

1.1 PLANT DIVERSITY - I:-

Structure, reproduction and classification of Algae, Fungi, Lichens, Bryophytes, Pteridophytes and Gymnosperms, Ecology and Evolutionary trends.

1.2 PLANT DIVERSITY - II:-

Taxonomy of Angiosperms - classifications of Bentham and Hookers, Engle & Prantl and Hutchinson. Numerical Taxonomy and Chemotaxonomy. Plant Anatomy - wood anatomy; Anomalous Secondary Growth - Anatomy of C<sub>3</sub> - C<sub>4</sub> leaves; stomatal types - Nodal Anatomy. Angiosperm Embryology - Incompatibility (gametophytic and Sporophytic) barriers to sexual incompatibility,

1.3 CELL BIOLOGY:-

Cell as a unit structure and function - cell Theory. Organization of Prokaryotic and Eukaryotic Cells Ultrastructure 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.

1.4 MORPHOGENESIS AND TISSUE CULTURE:-

Polarity, Symmetry and Totipotency, Morphogenetic Centres of origin and organization. Differentiation and dedifferentiations and re-differentiation of cells and organs. Morphogenetic factors. Methodology and application of cell, tissue, organ and protoplast culture from vegetative and reproductive parts - Meristem culture and its significance. Somatic hybrids and cybrids. Synthetic seeds and their application.

1.5 GENETICS - I:-

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. 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.

1.6 GENETICS - II:-

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, Penetrance and expressivity, Gene interaction, Multiple factor interaction.

1.7 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 C<sub>3</sub> - C<sub>4</sub> cycles. CAM pathway Photo - respiration. Respiration and Fermentation - Respiratory Metabolism - Glycolysis-TCA cycle (Krebs's) Electron Transport chain - Oxidative Phosphorylation - Pentose Phosphate Pathway - C<sub>6</sub>/C<sub>1</sub> ratio; Pyruvate metabolism. Respiratory control and uncouplers. Nitrogen Metabolism. Biological Nitrogen fixation - Nitrate and sulphate Reduction - Ammonia assimilation GS/GOGAJ Pathway. Biosynthesis of Amino-acids-Reductive amination and transamination - Role of ureides and amides. Plant growth substances - Phytochrome and its role. Calcium - calmodulin concept - Agrochemicals - Stress physiology (abiotic and Biotic Stress). Physiology of fruit development.

### 1.8 BIOCHEMISTRY AND BIOPHYSICS:-

Biopolymers - Structure and Chemistry of Carbohydrates, lipids, proteins and their monomers. Laws of Thermodynamic, concept of Free - energy. Energy - rich compounds - Bioenergetics: Structure and role of ATP ATP - Cycle. Enzymes - Nature, Properties, Significance of conformation. Nomenclature. Mechanism of Action, Enzyme kinetics - Michaelis - Menton constant. Regulation and modulation of enzyme action. Isoenzymes, Enzyme Catalysis and Ramachandran's curve Fats Acids and Lipid Biosynthesis and Metabolism - Gluconeogenesis and B - oxidation. Secondary Metabolites - Alkaloids, Steroids, Terpenes, Phenolics, Glycosides - their chemical nature and role.

### 1.9 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.

### 1.10 PLANT PATHOLOGY:-

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

## PAPER - II

### 2.1 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 / animals genes in Bacteria.

### 2.2 APPLICATION OF BIOTECHNOLOGY IN HUMAN WELFARE AND MEDICINE :-

Monoclonal antibodies 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). Bt genes 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 production Microbial SCP production.

### 2.3 ENVIRONMENTAL BOTANY - I :-

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 occurrence. Vegetation types of India. Willis age and Area Hypothesis, Wegener's continental Drift hypothesis, Endemism.

### 2.4 ENVIRONMENTAL BOTANY - II :-

Biogeochemical cycles. Plant indicators. Environmental pollution and abatement - water, air, land, radiation, noise, acid, rain green house effect. O Zone depletion, Broad 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, Tribals, students, intellectuals, legislators/Policy makers) Inculcating environmental education is curriculum of school, college and University levels.

#### 2.5 BIORESOURCES :-

Definition - scope - enumeration and documentation of Bioresources. 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.

#### 2.6 SEED BIOLOGY :-

Definition - scope - Importance 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 mobilisation of reserve food materials, from storage organ tissues to the germinating embryonal axis. Seed certification and quarantine.

#### 2.7 BIostatISTICS :-

Sampling techniques. Central values (mean, mode, median). Dispersions: absolute Relative Probability: Binomial properties, problems, fitting Poissons, Normal, Skewness, Kurtosis Correlations and Regressions - simple linear Testing - Large sample, T test -  $\chi^2$  ANOVA - 2 way Experimental Design - Principles, CRD , RBD, LSD, Missing plots.

#### 2.8 ETHNOBOTANY :-

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

#### 2.9 ECONOMIC BOTANY :-

Study of plants as sources of food, (cereals, millets, pulses oilseeds) fodder, forage, fatty acids, essential oils, wood, timber, fibre, paper rubber beverages, spices and condiments, drugs, narcotics Resins and gums, dyes and tannings, insecticides and pesticides, ornamental and medicinal - plants as indigenous medicine system (siddha, Ayurveda & Unani) Bioactive compounds.

#### 2.10 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 Organisation (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 WWF - World. WILD LIFE FUND