Government College (Autonomous), Rajamahendravaram

I M.Sc., (Botany) - Semester- I (w.e.f.2024-25)

Core Course -1: Diversity of Cryptogams and Gymnosperms

Hrs./Semester: 45 **Credits: 3**

Unit-1: Diversity of Algae

1. General characters; R.E. Lee (2008) classification of Algae.
2. Habitat, range of thallus, cell structure, reproduction, and life cycles of the following algalclasses:
   (a) Cyanophyceae (b) Rhodophyceae (c) Bacillariophyceae
   (d) Xanthophyceae (e) Phaeophyceae (f) Chlorophyceae
3. Ecological and economic importance of algae.

Unit-2: Diversity of Bryophytes

1. General characters; Crandall-Stotler & Stotler (2000) classification of Bryophyta
2. General account of the following orders:
   (a) Marchantiales (b) Jungermanniales (c) Anthoceratales (d) Brylaes
3. Evolution of gametophytes; evolution of sporophytes
4. Ecological and economic importance of Bryophytes

Unit-3: Diversity of Pteridophytes

1. General characters; Cronquist et al. (1986) classification of Pteridophyta.
2. General account of the following classes:
   (a) Psilopsida (b) Lycopsida (c) Sphenopsida (d) Pteropsida
3. Telome concept, evolution of stele; evolution of sori; heterospory and seed habit
4. Ecological and economic importance of Pteridophytes
5. Fossil pteridophytes (*Rhynia*, *Horneophyton* and *Cladoxylon*)

Unit-4: Diversity of Gymnosperms

1. General characters; Kramer and Green (1990) classification of Gymnosperms
2. General account of vegetative, anatomical, reproductive structures, and evolutionarytrends of the following classes:
   (a) Cycadopsida (b) Ginkgopsida (c) Coniferopsida (d) Gnetopsida
3. Ecological and economic importance of Gymnosperms.
4. General account of fossil gymnosperms (Cycadofilicales, Caytoniales, Pentoxylales)

Government College (Autonomous), Rajamahendravaram

I M.Sc., (Botany) - Semester- I (w.e.f.2024-25)

Core Course -2: Angiosperm Systematics and Biodiversity

Hrs./Semester: 45 **Credits: 3**

Unit-1: Introduction to systematics

1. Significance of plant systematics: Plant identification, classification, nomenclature. Fieldinventory.
2. Functions of Herbarium; Important herbaria and botanical gardens of the world and India;Virtual herbarium; E-flora;
3. Documentation: Flora, Monographs, Journals; Keys: Single access and Multi-access.
4. Taxonomic hierarchy: Concept of taxa (family, genus, species); categories and taxonomichierarchy; species concept (taxonomic, biological, evolutionary).

Unit-2: Nomenclature and biometrics

1. Botanical nomenclature: Principles and rules (ICN-2017); Ranks and names; Typification, author citation, valid publication, rejection of names, the principle of priority and its limitations; Names of hybrids.
2. Brief account of Angiosperm Phylogeny Group (APG IV) classification.
3. Biometrics, numerical taxonomy, and cladistics: Characters; Variations; OTUs, character weighting, and coding; Cluster analysis; Phenograms, cladograms (definitions and differences).
4. Origin and evolution of angiosperms; Methods of illustrating the evolutionary relationship(phylogenetic tree, cladogram).

Unit-3: Angiosperm systematics

1. Characteristic features, interrelationships, economic importance, and classification as perAPG-IV of the following groups and families:
   (a) ANA grade: Amborellaceae, Nymphaeaceae, Austrobaileyaceae
   (b) Magnoliids: Magnoliaceae; Monocots: Araceae; Commelinoids: Arecaceae
   (c) Eudicots: Papaveraceae, Core Eudicots: Amaranthaceae
   (d) Eurosids-I: Malpighiaceae; Eurosid-II: Malvaceae
   (e) Asterids: Sapotaceae; Euasterids-I: Gentianaceae, Acanthaceae; Euasterid-II:Apiaceae, Asteraceae.

