

UNIT- I

PLANT DIVERSITY – I, PLANT DIVERSITY – II AND ECONOMIC BOTANY

Plant Diversity –I Classification, structure and reproduction of Algae, Fungi, Lichens, Bryophytes, Pteridophytes and Gymnosperms, Ecology and Evolutionary trends.

Plant Diversity – II Taxonomy of Angiosperms - classifications of Bentham and Hookers, Engle & Prantl, Hutchinson and Takhtajan. Numerical Taxonomy and Chemotaxonomy.

Economic Botany- Study of plants as sources of food, (cereals, millets, pulses, oil seeds) fodder, forage, fatty acids, essential oils, wood, timber, fiber, paper, rubber, beverages, spices and condiments, drugs, narcotics, resins, gums, dyes and tannins, insecticides and pesticides, ornamental and medicinal – plants as indigenous medicine system (Siddha, Ayurveda & Unani) Bioactive compounds.

UNIT- II

CELL BIOLOGY AND SEED BIOLOGY

Cell Biology - Cell as a unit structure and function - cell Theory. Organization of Prokaryotic and Eukaryotic Cells ultra Structure and Chemistry of plant Cell walls. Cell Organelles: Ultrastructural details and functions, including Cytoplasmic Membranes. Organization of Chromosomes and special types of Chromosomes. Cell division: Mitosis and Meiosis Chromosomal behaviour and their cytological significance.

Seed Biology - Definition – scope – Importance of seed as source of enriched nutrients – Chemical composition of cereals, millets, Common pulses and common oil – seeds. Seed development, phases of growth. Synthesis and accumulation of food reserves (storage proteins, carbohydrates, lipids, oils) Physiology of seed dormancy and germination. Methods to overcome seed dormancy. Early physiological events of seed germination. Hydrolysis and mobilization of reserve food materials from storage organ tissues to the germinating embryonic axis. Seed certification and quarantine.

Unit: III

ANATOMY AND EMBRYOLOGY

Plant Anatomy – Wood Anatomy; Anomalous Secondary Growth – Anatomy of C₃ – C₄ leaves; stomata types – Nodal Anatomy. Angiosperm Embryology – Incompatibility (Gametophytic and Saprophytic) barriers to sexual incompatibility.

Unit: IV

GENETICS AND PLANT BREEDING

Genetics - Mendelian Genetics - Development of Genetics and gene concept. Sex chromosomes and sex - linked inheritance, Cytoplasmic inheritance. Chromosome theory of inheritance, linkage, Chromosome mapping and Karyotype analysis. Male sterility and its significance. Population Genetics - Non random mating; Genetic Drift

Hardy Weinberg law. Molecular Genetics: Nucleic Acids as genetic material – Structure and role of Nucleic acids in protein synthesis and replication. Modern concept of the gene – Cistron, Recon and Muton. Genetic code and regulation of Gene expression; Gene amplification – Transposons, modifiers of gene expression. Meiotic Drive. DNA replication in Prokaryotic (E.coil) and Eukaryotic. Semi conservative model of DNA replication. Rolling circle replication. Transcription in Prokaryotic and Eukaryotic polarity effect. Splicing. Genetic switch-Ribo switch. Wobble gene. Multiple factor interactions.

Plant Breeding – Objectives of Plant Breeding. Breeding methods for self – pollinated and cross pollinated plants. Selection Methods including distant hybridization method. Role of Polyploidy and induced mutations in crop improvement. Heterosis and Inbreeding Depression.

Unit: V

PLANT PHYSIOLOGY AND BIOCHEMISTRY

Plant Physiology - Water relations of plants. Ion transport - Photosynthesis: mechanism and importance. Photo - Chemical reactions. Photo - Phosphorylation - Photolysis of water. Quantum efficiency - Carbon fixation in C₃-C₄ cycles. CAM pathway Photo - respiration. Respiration and Fermentation - Respiratory Metabolism- Glycolysis TCA cycle (Kreb's) Electron Transport chain - Oxidative Phosphorylation - Pentose Phosphate Pathway - C₆/C₁ ratio; Pyruvate metabolism. Respiratory control and uncouplers. Nitrogen Metabolism. Biological Nitrogen fixation - Nitrate and sulphate Reduction - Ammonia assimilation GS/GOGAJ Pathways. Biosynthesis of Amino-acids- Reductive amination and Transamination - Role of ureides and amides. Plant growth Regulator Phytochrome and its role. Calcium – calmodulin concept – Agrochemicals – Stress physiology (Abiotic and Biotic Stress). Physiology of fruit development.

Biochemistry – Biopolymers – Structure and Chemistry of Carbohydrates, lipids, proteins and their monomers. Mechanism of Action. Enzyme kinetics-Michaelis-Menten constant. Regulation and modulation of enzyme action. Isoenzymes, Enzyme Catalysis and Ramachandran's curve. Fatty Acids and Lipid Biosynthesis and Metabolism – Gluconeogenesis and B-oxidation. Secondary Metabolites – Alkaloids. Steroids. Terpenoids. Phenolics. Glycosides – their chemical nature and role.

Unit: VI

BIOPHYSICS AND BIOSTATISTICS

Bio Physics – Bioenergetics, Energy and work. Laws of Thermodynamics, Energy transduction in biological systems. Redox potential. Redox couples. ATP bioenergetics. Order of reaction. Photobiology: Dual nature of light. Characteristics of solar radiation, Solar energy, efficacy of atoms – Absorption spectra in molecules, energy states, De-excitation.

