03 . BOTANY

DETAILS OF SYLLABUS

SECTION – A

UNIT 1

A. MICROBIOLOGY:

1. Bacteria : Classification, Ultra structure, Nutrition, Reproduction and Growth,
2. Respiration, Genetic recombination and Antibiotics.
3. Soil Microbiology (Rhizosphere, Nitrogen fixation, Mycorrhiza), Microbiology of Air, Water, Food and Sewage.
4. Industrial Microbiology (Fermentation processes, Bioreactors, organic acids and vitamins).
5. Application of microbes in Biotechnology and genetic engineering, Single Cell proteins, Microbes in decomposition and recycling processes and bioconversion of waste products.
6. Mycoplasma, Rickettsia, Chlamydia (brief account).
7. Viruses: classification, Structural organisaion, Infection, Reproduction, Viroids
8. Virions, Prions, Retroviruses, Single stranded viruses and Interferons.
9. Microbial diseases in plants, animals and humans,
10. Immunology: Immunity, mechanisms, regulation of Immune responses
11. Immunogens, Immunoglobulins - formation and reaction
12. Immune system - Lymphocytes and accessory cells
13. Cellular immunity and Humoral immunity, Autoimmunity, MHC.
14. Immunological memory, Adjuvants, Lymphokines. T-cell receptor.
15. Epitopes, Monoclonal antibodies, immunological techniques and applications.

B. PHYCOLOGY:

1. Taxonomy of algae- principles and modern trends.
2. Algal cell structure and thallus structure- prokaryotic, mesokaryotic and eukaryotic organizations.
3. Reproduction and life cycle.
4. Economic importance.

C. MYCOLOGY:

1. Taxonomy of fungi- principles and modern trends.
2. Structure, reproduction and phylogeny.
3. Economic importance.

D. **LICHENOLOGY**: General account.

E. PLANT PATHOLOGY:

1. Host-parasite interactions and defense mechanisms.
2. Control methods, biological control, fungicides and pesticides, sanitation, disease resistance, epidemiology and quarantine.
3. Study of plant diseases: Brown spot and false smut of paddy, White rust of sweet potato, Mosaic and leaf spot of tapioca, Powdery mildew of rubber, Rust of coffee, Red rust of tea, Leaf rot of betel wine, Red rot of sugar cane, Katte disease of cardamom and Rhizome rot of ginger.

F. BRYOPHYTA

1. General characters, taxonomy, origin, evolution and phylogenitic trends.
2. General account of Sphaerocarpales, Marchantiales, Jungermanniales, Calobryales, Anthocerotales, Sphagnales, Andreaeales, Funariales, Polytrichales. and Fossil bryophytes.

G. PTERIDOPHYTA

1. General characters, taxonomy, origin, evolution and phylogenitic trends, stelar evolution and telome concept.
2. Apospory, apogamy and parthenogenesis.
3. Brief study of fossil pteridophytes – Rhynia, Lepidocarpon, Sphaenophyllum and, Zygopteris.
4. General Account of Psilopsida, Lycopsida, Sphaenopsida and Pterospsida.

H. GYMNOSPERMS

1. General characters, distribution, phylogeny, classification and economic importance.
2. General account of Cycadofilicales, Caytoniales, Bennettitales, Pentoxylales, Cycadales, Ginkgoales, Coniferales and Gnetales.