Unit-4: Biodiversity

1. Mega diversity countries, the magnitude of biodiversity; direct, indirect, and ethical valuesof biodiversity; loss of biodiversity, reasons for loss of biodiversity.
2. Endemism: Definition and types; plant endemism in India with special emphasis on the Western Ghats; RED list categories of IUCN, Hot spots and Hottest hotspots,Keystone and Flagship species.
3. Biodiversity of India, Hotspots of plant diversity in India.
4. Principles of Biodiversity Conservation; *In situ* (sanctuaries, national parks, conservationreserves, community reserves, biosphere reserves, wetlands, Mangrove forests and coral reefs) and *Ex-situ* (Botanical gardens, gene banks, seed banks, pollen bank, cryobanks) conservation.

Government College (Autonomous), Rajamahendravaram

I M.Sc., (Botany) - Semester- I (w.e.f.2024-25)

Core Course -3: Biomolecules and Cell Biology

Hrs./Semester: 45 **Credits: 3**

Unit-1: Primary metabolites

1. Carbohydrates: Classification, physicochemical properties; chemistry, biological roles andstructure of polysaccharides.
2. Amino acids: Classification, structure, and physicochemical properties; Peptide bond,peptides of biological importance.
3. Conformation of proteins (Ramachandran plot, secondary structure, domains, motif andFolds), denaturation of proteins.
4. Lipids: Classification; Structure, properties and biological roles of Phospholipids andSphingolipids; Fatty acids and their physicochemical properties; Fats and Waxes - Physicochemical properties and characterization of fats and oils.

Unit-2: Nucleic acids

1. Nucleic acids: Bases, Nucleosides, Nucleotides; Nucleotides as energy carriers, enzyme co-factors, and chemical messengers; synthetic nucleotide analogs; chemical synthesis ofoligonucleotides.
2. Structure of DNA and different types of DNA, Supercoiled DNA; Structure of RNA, anddifferent types of RNA.
3. Physicochemical properties of nucleic acids: Denaturation and renaturation kinetics ofnucleic acids - melting temperature, Cot curves.
4. Structure and properties of Porphyrins- Heme, Chlorophylls, Bacterio-chlorophylls andCytochromes.

Unit-3: Plant cell and organelles

1. General account of plant cell structure and its organization.
2. Structural organization and the functions of cell wall and intracellular organelles (nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids,vacuoles, chloroplast).
3. Plasma membrane: Structure, models and functions, sites for ATP ion carriers, channels andpumps, receptors, transport.
4. Plasmodesmata: structure, role in the movement of molecules; Cell shape and motility: Thecytoskeleton, organization and role of microtubules and microfilaments, motor movements.

Unit-4: Cell cycle, signaling and communication

1. Cell division: Mitosis and meiosis; Cell cycle: Cell cycle control system, cell cyclecheckpoints, Cyclin-dependent kinases, and cyclins.
2. Cell signaling: Hormones and their receptors, cell surface receptors, signaling through G-protein-coupled receptors. Signal transduction pathways, secondary Messengers.
3. Regulation of signaling pathways, Two-component systems of signaling: Bacterial and plant, light signaling in plants.
4. Cellular communication: General principles of cell communication, Cell adhesion and role of different adhesion molecules, Gap junctions, Extracellular matrix and integrins; Cell apoptosis: Intrinsic and extrinsic pathways.

