M.Sc. (Botany) 1st Semester, Course – I (H 1001): Angiosperm Taxonomy, Plant Resources and Utilization

After completing this paper the students will be able to understand and explain:

- History of plant Taxonomy, International Code of Botanical Nomenclature (ICBN)
- Salient feature, important rules and recommendation, binomial nomenclature, botanical gardens and herbaria
- Taxonomic evidences: Morphology, Plant anatomy, Palynology, Embryology, Cytology, Phytochemistry
- Genome analysis and DNA hybridization technique in relation to taxonomy, numerical taxonomy, serotaxonomy
- The species concept: Taxonomic hierarchy, species, genus, family and other categories
- Principles used in assessing relationship, delimitation of taxa and attribution of rank.
- Variation and specialization in plants
- Phylogenetic systems of classification: Hutchinson, Cronquist, Takhtajan and Dahlgren. Outlines, merits and demerits
- Basic knowledge of phylocode and A P G system.
- Range of floral structure and phylogeny in: I. (Dicotyledons):
  - Magnoliidae with special reference to Magnoliaceae, Lauraceae, Piperaceae
  - Hamamelidae with special reference to Moraceae, Juglandaceae and Casuarinaceae
  - Caryophyllidae with special reference to Cactaceae, Chenopodiaceae and Polygonaceae
  - Dilleniidae with special reference to Tiliaceae, Sterculiaceae, Violaceae
  - Rosidae with special reference to Lythraceae, Combretaceae
  - Asteridae with special reference to Boraginaceae, Scrophulariaceae, Bignoniaceae

- II. Monocotyledons:
- Alismatidae; Commelinidae with special reference to Commelinaceae and Zingiberaceae
- Arecidae with special reference to Araceae: Liliidae with special reference to Amaryllidaceae
- Cradle of flowering plants.
- Botanical names, families, Plant part(s) used and uses of the important plants belonging to: Fiber plants; Spices and condiments; Beverages; Medicinal plants
- Non-wood plant products (NWPPs): rubber, dyes, resin, gums etc.

M.Sc. (Botany) 1st Semester, Course – II (H 1002): Biology and Diversity of Viruses and Bacteria

After completing this paper the students will be able to understand and explain:

- Development of microbiology as science, important contribution of pioneer microbiologists; golden era of microbiology.
- Isolation, purification and cultivation of microbes.
- Important criteria used for classifications of microorganisms (morphological, ecological, biochemical, molecular and numerical).
- Classification of bacteria based on Bergey's manual of determinative bacteriology.
- Archaeobacteria and Eubacteria: Characters, Ultrastructure, nutrition, genetic recombination (Transformation, Transduction, Conjugation), and economic importance.
- Cyanobacteria: salient features and biological importance.

- Viruses: biological nature, characteristics and ultrastructure of Plant, animal and bacterial virus, replication, transmission and economic importance of viruses.

- **Phytoplasma**: General characteristics, structure, reproduction and role in causing plant diseases.
- General Structure, reproduction and importance of viroids, virusoids, prions and Retrovirus.

- **Host-parasite interaction**: a brief idea of recognition and entry process of bacteria, viruses into animal & plant-host cells, alteration of host cell, virus induced cancer,
- Bacteria and plant two- component signaling systems; bacterial chemotaxis and quorum sensing.
- Hormones and their receptors, signaling through G–protein coupled receptors, regulation of signaling pathways.
- **Innate and adaptive immune system**: Types of Immunity, antigens, antigenicity, structure and function of antibody molecules, monoclonal antibodies,
- Antigen-antibody interactions (serology), activation & differentiation of B and T Cell, B & T cells receptors, MHC molecules compliment system, immune response during bacterial (tuberculosis), parasitic (malaria) and Viral (HIV) infections, vaccine.

- Distribution of microbes in air, water, soil and human body.
- Microbes for control of pollution.
- Microbial enzymes and their applications.
- Microbes in nanobiotechnology.

