin Organization-** Chromosome structure and packaging of DNA, Molecular organization of centromere and heterochromatin; karyotype analysis; banding patterns; karyotype evolution; specialized type of chromosomes; polytene, lampbrush, B-chromosomes and sex chromosomes; molecular basis of chromosome pairing.
- **Structural and Numerical alterations in chromosomes-** Origin, meiosis and breeding behavior of duplication deficiency, inversion and translocation heterozygote; 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 plant; induction and characterization of trisomics and monosomics.

Genetics

- **Genetics of prokaryotes and eukaryotic organelles-** Mapping the bacteriophage genome; phage phenotypes; genetics recombination in phage; genetic transformation, conjugation and transduction in bacteria, genetics of mitochondria and chloroplasts; cytoplasmic male sterility.
- **Gene Structure and expression-** Genetics fine structure; cis-trans test; fine structure analysis of eukaryotes; introns and their significance; RNA splicing; regulation of gene expression in prokaryotes and eukaryotes.

Mutations

- Spontaneous and induced mutation; physical and chemical mutagens, molecular basis of gene mutation; transposable elements in prokaryotes and eukaryotes; mutations induced by transposons; site-directed mutagenesis, DNA damage and repair mechanisms; inherited human diseases and defects in DNA repair; initiation of cancer at cellular level proto-oncogenes and oncogenes.

Cytogenetics

- **Cytogenetics of aneuploids and structural heterozygote-** Effect aneuploids on phenotype in plants; transmission of monosomics and trisomics and their use in chromosome mapping of diploid and polyploidy species; breeding behavior and genetics of structural heterozygotes; complex translocation heterozygotes; translocation tester sets; Robersonian translocation; B-A translocations.

- **Molecular cytogenetics-** Nuclear DNA content; C-value paradox; cot curve and its significance; restriction mapping – concept and techniques; multigene families and their evolution in gene or chromosomes; computer assisted chromosome analysis; chromosome microdissection and micro-cloning; flow cytometry and confocal microscopy in karyotype analysis.

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.

Class – M.Sc (Previous)
Subject Name - Botany
Subject code - 05
Paper Number – III
Paper name – Biology and Diversity of Lower Plants: Cryptogams
Paper code – MSBO-103

Course Outcomes (COs): After completion of this course students will be able to;

CO-1: To understand about bacteria, virus, and phytoplasma.
CO-2: To understand evolution from bacteria to Pteridophyte.
CO-3: To know diversity from bacteria to pteridophyte.
CO-4: To explain variation among algae, fungi, bryophytes and pteridophytes.
CO-5: To describe importance of bacteria, virus algae, fungi, bryophytes and pteridophytes.
CO-6: To gain knowledge about pigments of algae, algal blooms, algal bifertilizers and heterothallism, heterokaryosis, parasexuality of fungi.
CO-7: To know role of phytoplasma in causing plant diseases.
CO-8: To understand evolution of stele, heterospory, seed habit and fossil of pteridophytes.