Government College (Autonomous), Rajamahendravaram

I M.Sc., (Botany) - Semester- I (w.e.f.2024-25)

Skill Oriented Course -1: Applied Mycology

Hrs./Semester: 45 **Credits: 3**

Unit-1: Economic value of fungi

1. General characteristics of fungi; Application of fungi in food industry (flavour and texture, fermentation, baking, mycoproteins)
2. A general account of edible fungi (mushrooms, truffles, puff-balls, and morels-medicinal and nutraceutical value).
3. Important metabolites (industrial alcohol, organic acids, beer) from fungi; fungal pigments and dyes.
4. Industrial chemicals from fungi: antibiotics, steroid transformation, enzymes, amino acids, growth regulators, vitamins.
5. Fungi as biofertilizers; fungi as biological control agents (mycofungicides, mycoherbicides,mycoinsecticides, myconematicides)

Uni-2: Fungal diseases and their management

1. Major fungal diseases of crops, their symptoms, and management.
2. Major diseases of human beings and animals caused fungi, their diagnosis and treatment; mycotoxins
3. Fungi in deterioration of food and leather; fungal degradation of wool and woods.
4. Fungi in deterioration of wall paints, sceneries, heritage buildings and statues, and clothes.
5. Myco-remediation of pollutants, oil spill cleanup (*Aspergillus terreus*).

Unit-3: Fungal technologies

1. Food processing by fungi: bread, cheese, oriental food and baker's yeast.
2. Cultivation of button mushroom and milky mushroom; preparation of value added products.
3. Scope and techniques of fungal biotechnology.
4. Bioplastics: Polyhydroxyalkanoates (PHAs) (*Mucor circinelloides, Aspergillus terreus*); mycelium-based bioplastics: (*Ganoderma lucidum, Pleurotus ostreatus*); Chitosan from fungal cell walls (*Aspergillus niger, Rhizopus oryzae*).

Unit-4: Fungal cultures and molecular

1. Common culture media for fungi and sterilization techniques.
2. Morphological and cultural characteristics of fungi; isolation and culturing of fungi; establishing a pure culture, aseptic technique.
3. Maintenance of culture collection; culture collection and identification centres.
4. Biochemical approaches and use of electrophoresis (Agarose and PAGE) for fungal taxonomy.
5. Molecular approaches in fungal taxonomy (RFLP, RAPD, ITS, PCR, microsatellites etc.,)

Government College (Autonomous), Rajamahendravaram

I M.Sc., (Botany) - Semester- I (w.e.f.2024-25)

Skill Oriented Course -2: Instrumentation techniques in Plant Sciences

Hrs./Semester: 45 **Credits: 3**

Unit I: Microscopic techniques **12 Hrs.**

1. Bright field Microscopy: Objectives, eyepiece, condenser; characteristics of lenses- resolution, magnification, numerical aperture, focal length, working distance, depth of focus.
2. Theory, principle, apparatus, methods and applications of:
   (a) Dark Field Microscopy, (b) Phase Contrast, (c) Fluorescence Microscopy,
   (d) Electron Microscopy: SEM and TEM

Unit II: Chromatography techniques **10 Hrs.**

1. Theory, principle, apparatus, methods and applications of:
   (a) Paper chromatography, (b) Thin Layer Chromatography (TLC),
   (c) Soxhlet extraction, (d) Gas Chromatography (GC)

.

Unit III: Electrophoretic and centrifugation techniques **14 Hrs.**

1. Theory, principle, apparatus, methods and applications of:
   (a) Paper Electrophoresis, (b) Poly Acrylamide Gel Electrophoresis (PAGE),
   (c) Agarose Gel Electrophoresis
2. Centrifuge machine types and centrifugation: Differential, Rate zonal, Density gradient, Rotor types and Ultra centrifugation.

Unit IV: Spectroscopic techniques **8 Hrs.**

1. Principle, working, instrumentation and applications of:
   (a) Colorimetry, (b) Flame photometry, (c) Visible spectrophotometry,
   (d) UV/Vis spectrophotometry, (e) Fourier Transform Infrared Spectroscopy (FTIR).

