OFFICE, PRINCIPAL GOVERNMENT TULSI COLLEGE, ANUPPUR

Affiliated to Awadhesh Pratap Singh University Rewa (MP)

Registered Under Section 2 (F) & 12 (B) of UGC Act

E-mail: hegtdcano@mp.gov.in ☎9893076404

M.Sc. Botany Course Outcome

M.Sc. Botany

COURSE OBJECTIVE:-

The program of M.Sc. Botany is designed with an objective to encourage and support the growing demands and challenging trends in the educational scenario. The program focuses on the all-round development of the students to face the competitive world. The objectives of the program are as follows:

- To understand the scope and significance of the discipline.
- To imbibe love and curiosity towards nature through the living plants.
- To make students open-minded and curious, we try our best to enhance and develop a scientific attitude.
- To make the students exposed to the diverse life forms.
- To make them skilled in practical work, experiments, laboratory equipment and to interpret correctly on biological materials and data.
- To encourage the students to do research in related disciplines.
- To develop the ability of the students to transform the society through their education.
- To acquaint the students about the methods used in the maintenance of different natural resources.
- Critical Thinking: to include creative thinking, innovation, inquiry and analysis, evaluation and synthesis of information.
- Topics include the study of plant form, function and reproduction, and an overview of plant diversity including bryophytes, ferns, and seed plants.

Programme Outcome (M.Sc. Botany)

1. Students have understood the scope and significance of the program.
2. Students have developed the scientific temperament after completion of the program. 3. Students have developed the skills to identify different types of plants.
4. Students have developed the skills to do laboratory work from different equipments. 5. Students have developed the skills related to scientific research in the area of Botany.
6. Students are ready to transform the society and can explain the importance of different plants to human beings.

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Programme Specific Outcome (M.Sc. Botany)

- Describe the evolution, anatomy, morphology, systematic, genetics, physiology and ecology of plants.
- The ecological and evolutionary features of the flora and fauna in environment
- Knowledge about identify and analyze scientific problems and environmental issues using oral and written communication skills.
- Knowledge about the continually developing and is dynamic; students can find new scientific information and compare it with existing information.
- Describe how all scientific knowledge is continually developing and is dynamic; students can find new information and compare it with existing information COURSE

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M. Sc. Botany (Semester System)
First Semester
Course BOT PG 101 BIOLOGY AND DIVERSITY OF VIRUS, BACTERIA AND FUNGI

COURSE OBJECTIVES:

To acquaint the students about the morphology, characters and importance of different microorganisms

Syllabus

- Viruses: General account, ultrasturcture, purification, replication, transmission and economic importance of viruses.
- Archaebacteria and Eubacteria: General account; ultrastructure, nutrition and reproduction; biology and economic importance.
- Cyanobacteria : salient features and biological importance.
- Classification of bacteria, Actinomycetes, Mycoplasma, Rickettsiae, Chlamydiae and their significance.
- Fungi: General Characters, Classification, cell ultrastructure, nutrition, reproduction, parasexuality, recent trends in classification and economic importance of fungi.
- General account of different groups and type study of fungi as - Mastigomycotina , Zygomycotina, Ascomycotina, Basidiomycotina & Deuteromycotina.
- Fungi in industry, medicine and as food. fungul diseases in plants and humans. Mycorriza; fungi as biocontrol agents.

COURSE OUTCOMES:-

To acquaint the students about the morphology, characters and importance of different microorganisms The course will enable students to know about different types of microorganisms viz. Bacteria, Viruses, Fungi and Cyanobacteria.

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M. Sc. Botany (Semester System)
First Semester
Course BOT PG 102 Biology & Diversity of Algae, Bryophytes and Pteridophytes

COURSE OBJECTIVES:

To acquaint the students about the morphology, biology and importance of algal organisms, Bryophytes, Peridophytes.

Syllabus

- Algae in diversified habitats; thallus organization; cell ultrastructure; reproduction; criteria for classification of algae, pigments, researve foods, flagella; classification.
- Salient features of Protochlorophyta, charophyta, chlorophyta, xanthophyta, bacillariophyta, phaeophyta and rhodophyta; algal blooms; algal biofertilizers; algae as food, feed and industrial uses.
- Morphology, structure, reproduction and life history of bryophyta; distribution, classification, general accounts of marchantiales, jungermeniales, anthocerotales, sphagnales, funariales and polytrichales; ecological and economic importance.
- Morphology, anatomy, reproduction and life history of pteridophyta; classification, evolution of stele, heterospory and origin of seed habits.
- Introduction to psilopsida, sphenopsida and pteropsida.