SYLLABUS
Microbiology

- **Bacteria–** Origin and specific characteristics, classification, detailed structure, types,bacterial genome and plasmid, nutrition and nitrogen cycle, reproduction, life cycle, techniques in sterilization, bacterial culture and staining, economic importance of bacteria.
- **Virus–** Origin and specific characters of viruses, classification of virus, structure of virus, DNA and RNA viruses, nomenclature, viral genom, serology and electron microscopy,TMV structure, electromicroscopic structure and molecular composition of bacteriophase, replication, transmission and symptoms of viral infection, structure and multiplication of viroid and prion, diseases of viroid and prion.
- **Phytoplasma**– General characteristics and role in causing plant diseases.
- **Phycology–** Algae in diversified habitats (terrestrial, fresh water, marine): thallus organization ; cell ultra-structure; reproduction (vegetative, asexual ,sexual) criteria for classification of algae; pigments, reserve food, flagella; classification, salient features of protochlorophyta, chlorophyta, charophyta, xanthophyta, bacillariophyta, phaephyta and rhodophyta; algal blooms, algal bifertilizers, algae as food, feed and use in industry.
- **Mycology–** General characters of fungi; classification of fungi, cell ultrastructure; unicellular and multicellular organization; cell wall composition; nutrition (saprobic, biotrophic, symbiotice), reproduction (vegetative, asexual, sexual); heterothallism; heterokaryosis; parasexuality; structure of mushroom and their types, cultivation of mushroom, gereral account of mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deteromycotina; fungi in industry, medicine and as food; fungal disease in plants and humans; mycorrhizae; fungi as bio–control agents.
- **Bryophyta–** Morphology, structure, reproduction and life history : distribution, classification; general account of Marchantiales, Junger- maniales, Anthoceratales, Sphagnales, Funariales and Polytrichales; economic and ecological importance.
- **Pteridophyta–** Morphology, anatomy and reproduction; classification, evolution of stele; heterospory and origin of seed habit; general account of fossil pteridophytes; introduction to Psilopsida, Lycopsida, Sphenopsida and Pteropsida.

Class –M.Sc. Previous
Subject Name – Botany
Subject Code – 05
Paper number – IV
Paper Name – Taxonomy and Diversity of Seed Plants
Paper Code – MSBO - 104

Course Outcomes (COs): After completion of this course students will be able to;

CO-1: Gain adequate knowledge on comparative gymnosperms

CO-2: Gain adequate knowledge of comparative angiosperms

CO-3: Understand the system of classification of angiosperms

CO-4: Give a fundamental knowledge of endemism, hotspot and hottest hotspots.

SYLLABUS

- **Gymnosperms:** Introduction : Gymnosperms, the vessel-less 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. Brief account of the families of Pteriodospermales (Lyginopteridaceae, Medullosaceae, Caytoniacease and Glossopteridaceae).
- **General Account of Cycadeoidales and Cordaitales:** Structure and reproduction in Cycadales, Ginkgoales, Coniferales, Ephedrales, Welwitchiales and Gnetales.
- **Origin of Intra population variation:** Population and the environment ecads and ecotypes; evolution and differentiation of species – various models.
- **The species concept:** Taxonomic hierarchy, species, genius 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.

- **Taxonomic evidence:** Morphology, anatomy, Polynology, 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, sustainable utilization of bio-resources and ecosystem research.
- **Concepts of phytogeography:** Endemism, hotspots and hottest hotspots; plant exploration; invasions and introductions; local plant diversity and its socio-economic importance.

Class – M.Sc. Previous
Subject Name – Botany
Subject Code – 05
Paper Number –V
Paper Name – Plant Physiology and Metabolism
Paper Code – MSBO – 105
Course Outcomes (COs): After completion of this course students will be able to;

CO-1: Understand the principles of thermodynamics and chemical potential.

CO-2: Demonstrate detailed understanding of the mechanism regulatory and actives sites, Iso

enzymes.

CO-3: Explain cellular establishment of membrane potential and its role in solute transport.

CO-4: Present relationship of complementary metabolic pathway such as photosynthesis and respiration in energy acquisition and use during plant development.