M.Sc. (Botany) 1st Semester, Course III (H 1003): Biology and Diversity of Algae and Bryophytes

After completing this paper the students will be able to understand and explain:

- Classification and salient features of different classes of Algae
- Algal pigments, food reserves, flagellation and their importance in classification
- Thallus organization, reproduction and life cycle patterns in Algae
- Economic importance of Algae; Algal biofertilizers, and Algal blooms.

- Comparative study of classes of Chlorophyceae, Xanthophyceae, Bacillariophyceae, Phaeophyceae and Rhodophyceae with reference to:
    - Range of structure of plant body including ultrastructure
    - Methods of reproduction and variation in life cycles
- Classification of Bryophytes and their distribution in India
- Range of thallus structure (plant body) and anatomy in Bryophytes
- A general account of Marchantiales, Jungermanniales, Anthocerotales, Sphagnales, Funariales and Polytrichales
- Evolutionary tendencies in sporophytes of Bryophytes (Progressive sterilization of sporogenous tissue)
- Reproduction, life history, Inter-relationship, affinities of various groups of Bryophytes.
- Ecology and economic importance of Bryophytes.

. (Botany) 1st Semester, Course IV (H 1004): Biology and Diversity of Pteridophytes, Gymnosperms and Palaeobotany

After completing this paper the students will be able to understand and explain:

- Classification of Pteridophytes; specific characters of important classes.
- Salient features, comparative organography, systematics, reproduction and Phylogeny of Psilopsida: Psilophytales (*Rhynia, Horneophyton*) and Psilotales (*Psilotum, Tmesipteris*).
- Lycopsida: Protolepidodendrales (*Protolepidodendron*), Lepidodendrales (*Lepidodendron, Stigmaria*), Lepidospermales (*Lepidocarpon*) and Isoetales (I*soetes*).
- Sphenopsida: Hyeniales (*Calamophyton*), Sphenophyllales (*Sphenophyllum*) and Calamitales (*Calamites*).
- Pteropsida: Coenopteridales — A general account. Ophioglossales (*Ophioglossum, Botrychium*), Marattiales (*Marattia, Angiopteris*), Osmundales (*Osmunda*), Filicales (*Cyathea, Dryopteris, Pteridium*), Marsileales (*Marsilea*), Salviniales (*Salvinia*, *Azolla*) and Indian Fossils
- Telome concept; stelar system and evolutionary tendencies
- Heterospory and evolution of seed habit
- Apogamy, apospory, parthenogenesis
- Soral evolution; and alternation of generations in Pteridophytes
- Classification and distribution of gymnosperms with special reference to India.
- Study of morphology, structure and life history as illustrated by the following: Pteridospermales: Palaeozoic and Mesozoic group with reference to Lyginopteridaceae (*Lyginopteris*), Medullosaceae (*Medullosa*), Glossopteridaceae and Caytoniaceae.
- Bennettitales: Cycadeoidaceae, Williamsoniaceae, Wielandiellaceae.
- Cycadales: A detailed account including distribution *of living C*ycads.
- Pentoxylale*s: A gene*ral account.
- Cordaitales: A general account of Cordaitaceae and Poroxylaceae.
- Ginkgoales: *Ginkgo*.
- Coniferales: *Abies, Cedrus, Cryptomeria, Cupressus. Podocarpus, Cephalotaxus* and *Araucaria*
- A general account of Taxales, Ephedrales, Welwitschiales and Gnetales
- Evolutionary tendencies in Gymnosperms
- Economic importance of Gymnosperms
- Geological areas and distribution of plants in geological time scale
- Types of Fossils, Process of fossilization and fossil preservation methods
- Techniques of study of fossils and distribution of fossils in India

M.Sc. (Botany) 2nd Semester, Course – V (H 2001): Fungal Biodiversity and Elementary Plant Pathology

After completing this paper students will be able to understand and explain**:**

- General characters, range of thallus organization of fungi, cell structure and nutrition.
- Types of reproduction in fungi.