COURSE OUTCOMES:-

The course will enable students to know the earlier plants, their vegetative and reproductive structures and their importance.

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M. Sc. Botany (Semester System)
First Semester
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COURSE OBJECTIVES:

To acquaint the students about the morphology, biology and importance of algal organisms, Bryophytes, Peridophytes.

Syllabus

- Algae in diversified habitats; thallus organization; cell ultrastructure; reproduction; criteria for classification of algae, pigments, researve foods, flagella; classification.
- Salient features of Protochlorophyta, charophyta, chlorophyta, xanthophyta, bacillariophyta, phaeophyta and rhodophyta; algal blooms; algal biofertilizers; algae as food, feed and industrial uses.
- Morphology, structure, reproduction and life history of bryophyta; distribution, classification, general accounts of marchantiales, jungermeniales, anthocerotales, sphagnales, funariales and polytrichales; ecological and economic importance.
- Morphology, anatomy, reproduction and life history of pteridophyta; classification, evolution of stele, heterospory and origin of seed habits.
- Introduction to psilopsida, sphenopsida and pteropsida.

COURSE OUTCOMES:-

The course will enable students to know the earlier plants, their vegetative and reproductive structures and their importance.

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M. Sc. Botany (Semester System)
First Semester
Course BOT PG 103 Biology & Diversity of Gymnosperms

COURSE OBJECTIVES:

To acquaint the students about the morphology, biology and importance of gymnosperms

Syllabus

- Introduction: Gymnosperms, the vesseless and fruitless seed plants; evolution of gymnsperms; complexity of female gametophytes.
- Classification of gymnosperms and their distribution in India. Economic importance of gymnosperms.
- Gerenal account of pteridospermales, cycadeoidales and cordaitales.
- Structure, reproduction and interrelationships of cycadales, ginkgoales and coniferales.
- Structure, reproduction and interrelationships of ephedrales, welwitschiales and gnetales

COURSE OUTCOMES:-

The course will enable students to know the earlier plants, their vegetative and reproductive structures and their importance.

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M. Sc. Botany (Semester System)
First Semester
Course PG 104: Plant Ecology

COURSE OBJECTIVES:

To Distinguish between species, populations, communities, ecosystems biomes and Understand the factors that affect population size, density, distribution, and dynamics.

Syllabus

- **Population Ecology**: Ecology & ecosystem: Definitions, Organization and components, Population & Environment; Population ecology, density & distribution, Natality, Mortality, Survivorship curves, Age structure & pyramids, Fecundity schedules, Life tables; Population growth . exponential and logistic curves; Intra specific competition and self regulation; r-and k-strategists.
- **Community organization**: Concepts of community and continuum; Analysis of community analytical and synthetic characters, Community coefficients and indices of diversity, interspecific association negative and positive associations; Concept of ecological niche; Concepts of biodiversity; evolution and differentiation of species . allopatric & sypatric speciation; ecads and ecotypes.
- **Ecosystem development and stability**: Temporal changes cyclic and non cyclic; Succession processes & types; Mechanism of succession facilitation, Tolerance and inhibition models; Concept of climax persistence resilience and resistance; Ecological perturbation natural and anthropogenic, Ecosystem restoration.
- **Fate of energy in ecosystems**: Trophic organization and structure, Food chains & webs; energy flow pathways, Ecological efficiencies consumption, assimilation and production trophic; Primary production methods of measurement, Global patterns, Limiting factors.
- **Fate of matter in ecosystems**: Recycling pathways; Relationship between energy flow and recycling pathways; Nutrient exchange and cycling; Global biogeochemical cycles of C, N, P and S; Physical, chemical and Biological characteristics of soil.

COURSE OUTCOMES:-

By understanding the concepts of ecological principles and environmental issues, the student will be able to develop attitude, value system and ethics towards environment related issues.

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M. Sc. Botany (Semester System)
Second Semester
Course PG 201: Plant Development & Reproduction

COURSE OBJECTIVES:

To enable the students:

- To understand the development of SAM and RAM.
- To understand the Mechanism of Leaf growth and differentiation.
- To understand the Mechanism of Flower Development and Sexual Reproduction.
- To understand the Principles and Mechanisms of Flora Charecteristics and Fruit Growth.