SYLLABUS

- **Energy flow:** Principles of thermodynamics free energy and chemical potential, redox reaction, structure and functions of ATP.
- **Fundamentals of enzymology:** General aspects allosteric mechanism, regulatory and actives sites, isozymes, kinetics of enzymatic catelysis, Michaelis-Menten equation and its significance.
- **Membrane transport and translocation of water and solutes:** Plant- water relatioins, mechanism of water transport through xylem, root-microbe interactions in facilitating nutrient uptake, comparison of xylem and phloem transport, phloem loading and unloading. passive and active solute transport, membrane transport proteins.
- **Photochemistry and Photosynthesis:** General concepts and historical background, evolution of photosynthesis apparatus. photosynthetic pigments and light harvesting complexes. photooxidation of water, mechanisms of electron and proton and its significance, the C_4 cycle, the CAM pathway, biosynthesis of starch and sucrose, physiological and ecological considerations.
- **Respiration and lipid metabolism:** Overview of plant respiration, glycolysis, the TCA cycle, electron transport and ATP synthesis pentose phosphate pathway, glyoxylate cycle, alternative oxidase system, structure and function of lipids, fatty acid biosynthesis, synthesis of membrane lipids, structural lipids and storage lipids, and their catabolism.
- **Nitrogen fixation, nitrogen and sulfur metabolism:** Overview, biological nitrogen fixation, nodule formation and nod factors, mechanism of nitrate uptake and reduction, ammonium assimilation, sulfate, uptake, transport and assimilation.
- **Sensory photobiology:** History of discovery of phytochromes and cryptochromes, and their photochemical and biochemical properties, photo-physiology of light-induced responses, cellular localization molecular mechanism of action of photo-morphogenic receptors, signaling and gene expression.
- **Plant growth regulators and elicitors:** Physiological effect and mechanism of action of auxins, gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, polymines, jasmonic acid and salicylic acid hormone receptor, signal transduction and gene expression.
- **The flowering process:** Photoperiodism and its significance. endogenous clock and its regulation, floral induction and development genetic and molecular analysis, role of vernalization.

- **Stress physiology:** Plant responses to biotic and a biotic stress, mechanism of biotic and abiotic stress tolerance, HR and SAR, water deficit and drought resistance. Salinity stress, metal toxicity freezing and heat stress, oxidative stress.

M.Sc. Final Year

Class – M.Sc. Final
Subject Name – Botany
Subject Code – 05
Paper number – VI
Paper Name – Plant Development and Reproduction
Paper Code – MSBO –201

Course Outcomes (COs): After completion of this course students will be able to;

CO-1: Identity plant vegetative and reproductive structure.

CO-2: Understand basic principles, processes and functions of plants growth and reproduction, fertilization and Fruit Formation.

CO-3: Identify development of male and female gamete formation.

CO-4: Know the processes to maintain the genetics of living plant.

CO-5: Understand to keep the plants valuable

SYLLABUS

- Unique feature of plant development; Epigenesis; specification, determination.
- **Seed germination and seedling growth:** Metabolism of nucleic acid, proteins, and mobilization of food reserves; tropisms; hormonal control of seedling growth; gene expression; use of mutants in understanding seedling development.
- **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 secretary ducts and laticifers; wood development in relation to environmental factors.
- **Leaf growth and differentiation:** Determination; phyllotaxy; control of leaf from; differentiation of epidermis (with special reference to stomata and trichomes) and mesophyll.
- **Root development:** Organization of root apical meristem (RAM); cell fates and lineages; vascular tissue differentiation; lateral roots; hairs, root-microbe interactions.
- **Reproduction:** Apomixis and sexual reproduction; flower development; genetics of floral organ differentiation; homeotic mutants in *Arabidopsis* and *antirrhinum;* 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; megasporogenesis; organization of the embryo sac, structure of the embryo sac cells. 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 fertilization; in vitro fertilization.
- **Seed development and fruit growth:** Endosperm development during early. Maturation and desiccation stages; embryogenesis. ultra structure and nuclear cytology; cell leneages during late embryo development; storage proteins of endosperm and embryo; polyembryony; apomixes; embryo culture dynamic of fruit. growth; biochemistry and molecular biology of fruit maturation.
- **Latent life-dormancy:** Importance and types of dormancy; seed dormancy; overcoming seed dormancy bud dormancy.
- **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 on

senescence.

Class – M.Sc. Final
Subject Name – Botany
Subject Code – 05
Paper number – VII
Paper Name – Plant Ecology
Paper Code – MSBO –202

Course Outcomes (COs): After completion of this course students will be able to;
CO-1: Know about the inter relationship between living world and environment.
CO-2: Explain about the effect of different abiotic factor in living system.
CO-3: Understand about the fundamental aspect of ecosystem.
CO-4: Describe the organization of ecosystem.
CO-5: Understand the concept of community and ecological succession.
CO-6: Have knowledge of biological diversity in different ecosystems.