UNIT 2

I. TAXONOMY OF ANGIOSPERMS

1. Brief study of importance of taxonomy, Essentialism, Nominalism, Empiricism,
2. Evolutionary systematics and Phylogenic systematics. Study of systems of classification by Linnaeus, Bentham and Hooker, Engler and Prantl, Bessey, Hutchison and Takhatajan including critical evaluation of their basic tenants.
3. Plant Nomenclature: Brief account of ICBN including Author Citation, Type Method, Rule of Priority, nomenclatural terms and taxonomic keys. Role Botanical Survey of India.
4. Elementary treatment of Cytotaxonomy, Chemotaxonomy, Numerical Taxonomy. (Taximetries), Molecular Taxonomy and Cladistics,
5. Evolutionary taxonomy, primitive and advanced characters, monophyly and polyphyly, parallelism and convergence, homology and analogy and Origin of angiosperms.
6. Study of the following Angiosperm families based on morphological peculiarities, economic importance, interrelationships and evolutionary trends: Ranunculaceae

Magnoliaceae, Cruciferae, Polygalaceae, Caryophyllaceae, Dipterocarpaceae, Malvaceae, Rutaceae, Rhamnaceae, Vitaceae, Leguminosae, Rosaceae, Droseraceae, Rhizophoraceae, Melastomaceae, Lythraceae, Passifloraceae, Cucurbitaceae, Umbelliferae, Rubiaceae, Compositae, Ebenaceae, Oleaceae, Asclepiadaceae, Genetianaceae, Boraginaceae, Solanaceae, Lentibulariaceae, Acanthaceae, Verbenaceae, Labiatae, Nyctaginaceae, Amaranthaceae, Podostemaceae, Aristolochiaceae, Piperaceae, Lauraceae, Loranthaceae, Euphorbiaceae, Moraceae, Casuainaceae, Orchidaceae, Scitamineae, Amaryllidaceae, Lilliaceae, Commelinaceae, Palmae, Araceae, Alismaceae, Cyperaceae and Gramineae.

UNIT 3

J. EMBRYOLOGY

1. Microsporogenesis and male gametophyte: Pollen fertility, sterility viabilityand germination.
2. Megasporogenisis and embryosacs: development and types.
3. Pollination: primary and secondary attractants, ultra structural and histochemistry of style and stigma, pollen-pistill interactions.
4. Fertilization: barriers, incompatibility and methods to overcome it (intra ovarian pollination, in-vitro fertilization), embryo rescue.
5. Embryo endosperm and seed development: Polyembryony and Parthenocarpy.
6. Palynology: Recent advances, pollen allergy, economic importance Mellissopalynology, role of apiaries in crop improvement.

UNIT 4

K. ECONOMIC BOTANY

Study of the Botanical name, Family, morphology of the useful parts and utility of the following:

1. Cereals and Millets (Rice, Wheat, Ragi)
2. Legumes (Soybean, Square bean or Winged bean, Horse gram, Ground nut)
3. Sugar yielding plants (Sugar cane and Sweet potato)
4. Spices and condiments (Turmeric, Cinnamon, Pepper, Nutmeg, Allspice)
5. Fibre (Cotton and Coir), Dyes (Indigo, Henna)
6. Rubber (Para rubber)
7. Gums (Gum Arabic, Karya gum)
8. Resins (Dammars),
9. Gum resin (Asafoetida),
10. Oil (Coconut oil, Sesame oil, Palm oil),
11. Medicinal plants (Ocimum, Acorus, Dioscoria, Neem)
12. Food additives and colours (Saffron, Annatto).
13. Wood yielding (Jack tree, Teak, Rose wood, Ailanthus, Dita bark tree)

UNIT 5

L. ETHNOBOTANY

1. Relevance in modern medicine.
2. Ethnic societies of Kerala and their traditional herbs.
3. Ethnobotanical explorations and documentation.
4. Medicines derived from ethnobotanical leads.
5. Herbal drug development and validation.

SECTION B

UNIT 6

M. HISTOLOGY

1. Origin, structure and function of cambia and their derivates.
2. Abnormal cambia, Anomalous secondary thickening.
3. Structure of wood (soft wood, hard wood, sap wood, heart wood) and role of extractives in wood quality.
4. Nodal anatomy, Root-stem transition, transfer cells.
5. Anatomy in relation to Taxonomy.