Syllabus

- Unique features of plant development; differences between animal and plant development. Organization of shoot apical meristem (SAM); control of tissue differentiation, especially xylem and phloem; secretory ducts and laticifers. Wood development in relation to environmental factors.
- Leaf growth and differentiation. Organization of root apical meristem (RAM); cell fates and lineages; vascular tissue differentiation; lateral roots; root hairs. Root . microbe interaction.
- Vegetative options and sexual reproduction; flower development; genetics of floral organ differentiation; homeotic mutants in *Arabidiopsis* and *Antirrhinum*; sex determination. Structrue of anthers, microsporogenesis, role of tapetum, pollen development and gene expression.
- Male sterility; pollen germination, pollen tube greet and guidance. Pollen storage, pollen allergy and pollen embryos. Ovule development, megasporogenesis; organization of embryo sac; structure of embryo sac cells.
- Flora characterisitics; pollination mechanisms and vectors; breeding systems; structure of pistil; pollen stigma interactions; sporophytic and gametophytic self-incompatibility. Double fertilization. Endosperm development during early, maturation and dessication stages; embryogenesis; storage proteins of endosperms and embryo. Polyembryoni, apomixis. Dynamics of fruit growth; biochemistry and molecular biology of fruit maturation.

COURSE OUTCOMES:-

On completion of this course, the students will be able to:

- Understand the various developments of SAM and RAM .
- Describe the mechanism of Leaf growth and differentiation.
- Understand the Mechanism of Flower Development and Sexual Reproduction.
- Understand the Principles and Mechanisms of Flora Charecteristics and Fruit Growth.

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M. Sc. Botany (Semester System)
Second Semester
Course PG 202: Morphology & Taxonomy of Angiosperms

COURSE OBJECTIVES:

1. To understand the various kinds of plants on the surface of earth with their names, affinities, geographical distribution, habit characteristics and their economic importance.
2. To understand the diversities of plant kingdom and their relation to evolution of plants. A systematic reconstruction of plant kingdom can be made only after the complete knowledge of the individual plants.
3. To understand the various aspects of plant nomenclature, classification and Taxonomic Tools.
4. To understand the classical and modern trends of Angiosperm taxonomy
5. To understand the salient features of angiosperm families

Syllabus

- Morphology of stamens and carpels; carpel evolution. Morphology of inferior ovary; placentation types and their origin.
- The species concept: taxonomic hierarchy; species, genus, family and other categories; principles used in assessing relationships, delimitation of taxa and attribution of rank. Salient features of Interantional code of Botanical Nomenclature.
- Taxonomic evidence: morphology, anatomy, palynology, embryology, cytology, phytochemistry, genome analysis and nucleic acid hybridization. Relevance of taxonomy to conservation.
- Taxonomic tools: herbarium, floras, histological, cytological, phytochemical, serological, biochemical and molecular techniques; Computers and GIS. Local plant diversity and its socio-economic importance.
- Systems of angiosperm classification: phenetic versus phylogenetic systems; cladistics in taxonomy; relative merits and demerits of major systems of classification. Endemism, hot spots, hottest hot spots; plant explorations; invasions and introductions.

COURSE OUTCOMES:-

On completion of this course, the students will be able to:

• Acquire basic skills on the plant taxonomy with special reference to Angiosperms.

• Illustrate the types; merits and demerits of various system of classification.

• Identify the angiosperms families with specific key characters; learn various advanced tools to study plant taxonomy.

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M. Sc. Botany (Semester System)
Second Semester
Course PG 203: Utilization & Conservation of Plant Resources

COURSE OBJECTIVES:

To enable the students:

- To understand the threats of air, soil and water pollution
- To understand the economic importance of different plants
- To understand the various threats of biodiversity and the strategies for conservation

Syllabus

- **Plant Biodiversity**: Major Biomes of the world, Tropical rain & Seasonal Forests, Temperate rain & Seasonal forests, Boreal forests, Grasslands, Deserts; Aquatic Ecosystems, wetlands, Lakes & Ponds Streams & Rivers, Marine & Estuarine habitats.
- **Sustainable Development**: Resource utilization; Status & Utilization of Biodiversity; Sustainable development and utilization of resources from forest, Grassland and aquatic habitats; Food forage, Fodder, Timber & Non-wood forest products; Threats to quality & quantity of Resources due to overexploitation.
- **Strategies for conservation of resources**: Classifications of resources; Principles of conservation; *In-situ* conservation, sanctuaries, National parks, Biosphere reserves for wildlife conservation; Habitat conservation practices of conservation for forests, ranges, soil and water; Ex-situ conservation, botanical gardens, field gene banks, seed banks, in vitro repositories, cryo-banks.
- **Pollution & Climate Change**: Air, Water and Soil pollution, Kinds, Sources, Quality parameters, Effects on structure & function of ecosystems; Management of pollution; Bioremediation; Climate changes sources, Trends & role of greenhouse gases, Effect of global warming on climate, Ecosystem processes & Biodiversity; Ozone layer & Ozone hole.
- **Resource monitoring**: Remote sensing concepts & Tools, Satellite remote sensing basics sensors, Visual & digital interpretation, EMR bands and their applications; Indian remote sensing program; Thematic mapping of resources; Application of remote sensing in Ecology & Forestry.