SYLLABUS

- **Climate, Soil and vegetation patterns of the world –** Life zones; major biomes and major vegetation and soil types of the world.
- **Vegetation organization –** Concepts of community and continuum; analysis of communities (analytical and synthetic characters); mechanism of ecological succession (relay floristic and initial floristic composition; facilitation, tolerance and inhibition models); changes in ecosystem properties during succession.
- **Ecosystem organization –** Structure and function; primary production (methods of measurement, global pattern, controlling factors); energy dynamics (tropic organization, energy flow pathways, ecological efficiencies); litter fall and decomposition (mechanism, substrate quality and climate factors); global biogeochemical cycles of C, N, P and S; mineral cycles (pathways; processes, budgets) in terrestrial and aquatic ecosystems.
- **Biological diversity –** Concepts 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.
- **Air, water and soil pollution –** Kinds; sources; quality parameters; effects on plants and ecosystems.
- **Climate change –** Greenhouse gases (CO2, NH4, N2O, CFCs: sources trends and role); ozone layer and ozone hole; consequences of climate change (CO2 fertilization global warming, sea level rise, UV radiation).

- **Ecosystem stability –** Concept (resistance and re-silence); 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.

Class – M.Sc. Final
Subject Name – Botany
Subject Code – 05
Paper number – VIII
Paper Name – Plant Resource Utilization and Conservation
Paper Code – MSBO –203

Course Outcomes (COs): After completion of this course students will be able to;
CO-1: To understand the concept of plant biodiversity in general.
CO-2: To know the basic concepts of sustainable development.
CO-3: To gain knowledge on world centre of plant diversity of domesticated plants.
CO-4: To understand the benefits and consequences of green revolution.
CO-5: To know the concepts of In-situ and Ex-situ conservation.

SYLLABUS

- **Plant Biodiversity –** Concept, status in India, utilization and concerns.
- **Sustainable development** – Basic concepts.
- **Origin of agriculture.**
- **World centre of primary diversity of domesticated plants –** The Indo-Burmese centre; plant introductions and secondary centre.

- Origin, evolution, botany, cultivation and uses of; (i) Food, forage and fodder crops, (ii) fibre crops (iii) medicinal and aromatic plants, and (iv) vegetable oil-yielding crops.
- Important fire-wood and timber-yielding plants and non-wood forest products (NWFPs) such as bamboos, rattans, raw materials for paper-making, gums, tannins, dyes, resins and fruits.
- **Green revolution –** Benefits and adverse consequences.
- **Innovations for meeting world food demands –** Plant used as avenue trees for shade, pollution control and aesthetics. Principle of conservation; extinctions; environment status of plants based on International Union for Conservation of Nature.
- **Strategies for conservation in situ conservation –** International efforts and Indian initiatives protected areas in Indian sanctuaries, national parks, biosphere reserves, wetlands, mangroves and coral reefs for conservation of wild biodiversity.
- **Strategies for conservation ex situ conservation –** Principle and practices; botanical gardens, fields gene banks, seed banks, in vitro repositories, cryobanks; general account of the activities of Botanical survey of India (BSI), National Bureau of Plant Genetic Resources (NBPGR) Indian Council of Agricultural Research (CSIR), and the Department of Biotechnology (DBT) for conservation, non-formal conservation efforts.

Class – M.Sc. Final
Subject Name – Botany
Subject Code – 05
Paper number – IX
Paper Name – Biotechnology and Genetic Engineering of Plant and Microbes
Paper Code – MSBO –204

Course Outcomes (COs): After completion of this course students will be able to;
CO-1: Define biotechnology, provide examples of biotechnology products.
CO-2: Know about the genomic organization or living organisms.
CO-3: Know about the Genetic Engineering.
CO-4: Obtain knowledge about the mechanism and essential component required for prokaryotic DNA replication.
CO-5: Understand the fundamentals of Recombinant DNA Technology.
CO-6: Understand the principle and basic protocols for Plant Tissue Culture.