Government College (Autonomous), Rajamahendravaram

I M.Sc., (Botany) - Semester- II (w.e.f. 2024-25)

Core Course - 4: Plant Developmental Biology

Hrs./Semester: 45 **Credits: 3**

UNIT I: Root and shoot development **10 Hrs.**

1. Plant growth kinetics and patterns of growth; Seedling growth: Tropisms; Photomorphogenesis of seedling; hormonal control of seedling growth.
2. Shoot development: Organization of shoot apical meristem (SAM); cytological and molecular analysis of SAM; regulation of cell fate in meristem; tissue differentiation in the shoot.
3. Root Development: Organization of root apical meristem (RAM); vascular tissue differentiation; lateral root hairs; root microbe interactions.
4. Secondary growth of root and shoot; formation and types of wood.

UNIT II: Leaf and flower development **12 Hrs.**

1. Leaf growth and differentiation: Determination; phyllotaxy; control of leaf form; differentiation of epidermis (with special reference to stomata & trichomes) and mesophyll.
2. Stomatal Development: organization and development of stomata, stomatal development and environmental factors.
3. Flower Development: Physiology of flowering, florigen concept and photoperiodism, Genetics of floral organ differentiation; homeotic mutants in *Arabidopsis* and *Antirrhinum.*
4. Nutrient Management for desired growth and development of the plants.

UNIT III: Sexual reproduction **12 Hrs.**

1. Anther: Structure and functions of anther wall, micro-sporogenesis, callose deposition and its significance; Pollen wall structure, MGU (male germ unit) structure, NPC system; a brief account of Palynology and its scope; development of male gametophyte.
2. Pollen wall proteins; Pollen viability, storage and germination; Abnormal features: pseudomonads, polyads, massulae, pollinia. pollen storage.
3. Ovule, megasporogenesis, development and organization of female gametophyte, ultrastructure of the embryo sac cells.
4. Pollination mechanisms and vectors, pollen germination, pollen tube growth and guidance, Pollen- Stigma Interactions, double fertilization.

UNIT IV: Post-fertilization developments **11 Hrs.**

1. Outlines of pollination; self-incompatibility- basic concepts; methods to overcome self-incompatibility (mixed pollination, bud pollination, stub pollination).
2. Perisperm; endosperm – types (free nuclear, cellular, helobial and ruminate) and biological importance.
3. Embryogenesis- Dicot and Monocot embryos - development and types.
4. Polyembryony and apomixes: Introduction, classification, causes and applications, parthenocarpy; fruit growth and seed development.

Government College (Autonomous), Rajamahendravaram

I M.Sc., (Botany) - Semester- II (w.e.f. 2024-25)

Core Course -5: Principles of Ecology

Hrs./Semester: 45 **Credits: 3**

Unit-1: Basic concepts of Ecology **10 Hrs.**

1. Ecology: definition, branches and significance; relation with other sciences.
2. Physical environment, biotic environment; structure and functions of ecosystems- abiotic and biotic components interactions; flow of energy.
3. Cycling of materials: water, carbon, nitrogen and phosphorus; trophic pyramids, food chains and food webs.
4. Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement.

Unit-2: Population Ecology **10 Hrs.**

1. Characteristics of a population; population growth curves; population regulation; life history strategies (r and K selection).
2. Concept of metapopulation – demes and dispersal, inter-demic extinctions, age-structured populations.
3. Plants and environment: Climatic (light and temperature) and edaphic.
4. Interactions among plants; interactions between plants and animals.

Unit-3: Community Ecology **14 Hrs.**

1. Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones.
2. Ecological Succession: Types; mechanisms; changes involved in succession; concept of climax.
3. Concepts of productivity: GPP, NPP and Community Respiration; Secondary production, P/R ratio and Ecosystems.
4. Structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, estuarine).
5. Major terrestrial biomes; theory of island biogeography; biogeographical zones of India.

Unit-4: Applied Ecology **11 Hrs.**

1. Environmental hazards and management: Pollutants: kinds- Air, Water, Soil, Sound, Radiation, heavy metals and atomic pollution, effects on plants and ecosystems, strategies for pollution waste water treatment.
2. Climatic Changes: Green House Gases and Global Warming; Ozone hole, Impact on Plant and Ecosystem, Restoration.
3. Waste management and bio-energy: Conventional, Non-conventional energy resources, Environmental impacts, biogas digester, design and methanogenesis.