COURSE OUTCOMES:-

On completion of this course, the students will be able to:

- Understand the various uses of plants; biodiversity status, loss and management strategies.
- Describe economically important plants with binomial names, family and uses.
- Analyse the biogeography, status and loss of biodiversity, initiatives for biodiversity conservation.

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M. Sc. Botany (Semester System)
Second Semester
Course PG 204 : Cell Biology of Plants

COURSE OBJECTIVES:

1. Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles
2. Students will understand how these cellular components are used to generate and utilize energy in cells
3. Students will understand the cellular components underlying mitotic cell division.
4. Students will apply their knowledge of cell biology to selected examples of changes or losses in cell function.
5. Students will learn the basic principles of inheritance at the molecular, cellular and organismal levels.

Syllabus

- Structural organization of the plant cell; specialized plant cell types. Structure and functions of cell wall; biogenesis; growth. Cytoskeleton: organization and role of microtubules and microfilaments; motor movements.
- Plasma membrane: structure, models and functions; sites for ATPases; ion carriers, channels and pumps; receptors. Structure of plasmodesmata, role in movement of molecules; comparison with gap junctions.
- Cholorplast: structure, genome organization, gene expression, nucleo-chloroplastic interactions; mitochondira: structure, genome organization, biogenesis. Plant vacuoles: tonoplast membrane, ATPases, trasporters, as storage organelle. Other cell organelles: golgi apparatus, lysosomes, endoplasmic reticulum.
- Nucleus: structure. Cell cycle: control mechanisms; role of cyclins and cyclindependent kinases; mechanisms of programmed cell death. Chromosome structure and packaging of DNA; euchromatin and heterochromatin; karyotype analysis and evolution; banding patterns; specialized types of chromosomes.
- Origin, meiosis and breeding behaviour of duplication, deficiency, inversion and translocation heterzygotes; origin, occurrence, production and meiosis of haploids, aneuploids and euploids; Origin and production of autopolyploids. Allopolyploids; types, genome constitution and analysis.

COURSE OUTCOMES:-

After completing this course, the students will be able to:

1. Understand and Describe the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles
2. Understand and Describe how these cellular components are used to generate and utilize energy in cells
3. Understand the cellular components underlying mitotic cell division.
4. Students will apply their knowledge of cell biology to selected examples of changes or losses in cell function.
5. Students will learn the basic principles of inheritance at the molecular, cellular and organismal levels.

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M. Sc. Botany (Semester System)
Third Semester
Course PG 301 : Plant Physiology

COURSE OBJECTIVES:

- Demonstrate an understanding of how water moves in plants at both molecular and organismal levels.
- Use simple laboratory skills in scientific measurements.
- Write a scientific research paper.
- The field of plant physiology includes the study of all the internal activities of plants- those chemical and physical processes associated with life as they occur in plants.
- A program that focuses on the scientific study of the cell and molecular plant biology and physiology, water relations and transpiration and mineral nutrition, especially nitrogen metabolism.
- Fundamental processes as plant hormone functions. During this course you also will learn how plant growth and development and their tropisms, nastic movements, photoperiodism, photomorphogenesis, circadian rhythms under different environmental conditions.
- .
- Understand how to apply the basic concepts of Plant Physiology in other disciplines of agriculture.
- To understand, to know and discuss the concept of physiological processes of plants.
- Understand the importance of mineral nutrition and transpiration of plant organisms.
- To understand and explain the processes of Stress physiology, growth and development of plants.