Bio Statistics – Sampling techniques, Central values (mean, mode, median). Dispersion: absolute Relative Probability: Binominal properties, problems, fitting Positions, Normal, Skewness, Kurtosis Correlations and Regressions – Simple Linear Testing – Large Sample. T-test, Chi square Test – Two way ANOVA. Experimental Design – Principles. CRD, RBD, LSD, Missing plots.

Unit: VII

MICROBIOLOGY AND PLANT PATHOLOGY

Microbiology – Structure, Classification, mode of nutrition, reproduction of viruses, Mycoplasma, Bacteria and Protozoa, Microbes in air, soil and water. Pollution control using Micro – organisms – Role of microbes in waste water treatment. Biofertilizer. Food Microbiology – Agricultural Microbiology and Industrial Microbiology.

Plant Pathology – Important plant diseases in Tamil Nadu caused by Bacteria, Mycoplasma, Virus, Fungi and Nematodes. Modes of infection and dissemination, Physiology of Host-Parasite interaction-Host-in-built-defense mechanisms and methods of control-Biocontrol agents. Mechanism of action of microbes in higher plants. Role of Biocides. Integrated pest/pathogen Management.

Unit: VIII

MORPHOGENESIS, PLANT TISSUE CULTURE, BIOTECHNOLOGY AND APPLICATIONS

Morphogenesis – Polarity, Symmetry and Totipotency, Morphogenetic Centres of origin and organization. Differentiations de- differentiations and re-differentiation of cells and organs. Morphogenetic factors.

Plant Tissue Culture – Methodology and application of cell, tissue, organ and protoplast culture from vegetative and reproductive parts – Meristem culture and its significance. Somatic hybrid and Cybrids. Synthetic seeds and their application.

Biotechnology – Definition – Historical account – Scope and importance of Biotechnology – Genetic Engineering and Gene cloning strategies. Vectors in gene cloning – Plasmids, Cosmids, Bacteriophages – Role in gene – transfer technology – Recombinant DNA Technology – Isolation and purification of DNA – DNA – sequencing; DNA – engineering through cutting and joining; Restriction Endonucleases and Ligases. Methods of Direct gene transfer; Hybridoma Technology – potentialities and limitations of Biotechnology. Transfer of novel gene including nif – genes. Expression of plant genes in Bacteria.

Applications of Biotechnology - Monoclonal antibody production; interferon production – Insulin Production – Humulin Production. Application of Biotechnology in Agriculture - Crop improvement and evolving of transgenic plants to combat diseases, insect, pest and abiotic stresses – (salt, heat, drought and frost). Bacillus thuringiensis and biocide production. Microbial Biotechnology – fermentation technology – fermentation as a biochemical process – Bioconversion – alcoholic beverages production. Antibiotics, fermentation Production of amino acids and vitamins organic acids. Microbial Single Cell Protein (SCP) production.

Unit: IX

ENVIRONMENTAL BOTANY

Definition – History – scope and relationship of Environmental Botany to other Sciences. Modern concept of Ecosystem – Synecology – Modern concept of Biotic – Community. Major and minor communities. Method of studying plant communities, Principles of Phytogeography. Major ecosystems of the world. Their distribution and centres of

accurrence. Vegetation types of India. Willis age and Area Hypothesis, Wegener's continental Drift hypothesis, Endemism. Modern concept of ecosystem: Components and functions – Ecological Pyramids – Ecological Niche Speciation – Population Ecology – Population growth – Biotic interactions – Succession and its types- Ecological compression (Lotka-Voltra model). Biogeochemical cycles. Plant indicators. Environmental pollution and abatement – water, air, land, radiation, noise, acid, rain green house effect. Ozone depletion, Brand outline of marine ecosystem and management, soil fertility and reclamation. Land application of sewage sludge. Advantages and disadvantages of sludge control and recommendation. Environmental management and legislation – Environmental conservation strategies. Environmental management and legislation Ecotechnology – formal and non-formal environmental education. Afforestation; Green – jobs, creating awareness among target-site people (Villages, tribal's, students, intellectuals, legislators/Policy makers). Inculcating environmental education is curriculum of School, College and University levels.

Unit: X

BIORESOURCES, BIODIVERSITY CONSERVATION AND ETHANOBOTANY

Bio-resources – Definition – scope - enumeration and documentation of Bio-resources. Energy plantation, Hydrocarbons, Agroforestry, Social Forestry. Conventional fossil – fuel energy. Non- conventional energy sources (solar, wind, tidal, atomic) - Biophotolysis and hydrogen photo-production. Utilization and degradation of cellulose and lignin (litter) sewage and Garbage disposal. Bio-degradable and non-biodegradable garbage for waste. Utilization – conversion into manure (vermicompost) Non-biodegradable substances disposal by incineration. Biogas from Biomass. Methanogenesis.

Biodiversity Conservation – The need and necessity, Rio de Janeiro Earth, Summit(1992) Leipzig(W.Germany) Earth Summit(1995) Problems in patenting and trade related intellectual property rights(TRIPS). General Agreement of Trade and Tariff (GATT). World Trade Organization (WTO). Prevention of Bio-Piracy. Role of wild – life sanctuaries, National Parks, Sacred Groves in Biodiversity Conservation. Red Data Book – Information on endangered threatened and extinct plants and animals. Strategies for Biodiversity Conservation – in situ and ex situ conservation. Role of World Wild Life Fund(WWF).

Ethnobotany - Definition – scope – Tribes of Tamil Nadu – Their Socio-economic status Demography and distribution Folk- Ethano Medicines Linkages with other Sciences. Ethno-food – linkages with other Sciences. Ethno politics. Tribal involvement in Biodiversity conservation. Policies and programmes for upliftment of the various tribes in Tamil Nadu.