Government College (Autonomous), Rajamahendravaram

I M.Sc., (Botany) - Semester- II (w.e.f. 2024-25)

Core Course -6: Genetics and Evolution

Hrs./Semester: 45 **Credits: 3**

Unit-1: Mendelian and non-Mendelian inheritance **10 Hrs.**

1. Mendelian principles - Dominance, segregation, independent assortment.
2. Concept of gene - Allele, multiple alleles, pseudo alleles, complementation tests.
3. Non-Mendelian inheritance: Codominance, incomplete dominance, gene interactions, pleiotropy.
4. Genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters.

Unit-2: Gene mapping **12 Hrs.**

1. Gene mapping methods: Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants.
2. Extra chromosomal inheritance: Inheritance of mitochondrial and chloroplast genes, maternal inheritance.
3. Microbial genetics: Methods of genetic transfers – transformation, conjugation, transduction and sexduction, mapping genes by interrupted mating, fine structure analysis of genes.
4. Quantitative genetics: Polygenic inheritance, heritability and its measurements, QTL mapping.

Unit-3: Mutations **11 Hrs.**

1. Mutations: Types, causes and detection, mutant types – lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants, insertional mutagenesis.
2. Structural and numerical alterations of chromosomes: deletion, duplication, inversion, translocation, ploidy and their genetic implications.
3. Recombination: Homologous and non-homologous recombination including transposition.

Unit-4: Concepts of evolution **12 Hrs.**

1. Primary abiogenesis, concept of Oparin and Haldane; Miller and Urey experiment (1953); the first cell; evolution of prokaryotes; origin of eukaryotic cells; evolution of unicellular eukaryotes.
2. Population genetics – Populations, gene pool, gene frequency; Hardy-Weinberg law; concepts and rate of change in gene frequency through natural selection, migration and random genetic drift.
3. Adaptive radiation; isolating mechanisms; speciation; allopatricity and sympatricity; convergent evolution; sexual selection; co-evolution.

Government College (Autonomous), Rajamahendravaram

I M.Sc., (Botany) - Semester- II (w.e.f.2024-25)

Skill Oriented Course -3A: Plant Tissue Culture

Hrs./Semester: 45 **Credits: 3**

UNIT-1: Basic techniques in plant tissue culture **12 Hrs.**

1. Plant tissue culture: Definition, scope, and significance; infrastructure and equipment required to establish a tissue culture laboratory.
2. Sterilization techniques; formulation of various media for plant tissue culture.
3. Concept of totipotency, initiation, and maintenance of callus cultures; induction of morphogenesis in vitro.
4. Somatic embryogenesis and organogenesis; factors affecting somatic embryogenesis and organogenesis; synthetic seeds and their applications.

UNIT-2: Organ and haploid culture techniques **10 Hrs.**

1. Importance and applications of meristem culture, zygotic embryo culture, and endosperm culture.
2. Micropropagation and its uses, commercial exploitation of micropropagation.
3. Production of haploids using anther, pollen, and unfertilized ovule cultures – characterization and applications.

UNIT-3: Cell and protoplast cultures **12 Hrs.**

1. Cell suspensions – continuous and batch cultures; mass cultivation of plant cells using bioreactors.
2. Production of secondary metabolites from cell cultures, strategies used for enhanced production of secondary metabolites. Biotransformation using plant cell cultures.
3. Isolation, purification, and culture of protoplasts; methods used for protoplast fusion.
4. Somatic hybridization/ cybridization – selection systems for somatic hybrids/cybrids, their characterization, and applications.

UNIT-4: Transgenic plants **11 Hrs.**

1. Transgenic plants – definition, biosafety, and ethical issues associated with transgenic plants.
2. Herbicide resistance (glyphosphate), insect resistance (alpha-amylase inhibitor).
3. Virus resistance (coat protein-mediated, nucleocapsid gene), disease resistance (antifungal proteins, PR proteins).
4. Quality improvement (Golden rice), Shelf-life enhancement (Flavr savr tomato).