SYLLABUS

- **Biotechnology –** Basic concepts, principles and scope.
- **Plant cell and Tissue Culture –** General introduction history scope, concept of cellular differentiation, totipotency.

- **Organogenesis and adventives embryogenesis –** Fundamental aspects of morphogenesis: Somatic embryogenesis and androgenesis, mechanisms, techniques and utility.
- **Somatic hybridization –** Protoplast isolation, fusion and culture, hybrid selection and regeneration, possibilities, achievements and limitations of protoplast research.
- **Application of plant tissue culture –** Clonal propagation, artificial seed, production of hybrids and somaclone, production of secondary metabolites/natural products, cryopreservation and germplasm storage.
- **Recombinant DNA Technology –** Gene cloning principles and techniques, construction of genomic/cDNA libraries, choice of vectors, DNA synthesis and sequencing, polymerase chain reaction, DNA fingerprinting.
- **Genetic engineering of plants –** Aims, strategies for development of transgenic (with suitable examples), Agrobacterium – the natural genetic engineer. T-DNA and transposon mediated gene tagging, chloroplast transformation and its utility, Intellectual property rights, possible ecological risks and ethical concerns.
- **Microbial genetic manipulation –** Bacterial transformation, selection of recombinants and transformants, genetic improvement of industrial microbes and nitrogen fixers, fermentation technology.
- **Genomics and proteomics –** Genetic and physical mapping of genes, molecular markers for introgression of useful traits, artificial chromosomes, high throughput sequencing, genome projects, bioinformatics, functional genomics microarrays, protein profiling and its significance.

Class – M.Sc. Final
Subject Name – Botany
Subject Code – 05
Paper number – X
Paper Name – Molecular Plant Pathology
Paper Code – MSBO –205

Course Outcomes (COs): After completion of this course students will be able to;

CO-1: Apply the methodologies to be used in molecular plant pathology.

CO-2: Identify pathogenicity and process of infection.

CO-3: Focused on solving issues related to plant pathology based on the molecular background.

CO-4: Understand and utilize their knowledge in different areas of pathology.

SYLLABUS

- **Rise and development of plant pathology:** The science of plant pathology, History of plant pathology, Modern plant pathology, Dependence of plant pathology on other botanical science, Importance of plant diseases and their effect on human affairs, Plant pathology in the twenty first century General principles of plant pathology.

- **Nature and concepts of plant diseases:**

Classification of plant diseases based on spread and severity of infections, Disease classified according to major Factors (Bacteria Mycoplasma, Viruses Fungi and Nematodes), Definition, Symptoms and classification of diseases Parasitism and pathogenicity.

Important diseases of plants of economic importance and their disease cycle

a) Bacteria
b) Fungus
c) Nematode
d) Mycoplasma

Koch's postulates

- **Pathogenesis / host pathogen relationship:**
  1. Dispersal of plant pathogens infection process.
  2. Effect of environment on disease development.
  3. Survival of plant pathogens effect of infection on physiology of the host.
  4. Role of toxins in plant pathogenesis.
  5. Defense mechanism in host plant (phytoalexins etc.)
  6. Epidemiology

- **Seed Pathology:**
  1. Seed borne pathogens
  2. Seed borne diseases
  3. Infection process factors effecting
  4. Transmission
  5. Control measures

- **Plant Diseases Management:**
  1. Cultural practices
  2. Biological methods
  3. Bio-pesticides
  4. Biocides

5. Fungicides
6. Chemotherapy
7. Insecticides
8. Developing diseases resistant varieties
9. Legislation
10. Quarantine law
11. Seed certification
12. Disease forecasting
13. Strategies of diseases of management and plant protection