Syllabus

- Principles of thermodynamics, free energy and chemical poetential, redox reactions, structure and functions of ATP, Plant water relations, mechanisms of water transport through xylem, root-microbe interactions in facilitating nutrient uptake. Membrane transport proteins.
- Phloem transport; phloem loading and unloading, passive and active solute transport. Signal transduction; overview, receptors andg proteins, phospholipids singaling, role of cyclic nucleotides, calcium-calmodulin cascade. Specific signaling mechanisms, for example, two-component sensor regulator system in bacteria and plants. Sucrose-sensing mechanism.
- Plant growth regulators and elicitors: Physiological effects andmechanism of action of auxins, gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, polyamines, jasmonic acid, and salicylic acid. Hormone receptors, singal transduction and gene expression.
- Flowering process: photoperiodism and its significance, endogenous clock and its regulation. Floral induction and development. Phytochromes and cryptochromes, their photochemical and biochemical properties. Molecular mechanism of action of

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photomorphogenetic receptors, signaling and gene expression. Role of vernalization.

- Stress physiology: Plant responses to biotic and abiotic stress. Water deficit and drought resistance. Salinity stress and resistance. Concepts of freezing, heat and oxidative stresses.

COURSE OUTCOMES:-

1. Understand how to apply the basic concepts of Plant Physiology in other disciplines of agriculture.
2. To understand, to know and discuss the concept of physiological processes of plants.
3. Understand the importance of mineral nutrition and transpiration of plant organisms.
5. To understand and explain the processes of growth and development of plants.
5. To understand and explain the processes of Stress physiology of plants.

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M. Sc. Botany (Semester System)
Third Semester
Course PG 302 : Plant Biochemistry & Metabolism

COURSE OBJECTIVES:

- Demonstrate an understanding of the biochemical processes of photosynthesis, glycolysis, citric acidcycle, and electron transport.
- Use simple laboratory skills in scientific measurements.
- Write a scientific research paper.
- chemical and physical processes associated with life as they occur in plants.
- A program that focuses on the scientific study of the cell and molecular plant biology and mineral nutrition, especially nitrogen metabolism.
- Fundamental processes such as photosynthesis, respiration, enzymes and Lipid Functions.
- Identify the organs and tissue systems of plants, and explain their respective functions.
- Understand and describe the distribution of metabolic processes in the cell.
- Understand the importance of Enzymes,Lipid,Nitrogen,photosynthesis and respiration of plant organisms.
- To understand and explain the processes of growth and development of plants..

Syllabus

- Fundamentals of enzymology: general aspects, allosteric mechanism, regulatory and actice sites, isozymes, kinetics of enzymatic catalysis, Michaelis- Menten equation and its significance, Mechanism of enzyme action.
- Photochemistry and photosynthesis: General concepts and historical background, evolution of photosynthetic apparatus, photosynthetic pigments and light .harvesting complexes. Photooxidation of water, mechanism of electron and proton transport, Carbon assimilation; Calvin cycle, photorespiration and its significance, C4-cycle, CAM pathway, physiological and ecological considerations. Biosynthesis of starch and sucrose.
- Respiration and lipid metabolism: Overview of plant respiration, glycolysis, TCA cycle, electron transport and ATP synthesis. Oxidative pentose phosphate pathway, glyoxylate cycle, alternative oxidase system.
- Structure and functions of lipids, fatty acid biosynthesis, synthesis of membrane lipids, structural lipids and storage lipids and their catabolism. Sulphate uptake, transport and assimilation.
- Nitrogen fixation, nitrogen and sulphur metabolism: Overview, biological nitrogen fixation, nodule formation and nod factors. Mechanism of uptake and reduction, ammonium assimilation.

COURSE OUTCOMES:-

- To understand, to know and discuss the concept of Metabolical processes of plants.
- Understand and describe the distribution of metabolic processes in the cell.
- Understand the importance photosynthesis, respiration, enzymes and Lipid Functions.
- Also the role of enzymes in it and mechanism of photosynthesis, respiration, nitrogen and lipid metabolism.
- The students are able to isolate starch, pectine and various nutritive products from the plants.
- Qualitative and quantification of the plant contents and its biochemistry and mode mechanism of synthesis etc.