Government College (Autonomous), Rajamahendravaram

I M.Sc., (Botany) - Semester- II (w.e.f.2024-25)

Skill Oriented Course -4A: Plant Molecular Biology

Hrs./Semester: 45 **Credits:3**

Unit – 1: Concepts of rDNA technology **10 Hrs**

1. Basics of rDNA technology: Restriction enzymes, types, nomenclature, mechanism of action.
2. Tools used in rDNA molecule synthesis: Poly linkers, Vectors- Features and types: Cloning vectors - Plasmids, Phagemids, Cosmids, - Bacterial and Yeast artificial chromosomes (BACs and YACs).
3. Expression vectors. Bacterial transformation, In-vitro packaging, Selection of transformants: Antibiotic resistance, Lac Z gene based selection. Genomic library, cDNA library

Unit– 2: Blotting and sequencing techniques **14 Hrs.**

1. Blotting techniques: Southern, Northern and Western blotting.
2. Properties of radio isotopes: Carbon, Phosphorus and Sulphur, In–situ Hybridization; Radioactive and non–radioactive probes; Enzyme and fluorescence detection methods (FISH), types and applications of PCR technique.
3. DNA sequencing: Basic principle of Sanger's method, sequencing genomes Automated DNA sequencing, High throughput DNA sequencing; Sequencing genomes: whole genome, shot gun sequencing.
4. Isolation purification and analysis of RNA; In vitro mutagenesis and deletion techniques, gene knock out in bacterial and eukaryotic organisms.

Unit-3: Gene transfer methods **11 Hrs.**

1. DNA fingerprinting: molecular markers RFLP; RAPD, AFLP; Chromosome mapping, Restriction maps and Genetic markers, QTL mapping analysis; Introgression of useful traits using DNA markers. Microarray and its applications
2. Methods of gene transfer in plants: Physical and Biological methods.
3. *Agrobacterium* mediated: Binary and co integrative vector based. Chloroplast transformation.

Unit-4: Biophysical methods **10 Hrs.**

1. Molecular analysis using UV/visible, fluorescence, circular dichroism, NMR and ESR Spectroscopy.
2. Molecular structure determination using X-ray diffraction and NMR, Molecular analysis using light scattering, different types of mass spectrometry and surface plasma resonance methods.
3. Protein sequencing methods, detection of post translation modification of proteins.
4. Applications of Bioinformatics in Genetic engineering and their importance. IPRs, ethical and environmental issues.

Government College (Autonomous), Rajamahendravaram

II M.Sc., (Botany) - Semester- III (w.e.f. 2025-26)

Core Course -8: Plant Pathology

Hrs./Semester: 45 **Credits: 3**

Unit-I: Basic Concepts of Plant Pathology

1. Plant pathology: Definition, importance and scope; major famines due to plant diseases.
2. Classification of plant diseases, causal agents of plant diseases.
3. Koch postulates, Flor's hypothesis.
4. Colonization of pathogen in host: Inoculum, penetration, infection, invasion, reproduction; Spread and survival of pathogens.

Unit-II: Pathogenesis

1. Role of enzymes, toxins and plant growth regulators in plant pathogenesis.
2. Plant defense mechanisms: preformed, induced, biochemical and physiological responses.
3. Host-pathogen interactions, disease signaling, pathogen recognition and signal transduction.
4. Physiological changes in diseased plants. Molecular determinants of pathogenicity, virulence, effectors, elicitors, defensins, phytoalexins, common phenolics.

Unit-III: Plant disease management

1. Plant Disease management: Plant Quarantine, Cultural practices, Chemical control, Biological control.
2. Integrated Pest Management (IPM) and Integrated Disease Management (IDM); plant disease resistance, classes of resistance genes.
3. Transgenic and genetic manipulation approaches, molecular marker to tag disease resistance and avirulence genes.
4. Use of databases and application of bioinformatics in plant pathology.