N. MICROTECHNIQUE AND HISTOCHEMISTRY

1. Scope of histochemistry and cytochemistry in Biology.
2. Buffers, reagents and fixatives and chemistry of fixation.
3. Tissue processing techniques for light microscopy (hand and serial sections, squashes, smears and maceration).
4. Microtomes (Rotary, Sledge, Freezing Cryostat and Ultratomes).
5. Biological stains: chemistry and classification (general and specific, vital stains and fluorochromes).
6. Tissue processing techniques for electron microscopy (SEM and TEM).
7. Detection and localization of primary metabolites – Carbohydrates (PARS reaction).
8. Proteins (Coomassie brilliant blue staining), Lipids (Sudan Black method).
9. Enzyme histochemistry and Cytochemistry (General information).

UNIT 7

O. BIOCHEMISTRY

1. Chemical bonds: Ionic bond, Covalent bond, Atomic orbitals, Concept of hybridization, bonding in organic molecules effect of bonding on reactivity, polarity of bonds-bond length- bond angle-hydrogen bond, dissociation and association constant.
2. Carbohydrates: Structure, function and metabolism of including hormonal regulation. Glycogenesis, gluconeogenesis. Interconversion of hexoses and pentoses.
3. Lipids: Lipid oxidation, Biosynthesis of fatty acids, Biosynthesis of Triacyl glycerol, diacyl glycerol, monoacyl glycerol, Phospholipids, Cholesterol.

4. Proteins: Classification (based on structure, function and localization). Structure and molecular composition (Ramachandran plot), Purification.
5. Amino acids: Transamination, deamination, classification, amino acid metabolism.
6. Nucleic acids: Structure, replication and modification; Enzymes for synthesis and degradation. Biosynthesis of bases. RNA biosynthesis, Transcription and translation.
7. Enzymes: major groups, distribution of plant enzymes; functional compartmentation; soluble and membrane bound enzymes, purification, localization of enzymes by electrophoresis, Zymogram, Isozyme analysis, abzymes. Enzyme-linked immunosorbent assay (ELISA).
8. Plant Hormones: Chemistry, biological functions and biosynthesis of auxins, cytokinins, gibberelins, abscisic acid (ABA) and ethylene.
9. Vitamins: plant sources as anti oxidants-Chemistry and biological roles of fat soluble and water soluble Vitamins.

P. PLANT PHYSIOLOGY:

1. Cell wall architecture. Water movement in plants and stomatal physiology. Interrelations of soil and cellular water.
2. Structure and organization of plant cell membranes, ion transport across the membrane, roles of ATP asses and G-Proteins.
3. Photosynthesis: Photosynthetic pigments, Photochemistry, Electron transport, Phosphorylation and oxygen evolution. Water oxidizing clock, Photosystem I and II, RubisCo, Photo inhibition, phytochromes, carbondioxide fixation (C_3-C_4 pathways, Crassulacean acid metabolism, energetics of CO_2 fixation, Bacterial photosynthesis).
4. Photorespiration, glycolate metabolism, Mechanism of photorespiration.
5. Respiration-Glycolytic pathway of glucose degradation; Oxydative Pentose phosphate pathway, anaerobic, TCA cycle, Respiratory chain, Electron transport and Terminal oxidation.
6. Transport of metabolites: Xylem and phloem sap translocation.
7. Photoregulation and growth responses: Plant morphogenesis. Physiology of flowering, fruit ripening, senescence and abscission,
8. Thermoregulation: vernalisation.
9. Physiology of Seed germination, Seeding growth and the storage tissues, glyoxylate cycle in fatty seeds
10. Physiological response of plants of stress. Various stresses viz. drought, heat and cold and salinity.
11. Defense mechanism in plants: Phytoalexins, phenyl propanoid pathway in plants.
12. Tree Physiology: Leaf canopies, Radiation environment and plants. Tree-water relations.
13. Allelopathy: Plant derived compounds.