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M. Sc. Botany (Semester System)
Third Semester
Course PG 303 : Genetics & Cytogenetics

COURSE OBJECTIVES:

- To understand the concepts and details of heredity and variation at molecular and cellular levels.
- Deals with more recent development which have taken place in the field of genetics besides providing introduction to methods of plant breeding of improvement of crop plants with respect to --
- Genetics of prokaryotic and eukaryotic organelles
- Chromatin organization
- Structural and Numerical alterations in chromosomes
- Mutation
- DNA Damage and repair mechanism
- Cytogenetics of aneuploids and structural heterozygotes:

Syllabus

- Genetics of prokaryotes and eukaryotic organelles; genetic recombination in phage; mapping the bacteriophage genome; genetic transformation, conjugation and transduction in bacteria. Genetics of mitochondria and chloroplasts; cytoplasmic male sterility.
- Genetic recombination and genetic mapping; Recombination, independent assortment and crossing-over, molecular mechanism of recombinatio. Chromosome mapping, linkage groups, genetic markers, construction of molecular maps, somatic cell genetics- an alternative approach to gene mapping.
- Mutations: spontaneous and induced mutations, physical and chemical mutagens, molecular basis of gene mutations. Transposable elements in prokaryotes and eukaryotes. Mutations induced by transposons, site-directed mutagenesis. DNA damage and repair mechanisms.
- Cytogenetics of aneuploids and structural heterozygotes, effect of aneuploidy on phenotype in plants, transmission of monosomics and trisomics and their use in chromosome mapping of diploid and polyploidy species. Complex translocation heterozygotes. Robertsonian translocations. 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. Transfer of whole genome, examples from wheat and *Brassica;* genetic basis of inbreeding and heterosis; exploitation of hybrid vigour.

.COURSE OUTCOMES:-

After successful completion of this course, students will be able to:

- Know about the induction of polyploidy in plants using colchicines, methods of application of colchicine.
- Isolation of biochemical mutants following physical and chemical mutagenic
- Isolation of chlorophyll mutants following physical and chemical mutagenic treatments.
- Isolation of morphological mutants following physical and chemical mutagenic treatments.
- Karyotype analysis , Meiosis of complex translocation heterozygotes.
- Meiotic behaviour of monosomy, trisomy in plants and its effect.
- Chromosomal behaviour in mutagen treated plants.
- Chromatin organization, Structural and Numerical alterations in chromosomes

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M. Sc. Botany (Semester System)
Third Semester
Course PG 304 : Molecular Biology of Plants

COURSE OBJECTIVES:

To enable the students:

- An in-depth study on Structure and organization of D.N.A., Replication Process, Transcription process, protein synthesis and Translation process.
- To expose the students on the understanding of various techniques of gene mapping, Protein sorting, Cell Cycle and its molecular aspects, Restriction mapping Laboratory Techniques and Immunotechniques.

Syllabus

- DNA structure; A, B and Z forms; replication; damage and repair; transcription; plant promoters and transcription factors; splicing; messenger RNA transport; ribosomal RNA biosynthesis.
- 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.
- Ribsosomes: structure and site of protein synthesis; mechanism of translation, initiation, elongation and termination; structure and role of transfer RNA; protein sorting; targeting of proteins to organelles.
- Cell cycle and apoptosis, control mechanisms; role of cyclins and cyclin dependent kinases; retinoblastoma and E2F proteins; cytokinesis and cell plate formation; mechanism of programmed cell death.
- Immunotechniques, In situ hybridization . concepts and techniques, physical mapping of genes on chromosomes. In situ hybridization to locate transcript in cell types; FISH; Flow cytometry and confocal microscopy.

COURSE OUTCOMES:-

- On completion of this course, the students will be able to:
  - Understand in-depth knowledge on Molecular Biology.
  - Understand in detailed mechanisms of DNA Replication.
  - Understand the overall concepts of Transcription, Translation.
  - Understand the process of Mapping and sequencing of genome
- Conversant with Laboratory Techniques *viz.* Microscopy, SEM & TEM,
- Ultracentrifugation, FISH and Immunochemical techniques. The flow cytometry and confocal microscopy in karyotype analysis.
- Isolation of plant DNA and its quantification.

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M. Sc. Botany (Semester System)
Fourth Semester
Course PG 401 : Plant Cell, Tissue & Organ Culture

COURSE OBJECTIVES:

- To develop understanding of techniques for tissue culture, cell culture and organ transplantation.
- Explain the various components of plant tissue culture media, e.g. minerals, growth factors, hormones, and what governs the choice of components.
- Explain the various steps taken to establish and optimise media for particular purposes in particular species.
- Establish and maintain plants in tissue culture and micropropagation, including morphogenesis.
- Explain the various cell lines used in tissue culture and their origins and uses:

Syllabus

- Plant cell and tissue culture: general introduction, history, scope, concept of cellular differentiation and totipotency.
- Techniques of tissue culture. Organ culture . meristem, anther and embryo. In vitro fertilization.
- Organogenesis and adventive 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 and achievements and limitations of protoplast research.
- Application of plant tissue culture; clonal propagation; artificial seeds; production of hybrids, somaclones and somaclonal variation; production of secondary metabolites natural products; cryopreservation and germplasm storage.