- Classification of fungi as proposed by Ainsworth (1973) Alexopoulus, Mims& Blackwell (1996).
- Recognition of Fungi as a separate kingdom; splitting of the fungi (Fungi and allied organisms into three kingdoms- Protista, Chromista and Fungi.
- Nutrition and growth in Fungi including factors affecting fungal growth.
- Differentiation in fungi: control of i) Dimorphism. ii) Conidiation. iii) Mating (with the help of Sex hormones).
- Heterothallism, Heterokaryosis, parasexuality and physiological specialization in Fungi.

- A general account and affinities of the following groups with special reference to systematic position, structure and reproduction of
    - The Fungi belonging to kingdom Protozoa:
        - Myxomycota (myxomycetes): *Stemonites, Ceratiomyxa*,
        - Plasmodiophoromycota (Plasmodiophorales) *Plasmodiophora*.
    - The Fungi belonging to Kingdom Chromista:
        - Oomycota: Saprolegnia, Phythium, Phytopthora, Albugo,
    - The Kingdom Fungi:
        - Chytridiomycota: *Synchytrium*,
        - Blastocladiomycota: *Allomyces, Coelomomyces*
        - Zygomycota: *Saksanaea, Pilobolus, Entomophthora*
        - Ascomycota : *Taphrina, Phyllactinia, Erysiphae, Neurospora, Peziza*
        - Basidiomycota: *Puccinia, Uromyces, Hemiliea, Melampsora, Tilletia, Ustilago*
        - Anamorphic fungi (Deuteromycotina): *Cercospora, Helminthosporium, Curvularia, Alternaria, Fusarium, Colletotrichum, Aspergillus, Penicillium*.

- Fungal interactions: I. Role of antibiotics, hyphal interference, II. Mycoparasitism, III. Commensalism, Mycorrihizae, Lichens (Structure, types, reproduction, importance),
- Fungi as biocontrol agents.
- Causes & symptoms of fungal, bacterial and viral plant diseases.
- Host-parasite relationship, role of enzymes and toxins in disease development.
- Effect of infection on physiology of host.
- Effect of environment on disease development-epiphytotics.
- Disease control by physical & chemical methods, crop rotation, plant quarantines, resistance
- Integrated pest management mechanism, its advantages, disadvantages and future prospects. 19. Principles of biological control of air- borne and soil-borne plant diseases.
- Etiology and control of the following crop diseases:
- Paddy: Paddy blast, Bacterial leaf blight; Wheat : Black Stem rust, Bunt of wheat, Flag smut.
- Jowar : Grain Smut; Sugercane : Smut, Red rot.
- Cotton : Wilt; Grape : Downy and powdery mildew
- Apple: Apple scab; Groundnut : Tikka disease.
- Fibre : Rust of *Linum*; Coriander : Gall of coriander

M.Sc. (Botany) 2nd Semester, Course – VI (H 2002): Cell and Molecular Biology of Plants

After completing this paper the students will be able to understand and explain**:**

- The Dynamic cell: Structural organization of plant cell, specialized plant cell.
- Microscopy: Principle, parts and functioning of electron microscopes including stereoscopic binocular, dark field illumination, confocal, phase contrast, fluorescence and polarizing microscopes, camera lucida, SEM, TEM. STEM.
- Cell envelopes: Ultra-structure, chemical foundation and functions of cell wall, Biological membranes with special emphasis on plasma membrane and tonoplast membrane.