SECTION C

UNIT 8

Q. ECOLOGY

1. Approaches based on levels of organization concept and habitat, interaction between environment and biota, Autecology and synecology, Law of limiting factors.
2. Ecosystems: concept of ecosystems, Components of ecosystem, Types of ecosystems (freshwater, marine and terrestrial).
3. Ecological energetics: Application of laws of thermodynamics, food chain, food web, trophic levels, ecological pyramids, material recycling and energy flow.
4. Development and evolution of ecosystems.
5. Plant community: Concept of community, Plant community and Vegetation.
6. Methods for the study of communities: Floristic, Physiogenomic and Phytosociological methods. Classification of communities: Raunkiaer's and Clements' systems.
7. Concept of community organization: Individualistic concept of Gleason, Vegetation continuum concept of Ittaker and Curtis, Ecotone.
8. Major terrestrial plant communities: Deserts (Dry and Cold), Tundra, Grass land, Savannah, temperate forest, tropical rain forest, mangrove.
9. Ecological concept of species: Genecology, Ecads (Ecophenes), Ecotypes and Ecospecies.
10. Pollution: Causes, effects and preventive measures of air, water, soil and radiation pollution.

R. PHYTOGEOGRAPHY

1. Static phytogeography and dynamic phytogeography.
2. Geological history and evolution of plant life.
3. Theories concerning present and past distributions of plant life, Effects of continental drift, glaciation and land bridges on plant distribution.
4. Phytogeographic regions of world (Vegetational belts).
5. Soil, climate, flora and vegetation of India.

S. CONSERVATION BIOLOGY

1. Concept, aim and principles of conservation.
2. Convention on biological diversity: Objectives, Definition of biodiversities, Roles of ICU (IUCN), MAB, Red data book, Threatened categories of plants.
3. Conservation strategies (In-situ and Ex-situ conservation), Biosphere reserves, Wild life sanctuaries and National parks.
4. Agriculture and conservation of resources: Novel agricultural technologies - Green manures, Biofertilizers, Biological pest control, nitrification inhibitors, Wind mills for irrigation, Solar energy for drawing ground water, bio-gas for cooking and slurry left to be used as fertilizers.
5. Urbanization and Conservation: Planning for environmentally compatible human settlements and strategy for sustainable industrial development.
6. Conservation and energy: Causes of energy crisis, Conventional and Non-Conventional energy sources, non-polluting energy systems(Solar energy, Wind energy and energy recovery from solid wastes).
7. Conservation of Physical resources (All physical factors of environment).

T. EVOLUTION:

1. Origin and evolution of life
2. Classical and synthetic theories of evolution.
3. Forces of evolution, Mechanism of evolution.
4. Species concept, Speciation.
5. Isolation mechanisms.
6. Evolution above species level.
7. Molecular evolution.

SECTION D

UNIT 9

U. CYTOLOGY AND CYTOGENETICS

1. The cell: ultra structural study of cell organelles giving importance to their functional Inter-relationship.
2. Cytoskeleton: its role in cell organization and motility.
3. Nucleus: importance of nucleus in cell metabolism, Nucleus as the centre of genes and genetic regulation in eukaryotes. Nuclear envelope: structure and dynamic aspects of nuclear envelope and pore complex.
4. Nucleoplasm: Constituents.
5. Chromosomes: organization of chromatin fibre, uninemic folded fibre organization and bead string organization. Nucleosomes: structural and functional organization.
6. ‘Chemistry of chromosomes: Histone and non-histone proteins and their organization in the three dimensional configuration of chromosome. Structure and function of Kinetochore, NOR and other secondary constrictions, satellites, heterochromatic segments and telomeres.
7. Nucleolus: Ultrastructure (Pars chromosoma, Pars fibrosa, Pars granulosa, Pars amorpha). Variations in nucleolar ultra structure. Functions and origin of nucleolus.
8. Special types of chromosomes: Lamp brush and polytene chromosomes,
9. Numerical variations of chromosomes: Haploidy, aneuploidy and polyploidy.
10. Structural variations and meiotic behaviour of chromosomes -Deletion, duplication, inversion and translocation.
11. Stages of cell cycle: Mitotic apparatus, Cytokinesis, Meiosis: Synaptonemal complex, structure, function and significance of the various stages of meiosis.
12. Theories and mechanism of crossing over: Stern’s experiment and Me Clintock Creighton experiment, Crossing over at tetrad stage.
13. Genetic consequence of meiosis, intercellular interaction. Cell recognition, specific cell adhesions and contact inhibition.