COURSE OUTCOMES:-

After successful completion of this course, students will be able to:

- Know about Equipment's required in Tissue culture Lab.
- Media preparation techniques for different plants.
- Sterilization techniques for media as well as for explants.
- Explant Culture.- Anther culture Pollen culture, Micropropagation. Embryo rescue technique.
- Somaclonal variation. *In vitro* mutation. Isolation of plant protoplasts and viability testing.
- Protoplast fusion techniques.
- Tissue culture of important Horticultural, medicinal plants.

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M. Sc. Botany (Semester System)
Fourth Semester
Course PG 402 : Biotechnology & Genetic Engineering

COURSE OBJECTIVES:

Provides a detailed view of the visualizing concepts and technique for genetic engineering and biotechnology.

Syllabus

- Biotechnology and Genetic Engineering: basic concepts, principles and scope. Intellectual Property Rights . possible ecological risks and ethical concerns.
- 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 transgenics (with suitable examples); *Agrobacterium* . the natural genetic engineer; T-DNA and transposon mediated gene tagging; chloroplast transformation and its utility.
- Microbial genetic manipulation; bacterial transformation; selection of recombinants and transformants; genetic improvements 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.

COURSE OUTCOMES:-

- Discuss the different applications of biotechnology
- Understand the importance of cells to genetic engineering.
- Know the natural function of restriction endonucleases and how a normal bacterial cell protects its DNA from their activity.
- Describe techniques used to characterize DNA and Axenic culture of cell.

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M. Sc. Botany (Semester System)
Fourth Semester
Course PG 403 : Elective I
Industrial Microbiology

COURSE OBJECTIVES:

Understanding the concept of :
basic microbiology, food microbiology, fermentation and various fermentation techniques. Detection and assay of fermentation products. Recovery of minerals by using microbes and Water quality in industry.
Biological waste management -Objectives of Biological treatment, Biochemical Oxygen Demand (BOD).

Syllabus

- Basic techniques in microbiology - Microscopy, staining techniques, Culture, Nutrition and growth of microorganisms. Replication and structure of viruses & other a cellular microorganisms, prokaryotic microorganisms, classification and diversity of Bacteria, Eukaryotic microorganisms.
- Food Microbiology: Food spoilage, Food preservation methods, Microbiological production of food such as fermented products, alcoholic beverages, vinegar. Fermented vegetables. Single cell protein production in industry, fermented dairy products and uses.
- Fermentation Industry: Selection of micro-organisms, Techniques and quality control, Production of antibiotics, steroids, Human proteins, Vaccines and vitamins. Survey of microorganisms of industrial uses. Production of organic acids, amino acids, Enzymes, Solvents and fuels.
- Recovery of minerals by using microbes, Oil recovery, Biodeterioration, Mushroom culture, Biotech products including human insulin, Microbial Growth-Environmental influences, Physical control, Chemical control & Antibiotic controls.
- Water quality in industry: Bacteriological safety of potable water, water quality analysis, importance of BOD. Biodegradation of wastes and pollutants, Primary, Secondary and Tertiary Sewage treatments.

COURSE OUTCOMES:-

After completion of the course the students are able to –

- Handle instruments related to fermentation.
- Screening of fungi for acid, alcohol and various organic acid Production.
- Design the media for fermentation.
- Application and management of industrial effluents.
- Student learns the water microbiology, potable water and sewage disposal and industrial base of microbes, production of antibiotics, steroids, Human proteins, Vaccines and vitamins etc.

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M. Sc. Botany (Semester System)
Fourth Semester
Course PG 404 : : Elective II
Plant Protection

COURSE OBJECTIVES:

To introduce concepts and principles of plant protection. Understanding the concept of pests, remote sensing and method of plant protection. Study of various pathogens as Fungal, Bacterial and viral with disease cycle, interaction between plant and pathogen, mechanism of disease development by pathogens.