- Plant Cell inclusions, their structure and function; Mitochondria and Chloroplast.
- Nucleus & Nucleolus: Structure, nuclear pores, nucleosome concept.
- Chromatin Organisation: Chromosome structure and composition, Centromere, Telomere, Euchromatin and Heterochromatin, Karyotypes, Polytene, Lamp brush chromosomes and Sex chromosomes.
- Ribosomes, Dictyosomes, Lysosomes, ER, Microbodies and Plasmodesmata.
- Cell cycle & Apoptosis: Biochemical and genetic mechanism–
    - Mitosis, spindle formation mechanism, cytokinesis, cell plate formation, Cytoskeleton with emphasis on spindle apparatus, motor movements.
    - Meiosis and its significance
    - Programmed Cell Death (PCD).
- Nucleic Acids: Nature, Structure, types of DNA (A, B, Z-DNA) and RNA, (t-RNA, micro-RNA) difference between DNA & RNA; DNA replication (Origin and fork) and its biosynthesis, extra chromosomal replications, DNA damage and repair,
- Ttransposons and mechanisms of transposition.
- Genetic Code: Discovery, Properties and cracking of genetic code.
- Protein Synthesis: Basics, mechanism of protein synthesis in prokaryotes and eukaryotes,
- Ttranscription, RNA processing, reverse transcription, translation and regulation of protein synthesis in prokaryotes (Structural, regulatory genes and operon model).
- Control of gene expression at transcription and translation level: Regulation of gene expression in phages, viruses, prokaryotes and eukaryotes,
- Role of chromatin in regulating gene expression and gene silencing.

M.Sc. (Botany) 2nd Semester, Course – VII (H 2003): Genetics, Cytogenetics and Plant Breeding

After completing this paper the students will be able to understand and explain**:**

- Mendel's Laws of inheritance and modified ratios.
- Allelic and non allelic interaction of genes.
- Multiple alleles: alleles, coat colour in rodents, blood groups in Humans, self incompatibility.

- Linkage and crossing over: chromosome mapping, linkage groups, mechanism of chromosome pairing and synaptonemal complex.
- Sex determination in man, Drosophila and plants.
- Maternal effects and Extra- nuclear inheritance.
- Biochemical genetics, concept of gene.
- Structural changes in chromosomes: Deficiency, duplication (meiotic pairing & phenotypic effects), Inversions, translocations, (meiotic pairing, Chromosome disjunction), multiple translocations.
- Numerical changes in chromosomes and Haploidy:
    - Euploidy/Polyploidy: Classification, production, role in evolution, utility in crop improvement.
    - Aneuploidy : Trisomics, tetrasomics, monosomy, multisomy- meiotic behaviours, breeding behaviour.
    - Apomixis : Cytogenetic basis and types of Apomictic reproduction
- Mutation: Types of mutations, spontaneous and induced mutations, Physical and chemical mutagens, gene mutations, induction and detection of mutation, mutation by transposons.
- Concept of gene: gene structure and expression; gene fine structure, cis-trans test, Biochemical genetics, introns.
- Methods of plant breeding.
- Genetic basis of inbreeding, hybridization and heterosis, exploitation of hybrid vigour.
- Plant breeding work done in India with special reference to potato, maize, rice, wheat, sugarcane and cotton.

M.Sc. (Botany) 2nd Semester, Course – VIII (H 2004) : Anatomy and Reproduction in Angiosperms

After completing this paper the students will be able to understand and explain**:**

- Shoot development: organisation of shoot apical meristem (SAM), Cytological and molecular analysis, Leaf (Marginal meristem).
- Root development: organisation of root apical meristem (RAM), Cell fates and lineage differentiation of vascular tissue, regulation of root growth.
- Epidermal structures, ontogeny and classification of stomata, trichomes and secretory glands
- Phloem: Structure and development of sieve elements, P-Proteins.
- Xylem: Structure and development of tracheary elements.
- Vascular cambium: normal and abnormal functioning.
- Nodal Anatomy: evolution of nodal vasculature.
- Formation of floral organs: floral development molecular basis of floral organ determination. Morphology of stamen, carpel and placentation, (MADS Box) Homeotic genes.
- Megasporangium (ovule): Structure and development.
- Female gametophyte: Megasporogensis, organisation and types of embryo sac, gene function during megagametogenesis, ultra structure of embryo sac.
- Anther: Structure, microsporogenesis, tapetum, pollen development, including pollen wall, pollen germination and pollen tube growth, development of male gametophyte, palynology and its applications.