V. GENETICS

I. Classical Genetics

1. Mendelism: Critical evaluation.

2. Gene interactions: Interactions of two genes (epistatic and non-epistatic interactions) and its biochemical interpretation. Interaction of more than two genes (coat colour in mice – three genes).
3. Dominance relationships with examples: Incomplete dominance, co-dominance, mosaic dominance and delayed dominance.
4. Lethal genes: Classification with examples: Autosomal dominant lethal, autosomal recessive lethal, sex linked dominant genes, sex linked recessive lethal.
5. Penetrance and expressivity.
6. Allelism and multiple alleles: origin of new alleles, types of alleles with examples (iso alleles, pseudo alleles and multiple alleles).
7. Polygenic inheritance: Quantitative characters with examples. Works of Nilsson-Ehle and East, Multiple factor hypothesis, Normal curve of the F2 distribution, elucidation of the number of genes involved and the effect of individual genes, modifiers, specific modifiers, heritability and role of environment.
8. Chromosome theory of inheritance: Evidences (white eye mutation and non-disjunction in Drosophila). Chromosomal mechanisms of segregation, independent assortment and sex determination, dosage compensation, Barr body, Lyon's hypothesis, sex-linked inheritance.
9. Linkage, recombination and linkage maps: Concept of coupling and repulsion, concepts of linkage, linear arrangement of genes, linkage groups, complete and partial linkage and recombination. Linkage maps, three point test crosses, interference, coefficient of coincidence and negative interference.
10. Molecular maping methods: RFLP mapping, chromosome walking, chromosome jumping and molecular makers.
11. Extra chromosomal inheritance: Maternal inheritance of cytoplasm, plasma genes plastid genome, mitochondrial genome, mitochondrial inheritance and episomes with examples.
12. Microbial genetics: Genetic recombination in viruses (lysogenic and lytic cycles in bacteriophages with experimental evidences, retro viruses, reverse transcription, onco viruses and oncogenes). Bacterial recombination (transformation, Conjugation, Conjugation mapping, F-duction and Transduction. Recombination in fungi (tetrad analysis), complementation tests.
13. Biochemical Genetics: Contributions of Garrod, Beadle and Ephrussi, and Beadle and Tatum.
14. Gene concept: Factor concept (Mendel), presence and absence theory (Bateson), gene- enzyme relationship (Garrod), one gene-one enzyme hypothesis (Beadle and Tatum), concept of Cistron, muton and recon (Benzer). Brief discussion of house keeping genes, smart genes, split genes (luxury genes), transposons, overlapping genes, gene cluster, gene families, orphan genes, homeotic genes, pseudo genes and selfish genes.

II. Molecular Genetics

1. Genetic Material - DNA as genetic material, DNA constancy, C-Value paradox, B-DNA and Z-DNA.
2. DNA replication: Semi conservative mode of replication (Messelson-Stahl experiment). The system of replication (template, deoxy nucleotide tri-phosphate pool, enzymes and protein factors). The mechanism of replication (unidirectional and bi-directional replication, replication fork, leading and lagging stands,

Okasaki fragments), DNA polymerases, topoisomerases, gyrases, ligases and nucleases, proof reading and repair. Eukaryotic and prokaryotic DNA replication.