Unit-IV: Plant diseases

Symptoms, etiology, epidemiology and control measures of following plant diseases:

a) Fungal: Whip smut of sugarcane, Coffee rust, Club root of crucifers, Leaf spot of turmeric, Damping off of seedlings
b) Phytoplasmal: Little leaf of brinjal, Grassy shoot disease of sugarcane
c) Bacterial: Citrus canker, Bacterial leaf blight of rice, Angular leaf spot of cotton
d) Viral: Rice tungro, Yellow vein disease of bhindi, Bunchy top of banana

Government College (Autonomous), Rajamahendravaram

II M.Sc., (Botany) - Semester- III (w.e.f. 2025-26)

Core Course -9: Plant Breeding

Hrs./Semester: 45 **Credits: 3**

Unit-I: Principles and Methods of Plant Breeding

1. Plant Breeding –Definition, basis, objectives and scope; sexual and asexual reproduction in plants, their relevance to breeding.
2. Mechanisms of self and cross-pollinations in plants, and their implications in plant breeding.
3. Introduction and acclimatization – procedure, achievements and limitations.
4. Breeding methods for self-pollinated crops- Pure line selection, mass selection.

Unit-II: Hybridization and Selection

1. Breeding methods for cross-pollinated crops- Recurrent selection, synthetic and composite varieties.
2. Breeding methods for asexually propagated crops- clonal selection.
3. Hybridization techniques-objectives and types, emasculation and pollination methods; handling and evaluation of segregating populations.
4. Genetic basis of heterosis and inbreeding depression; selection methods for hybrids-backcross breeding method; achievements and challenges in hybrid crop development.

Unit-III: Mutation and Polyploidy Breeding

1. Mutation breeding- types of mutations; physical and chemical mutagens, procedure and selection of mutants; applications and limitations of mutation breeding.
2. Polyploidy- Definition, auto and allopolyploids; polyploidy breeding - induction of polyploidy, applications and limitations.
3. Apomixis- Definition, classification and types; apomixis in important crop species; genetic and molecular basis of apomixes.
4. Detection and evaluation of apomixes, applications in of apomictics in plant breeding.

Unit-IV: Molecular Plant Breeding

1. Molecular plant breeding- Definition and scope; integration of molecular biology, genomics, and breeding.
2. Molecular Markers: Characteristics and types (RFLP, RAPD, AFLP, SSR, SNP, ISSR, SCAR, STS).
3. Marker-Assisted Selection (MAS)-Types, steps involved, applications, advantages and limitations; Quantitative Trait Loci (QTL) mapping.
4. Genomic breeding in major crops; molecular breeding in crop improvement.

Government College (Autonomous), Rajamahendravaram

II M.Sc., (Botany) - Semester- III (w.e.f.2025-26)

Skill Oriented Course -5A: Traditional Systems of Medicine

Hrs./Semester: 45 **Credits:3**

Unit -I: Ayurveda **10 Hrs.**

1. Origin and history, goals of Ayurveda; philosophical foundations of Ayurveda (Panchamahabhutas, tridosha theory, dhatus (body tissues) and malas (waste products).
2. Ayurvedic diet and nutrition; diagnostic methods: Darshana, Sparshana, Prashna; treatment methods: shamana and shodhana.
3. Plants used in Ayurveda: *Withania somnifera, Emblica officinalis, Bacopa monnieri, Tinospora cordifolia, Terminalia chebula,* and *Terminalia arjuna*

Unit- II: Siddha medicine **10 Hrs.**

1. Historical background and evolution; contributions of Siddhars; concept of macrocosm and microcosm; elements of human composition; three humors (Mukkutram) – vali, azhal, and iyyam. concept of Uyir Thathukkal.
2. Diagnostic techniques and treatment modalities in Siddha medicine; Siddha in contemporary health treatments.
3. Plants used in Siddha medicine: *Andrographis paniculata, Adhatoda vasica, Piper longum, Gymnema sylvestre, Boerhavia diffusa* and *Zingiber officinale*