Syllabus

- History and development of Plant Protection Science. General Idea about the following pests:
  1. Insects as pests of Gram, Soyabean and Teak
  2. Weeds: Parthenium, Waterhyacinth and Cuscuta.
  3. Remote sensing in plant protectoin.
- Fungi as Plant Pathogens: General idea about causal organisms, Symptoms and disease cycles of following fungal diseases. collar rot, Damping off of seedlings, Late blight of Potato, Downy Mildew of Grapes, Powdery mildew of Wheat, Smut of Wheat, Rust of Wheat, Wilt of Arhar, Anthracnose of Soyabean, Tikka disease of Groundnut. General idea about the Problems of post harvest storage due to fungi and insects.
- General idea about causal organism, Symptoms and disease cycle of following diseases.
  1. Bacterial Diseases. Citrus canker, Blight of Paddy.
  2. Viral diseases. Tobacco mosaic, Yellow vein mosaic of Bhindi, Bunchy of banana. Transmission of virus.
  3. Mycoplasma Grossy shoot disease of Sugarcane, Little leaf of Bringal.
  4. Nematodes: Root knot of vegetables.
- Chemical Methods of plant protection types of chemical/formulations/Application methods and problems in environment. Cultural methods: Sanitation, Crop rotation and seed materials. Use of resistance varieties. Legislative methods : Plant Quarantine.
- Biological Plant Protection: Use of biological pesticides from microbes (Fungi, Bacteria and viruses). Brief idea of management of Insects and Plant diseases (I.P.M.).

COURSE OUTCOMES:-

After completing this course.

- Students will know about concept of diseases, knowledge and awareness of diseases, causal agents of plant diseases, identification methods and management of crop diseases.
- This subject is based on the study of plant pathogens and the concept of disease in plants. Importance of plant disease. Student gain the knowledge and become a plant pathologist. .
- Student increase the knowledge of about the Principles and methods of plant disease control, Control through regulatory methods: Plant quarantine, cultural and biological methods of control, control through physical means, chemical method for plant disease control: Fungicides, chemotherapy and use of resistant varieties.
- Students learns and also performs the dissertation about the study of importance, symptoms, causal organism, disease cycle and control of following diseases of crop plants caused by fungi, bacteria, viruses, micoplasma and nematodes.

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M. Sc. Botany (Semester System)
Fourth Semester
Course PG : Project work/Dissertation work

COURSE OBJECTIVES

- Each student complete a dissertation on a topic mutually agreed between him/her and a faculty member, who asks as a mentor.
- The objective is to train students in basics of research, literature recession, analysis and expression of their understanding of the topic in their own words.
- To create research oriented thought process and basic training

List of suggested Project work/Dissertation work

The following is the list of the proposed areas of dissertation/ project work. The concerned university and college may encourage the students to undertake project work in collaboration with industrial and research organizations.

1. Plant Biodiversity Assessment
2. Conservation of Endangered Species
3. Inventroization of Unexplored Areas and Hotspots
4. Pollution Monitoring
5. Survey of Less-known Economic Plants of India
6. Chromosome Analysis and Indexing of Indian Flora
7. Bioremediation of Xenobiotics
8. Exploitation of Secondary Metabolites
9. Extraction of Allelochemicals
10. Tissue Culture of Economic Plants
11. Assessment of Pollution Toxicity by Bioassay
12. Microbial proteins
13. Enzymes
14. Cosmetic Products from microbes and plants
15. Nutraceuticals from microbes and plants
16. Pharmaceutical Products
17. Ethnobotany
18. Chemotaxonomy
19. Cladistics
20. Protein Profiling
21. DNA Fingerprinting
22. Microarrays
23. FISH (Fluorescent In Situ Hybridization)
24. Mutation
25. Plant Hormones and Growth promoters
26. Bioinformatics
27. Application of PCR
28. Somatic Hybridization
29. Biofertilizers and Bioinoculants
30. Transgenics
31. Exploitation of Rhizospheric microbes including mycorrhizae
32. Recycling of domestic, municipal and industrial wastes
33. Vermicomposting and Biomethanation
34. Environmental Monitoring
35. Assessment of Pollution in different habitats

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COURSE OUTCOMES

- On completion of the research project the students will be able to-
- Design the experiments of his interest and execute it
- Trained in handling of the basic and advance instruments
- Generate the data, compile and analyze and interpret the data.
- Presentation skill is developed in the students
- The student is ready to work in any R&D setup
- Student will be able to choose the career as per their interest.
- Student will get experience of working in Department/ Institutes/ industry/ laboratory etc.
- Student will be able to work independently.
- Students will get confidence in public speaking.
- Students will be able to make presentation and express their views.
- The personality of students will improve.

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