3. DNA damage and repair: Photo reactivation excision repair, recombinational repair, SOS repair. Defects of DNA repair system (Blooms syndrome, xeroderma pigmentosum, retinoblastoma).
4. Mutations-Types of mutations and methods of detection of mutations, Molecular mechanism of spontaneous and induced mutations, High radiation belts of Kerala. Mutagenic effects of food additives, drugs etc. Ames test.
5. Genetic code: Experiments of Crick, Nirenberg and colleagues and Hargobind Khorana. Features of the genetic code and its exceptions.
6. Protein synthesis: Transcription, transcriptional units, Prokaryotic and Eukaryotic RNA polymerases, RNA processing and Translation.
7. Gene regulation: Gene regulation in viruses: cascade mode of expression of early, middle and late genes in viruses. Gene regulation in prokaryotes: Operon concept, positive and negative control attenuation, antitermination. Eukaryotic gene regulation: heterochromatinisation and DNA methylation. DNA methylases, DNA rearrangement. Transcriptional regulation- signal transduction upstream and down stream. Regulatory sequences and transacting factors, activators and enhancers. DNA binding by transcription factors. Britten and Davidson model, Post transcriptional regulation. RNA processing-hnRNA, introns and exons, capping, poly adenylation, splicing, snRNAs and spliceosomes. Translational regulation and post translational regulation. Cleavage and processing of proteins. Genetic imprinting. Environmental regulation of gene expression.
8. Gene synthesis: Kornberg's in vitro replication of ϕX174 DNA, Khorana's artificial synthesis of the genes for alanine transfer RNA and tyrosine transfer RNA of yeast. Gene synthesizing machines.
9. Molecular genetic techniques: DNA sequencing method (Sanger, Maxam and Gilbert), nucleic acid hybridization and Cot curves, PCR, RFLP, RAPD, AFLP, Blotting techniques (western blotting, dot blotting, slot blotting, DNA finger printing and foot printing.
10. Genetic Engineering: Tools and methods, DNA isolation, purification, cDNA, gene cloning-vectors and vectorless methods, PCR, Recombinant DNA, cutting and joining DNA, Restriction enzymes and Ligases, gene transfer, vectors and vectorless methods, identification of transformation, Genetically modified organisms, plants, animals and microbes, applications, public perspectives of recombinant DNA technology, Human Welfare.

III. Population Genetics, Human Genetics etc.

1. Population Genetics: Systems of mating and their genetic effect. Hardy-Weinberg law, factors affecting gene frequencies, genetic drift, founder effect, genetic load, consanguinity and its genetic effects.
2. Human Genetics: Mendelian characters in humans, blood group systems, human karyotype and syndromes caused by its aberrations, genetic diseases caused by gene mutations, amniocentesis, genetic counseling.
3. Genomics: Genome organization in prokaryotes and eukaryotes, Genomic RNA, structure of chromatin, coding and noncoding sequences and satellite DNA., sequencing of prokaryotes and eukaryotes. Reverse genetics.
4. Gene therapy - Somatic cell and germline gene therapy.

5. Developmental genetics - Genetic control of development in plants and animals (developmental genes in Arabidopsis and Drosophila), Role of cytoplasm in development. Animal cloning.
6. Somatic cell genetics: Dynamism of genome in somatic cells, gene amplification, transposons, gene modifications and rearrangements in somatic cells with stress to immune system, Hybridoma technique.