Unit -III: Unani Medicine **10 Hrs.**

1. Origin and development of the Unani system; contributions of ancient scholars: Hippocrates, Galen, Avicenna (Ibn Sina), Al-Razi.; basic philosophy and principles: Concept of Tabi‘at, four elements (Arkan), four humors (Akhlat) and temperament (Mizaj).
2. Diagnostic methods and principles of treatment in Unani medicine.
3. Plants used in Unani medicine: *Glycyrrhiza glabra, Aloe vera, Curcuma longa, Acorus calamus, Trigonella foenum-graecum* and *Commiphora wightii*

Unit IV: Homeopathy and Naturopathy **8 Hrs.**

1. Homeopathy-origin and history; fundamental principles of Homeopathy.
2. Remedy preparation; Materia Medica and Repertory; clinical applications and Homeopathy in practice.
3. Plants used in Homeopathy: *Aegle marmelos, Strychnos nux-vomica, Bryonia alba, Achyranthes aspera, Arnica montana* and *Caesalpinia bonducella*
4. A brief account of Naturopathy system of medicine.

Government College (Autonomous), Rajamahendravaram
II M.Sc., (Botany) - Semester- III (w.e.f.2025-26)
Skill Oriented Course -6A: Ethnobotany and Phytomedicine

Hrs./Semester: 45 **Credits:3**

I. Learning objectives: By the end of this course the learner has to:

1. Understand basic concepts of ethnobotany with emphasis on plant-human interactions.
2. Discuss about the indigenous plants used by ethnic people.
3. Explain about plants used in making phytomedicines.
4. Discuss the techniques to screen the phytomedicines.

II. Course outcomes: On completion of this course students will be able to:

1. Infer the traditional knowledge among ethnic groups in utilizing plants.
2. Assess and determine the medicinal value of plants used by ethnic groups.
3. Evaluate phytomedicines used for drug development.
4. Test the efficacy of phytomedicines using various techniques.

III. Theory syllabus

Unit –1: Introduction to Ethnobotany

1. Ethnobotany- definition, concept, scope and objectives; ethnobotany as an Interdisciplinary science; the relevance of ethnobotany in the present context.
2. Major and minor ethnic groups - tribals of India and Andhra Pradesh, and their life styles.
3. Plants used by ethnic groups as food, medicines, beverages, fodder, fibre, resins, oils, fragrances and other uses.

Unit-2: Role of ethnobotany in modern Medicine

1. Role of ethnobotany in modern medicine with special reference to *Rauvolfia serpentina, Trichopus zeylanicus, Artemisia annua, Withania somnifera*
2. Medico-ethnobotanical sources in India: Ancient Indian scriptures; CCRAS (Central Council for Research in Ayurvedic Sciences)
3. Significance of *Azadirachta indica, Vitex negundo, Curcuma longa, Tribulus terrestris* and *Senna auriculata* in ethno botanical practices (along with their habitat and morphology)

Unit-3: Concepts of Phytomedicine

1. History of phytomedicine; taxonomy, morphology and ecology of medicinal plants: a botanical perspective; economic value of phytomedicnes.
2. Bioactive compounds in phytomedicine; role of plant-derived compounds in drug development.
3. Recent developments in drug discovery from plants; examples of plant-derived compounds currently involved in clinical trials; India contribution in phytomedicine.

Unit -4: Screening of phytomedicine

1. Application of phytomedicine in modern drug development; phyto-complexes versus single entity drug, bioavailability issue.
2. Drug delivery system for herbal-based therapeutics; Reverse pharmacology approach for phytomedicine development.
3. Methods for testing the anti-microbial, anti-cancer, anti-HIV, anti-diabetic, and neuroprotective activities of plant extracts.