- Pollen-Pistil interactions, Pollination mechanism and vectors, double fertilization.
- Sexual Incompatibility: its genetic basis, molecular aspects, physiology and biochemistry. Barriers to fertilization, methods to overcome incompatibility.
- Polyembryony: causes, classification and applications.
- Endosperm: development, types, haustoria, mosaic endosperm, ruminate endosperm, xenia, metaxenia.
- Embryogenesis: nutrition and growth of embryo; development of dicot and monocot embryos.
- Fruit growth and development: with special reference to legumes and cucurbits.
- Seed anatomy
- Apomixis and Parthenocarpy: types and importance.

M.Sc. (Botany) 3rd Semester, Course IX (H 3001): Plant-Soil-Water Relations & Growth and Development

After completing this paper students will be able to understand and explain**:**

Soil - water-plant relations:

- Functional aspects of plant cell structure: colloidal systems,
- Water as a universal solvent, pressures and potentials.
- Active and passive absorption of water. Factors affecting water absorption
- Role of micro and macro mineral nutrients, their physiological functions and deficiency symptoms, Hydroponics.
- Mechanism of ion (mineral) absorption. Factors affecting mineral absorption.
- Driving forces and resistances in transpiration; stomatal movement mechanism.
- Ascent of sap, Translocation of solutes in plants; sensor- regulator system, sucrose sensing mechanism.
- Stress Physiology: Plant response to biotic and abiotic stress, mechanism of stress tolerance, HR and SAR, water deficit and drought resistance mechanism of salinity, metal toxicity, freezing heat and oxidative stress resistance,

Growth & Development:

- Discovery, chemical structure, physiological role, mechanism of action, bioassay and practical applications of plants hormones: Auxins Gibberellins, Cytokinins.
- Hormone receptors, cell signaling and Signal transduction
- Elementary idea of structure and functions of ABA, Ethylene, Ascorbic Acid,
- Brassinosteroids, Polyamines, Jasmonic acid and Salicylic acid.
- Sensory photobiology: detection structure, chemistry, physiology, function and mechanism of action of phytochromes, cryptochromes and phototropins.
- Photoperiodism; Photoinduction and vernalization,
- Role of florigen, vernalin, phytochrome and C/N ratio in flowering.

- Dormancy: Dormancy of seeds and buds, gene expression during dormancy.
- Seed germination and seedling growth, metabolism of nucleic acid, mobilization of reserved food material, hormonal control of seedling growth, gene expression during seedling growth.

- Endogenous rhythms
- Plant movements
- Ageing and Senescence

M.Sc. (Botany) 3rd Semester, Course X (H 3002): Phytochemistry and Metabolism

After completing this paper students will be able to understand and explain**:**

- Fundamentals of thermodynamics and bioenergetics
- Buffers, pH Scale, redox potential
- Structure and functions of ATP;
- Forces stabilizing macromolecules
- **Fundamentals of Enzymology**:
- Classification, mechanism of enzyme action and catalysis, Allosteric mechanism, active sites, isoenzymes, Coenzymes, steady state enzyme kinetics, Michaelis - Menten equation and its significance.
- Conformation of proteins: secondary, tertiary and quaternary structure; domains; motif and fold, Ram Chandran's Plot
- Protein catabolism: Lysosomal and ubiquitin targeted proteolysis.
- **Photochemistry and Photosynthesis and Carbohydrate Metabolism:**
- General concept, Photosynthetic apparatus, Photosynthetic cycle, pigments, light harvesting and non-cyclic complexes, Photo-oxidation of water, electron and proton transport, Photophosphorylation.
- Carbon assimilation – the calvin cycle (C3 cycle), Photorespiration and its significance, the C4 cycle, the CAM pathway, biosynthesis of starch and sucrose, physiological and ecological considerations.
- **Respiration and fatty acid metabolism:**
- Overview of plant respiration, glycolysis, the TCA cycle, electron transport and ATP synthesis, oxidative phosphorylation; coupled reaction group transfer biological energy transducers,
- Pentose phosphate pathway, glyoxylate cycle, alternative oxidase system;
- Structure and function of fatty acids, biosynthesis and their catabolism.
- **Nitrogen and sulphur metabolism:**
- Overview of biological nitrogen fixation, nodule formation and nod factors, mechanism of nitrate uptake and reduction, ammonium assimilation, nucleotide metabolism.
- Sulphur uptake, transport and assimilation.
- **Secondary metabolites:**
- Elementary idea of secondary metabolities like alkaloids, lignin and phenolics (terpenes, phenols) with emphasis on flavonoids.