W. MOLECULAR BIOLOGY

1. Central Dogma of Molecular Biology- Nucleic acids and proteins.
2. Molecular structure of proteins, protein folding, domains in proteins, cloning strategy, protein, site directed mutagenesis for protein studies.
3. Molecular mechanism of Nitrogen fixation in Azotobacter and Rhizobia. Genetic regulation of Nitrogen fixation.
4. Molecular mechanism of photosynthesis, regulation in nuclear and chloroplast gene expression, mitochondrial genome organization and function.
5. Molecular biology of various natural stresses..
6. Structural polymorphism of DNA, RNA and three dimensional structure of tRNA.
7. Genomics: Structural genomics, Genetic and Physical mapping, microsatellite map, positional cloning, genome sequencing, genome databases, human genome project. Functional genomics, transcriptome, protenome and metabolome, microarrays and gene chips, Comparative genomics.
8. Bioinformatics: Detecting open reading frames, gene prediction, programmes for finding genes, secondary databases of functional domains, molecular phylogenetic programmes, comparing nucleotide and amino acid sequences using BLAST. Programmes for determination of protein structure. Molecular modeling, drug designing, drug targeting

X. PLANT BREEDING

1. Introduction: Objectives in Plant breeding.
2. Floral Biology: in relation to selfing and crossing techniques.
3. Reproduction in plants: in relation to breeding.
4. Sexual reproduction: objectives and methods of emasculation and pollination, raising F1 hybrids.
5. asexual reproduction: Vegetative apomixis and Adventive embryony, Non recurrent apomixis, diplospory, apospory, parthenogenesis, androgenesis automixis, semigamy, agamic complex, polyembryony. Role of apomixes in plant breeding.
6. Sterility: Environmental and morphological sterility, gametic and zygotic sterility, somatoplastic sterility, inviability, weakness, breakdown of hybrids, cytoplasmic and genetic sterility, cytogenetic and biochemical basis of sterility. Significance in plant breeding.
7. Breeding Methods: Sources of plant germplasm. Centres of genetic diversity. Concepts of de-Candolle and Vavilov. Genetic erosion threatened species
8. Plant introduction: Types and procedures. Preservation and utilization of germplasm.

9. Selection: Principles, genetic basis and methods. Mass selection, pure line selection, clonal selection.
10. Hybridization: Objectives, choice of parents, problems and causes of failure of hybridization - Incompatibility and sterility - Methods of overcoming - genetic consequences of hybridization. Methods (Bulk method and pedigree method). Role of interspecific and intergeneric hybridization.
11. Back-cross breeding: Theory and procedure.
12. Inbreeding: consequences.
13. Heterosis: Theories, genetic and physiologic basis, applications in plant breeding. Steps in the production of single cross, double cross, three-way cross and synthetic cross.
14. Sterility: Use of male sterility in hybrid production. Genetic, cytoplasmic, Genetic and cytoplasmic sterility.
15. Polyploidy breeding: induction of autopolyploidy and allopolyploidy, chromosome manipulation (chromosome addition and substitution lines), achievements.
16. Mutation breeding: Situations suitable for mutation breeding. Materials needed for treatment. Physical and chemical mutagens. Handling of mutants. Evaluation of mutants in Mu M2 and M3 generations.
17. Modified methods: Recurrent irradiation, split dose irradiation, combination treatment, achievements, advantages and disadvantages
18. Resistance breeding: Causes of diseases, disease resistance breeding, concepts of disease triangle, degree of resistance, basis of resistance (structural biochemical, physiological and genetic). physiological races of pathogen and pathotype specialization. Genetic basis of virulence and plant-pathogen resistance, vertical and horizontal disease resistance. Methodology of disease resistance breeding. Artificial production of epiphytotic conditions and screening procedures for resistance.
19. Multiline production:- achievements, Idiotype breeding, Concepts, examples.

Y. PLANT BIOTECHNOLOGY

1. Definition, impact of biotechnology: an overview.
2. Plant tissue culture techniques: Different types of cultures, organogenesis, cell suspension culture, cell line selection, in vitro mutagenesis, somatic cell genetics, selection for biotic and abiotic tolerance. Somatic embryogenesis, artificial seeds, applications. Somatic hybridization, production of cybrids, asymmetric hybrids use of protoplasts in genetic transformation, somaclonal variations. Haploid production- anther and ovule culture, dihaploids and polyhaploids, applications.
3. Production of secondary metabolites: Cell immobilization, bio-reactor technology.
4. Conservation of germplasm: in vitro strategies, cryopreservation and international exchange of germplasm. .
5. Genomic and organelle DNA isolation: methods of gene identification, DNA amplification -vector mediated and vectorless methods - Polymerase chain reaction (PCR). Restriction, digestion and ligation; restriction mapping, genomic and cDNA libraries.
6. Methods of gene transfer in plants. Agrobacterium and CaMV mediated gene transfer; direct gene transfer using PEG, micro injection, electroporation, microprojectile (biolistics) methods, liposome mediated DNA delivery;

Transposons as vectors; use of mixed vectors, transient and stable gene expression in transgenic plants.
7. Analysis and expression of cloned genes: DNA sequencing, DNA markers, RFLP, RAPD, AFLP, LCR, Antisense RNA.
8. Application of gene cloning and transformation techniques in plants.

Z. HORTICULTURE

1. Concept and Scope.
2. Famous gardens in the world and in India
3. Tools and Implements, Plant growing structures.
4. Plant propagation: Cutting, laying, Grafting and Budding.
5. Cultural practices: Thinning, Training, Trimming and Pruning.
6. Fertilizers: Biofertilizer, Green manure, NPK , Compost-Vermicompost.
7. Outdoor horticulture- Gardens: Vegetable garden, Medicinal plant garden, Roof garden, Fruit garden, Lawns and Landscapes.
8. Commercial horticulture - Nurseries, Indoor plants and flowers.
9. Arboriculture - Pruning, Bracing, Feeding and transplanting, Bonsai.
10. Floriculture: Commercial floriculture, home floriculture.
11. Plant growing problems and their control: Disease and pest control.

UNIT 10

AA. BIOPHYSICS

1. Vander Vaal's electrostatic, hydrogen bonding and hydrophobic interactions.
2. Concepts of free energy and Thermodynamic principles in Biology.
3. Principles and applications of light and electron microscopy, bright field phase contrast, fluorescence, scanning and transmission electron microscopy. Cytophotometry, flowcytometry, micrometry, camera lucida, photo micrography.
4. Principle and applications of Gel filtration, Ion exchange and affinity chromatography. HPLC, Electrophoresis, Electro focusing, ultra centrifugation.
5. Principles of biophysical methods used for analysis of biopolymers: X-ray diffraction: fluorescence; UV visible, IR, NMR, ESR, Spectroscopy. Atomic absorption spectroscopy.
6. Principles and applications of tracer techniques in biology. Radiation dosimetry. Radioactive isotopes; Autoradiography, Cerenkov radiation, ORD/CD. hydrodynamic methods, plasma emission spectroscopy, liquid scintillation.

AB. BIOSTATISTICS

1. Principle and practice of statistical methods in biological research: Sources and presentation of data.
2. Measures of Central Tendency: Mean, Median and Mode.
3. Measures of Dispersion: Range, Quartile deviation, mean deviation, standard deviation, coefficient of variation and standard error.

4. Probability: Basic concepts, addition theorem, multiplication theorem and conditional probability.
5. Theoretical distributions: Binomial, Poisson and Normal.
6. Test of statistical significance: Chi-square test and t-test.
7. Simple correlation and regression.
8. F-distribution and analysis of variance.

AC. COMPUTER APPLICATIONS

1. Common elementary computer science. History of development of computers. Mainframe, minis, micros and super computer systems.
2. General awareness of computer hardware - CPU and other peripheral devices (input/output and auxiliary storage devices).
3. Basic knowledge of computer systems, soft ware and programming language.
4. File management- handling and creation of files.
5. General awareness of popular commercial software packages and scientific application packages. Statistical application, Histograms and graphs.
6. Multimedia presentations.
7. Internet Browsing. Role of Websites and their organization.