M.Sc. (Botany) 3rd Semester, Course XI (H 3003): Plant Ecology and Phytogeography

After completing this paper students will be able to understand and explain**:**

- Ecological factors (light, air, water, topographic, edaphic, biotic)
- Ecological concepts of species: Genecology and Ecological niche.
- Population Ecology: Basic concepts, characteristics of population and population structure.
- Community Ecology: Composition, characters, structure, origin and development of community: methods of study of structure of community.
- Ecological succession: Process concept and trends. Climax. (Xerosere, hydrosere)
- Ecosystem Ecology: Structure and functions, with example of a natural and artificial ecosystem, Energy flow in ecosystem.
- Production Ecology: Measurement methods and productivity in different ecosystems.
- Preliminary Knowledge of I.B.P. (International Biological Programme), M.A.B (Man and Biosphere Programme).
- Pollution: Kinds of pollution (Air, Water, Soil and Noise) and green house gases, Ozone hole, and global warming.
- Recycling of waste: Biogas, utilization and disposal of organic wastes and inorganic wastes,
- Biodiversity and its conservation.
- Biogeochemical cycles of C,N,P,S, and Hydrological cycle, Nutrient sources, Nutrient budgets in terrestrial communities and aquatic communities.
- Soil erosion and conservation, rainwater harvesting, Chipko Movement, Van Mahotsava, Afforestation, Reforestation.

- Principles of phytogeography, vegetation types and Phytogeographical regions of India.
- Age and area hypothesis, continental drift, endemism, Hot spots, Plant exploration. Invasion and introduction.
- Remote sensing: Concepts, principles, processes, tools, techniques in acquisition of R.S. data, application in ecological and meteorological research

M.Sc. (Botany) 3rd Semester, Course XII (H 3004): Elementary Biotechnology

After completing this paper students will be able to understand and explain**:**

- Definition, Basic concepts, Principles and scope of Biotechnology.
- Recombinant DNA technology, basic concept in genetic engineering, tool and techniques of recombinant DNA technology.
- Enzymology of genetic engineering: Restriction enzymes, DNA ligase, Polymerase etc.
- Cloning vehicles: Plasmids, Cosmids, Lambda phage, Charon phage, shuttle vectors, 2μ DNA plasmids, yeast plasmids.
- Gene cloning: principles and techniques, choice of vectors, DNA synthesis and sequencing, Analysis and expression of cloned genes in host cells.
- Polymerase chain reaction (PCR), RFLP, DNA finger printing (Southern and Northern blotting), gene therapy, Genetic counselling.
- Gene libraries: mRNA isolation, cDNA synthesis, cloning and amplification of gene libraries, Genomic DNA libraries, YACs, BACs Transposable elements, techniques of gene mapping and chromosome walking.

- Transgenic (Genetically modified) Plants: Genetic engineering of plants, Aims, strategies for development of transgenic plants (with *Agrobacterium* – the natural genetic engineer, T-DNA and transposon mediated gene-tagging, chloroplast mediated transformation and its utility,
- Intellectual Property Right (IPR), possible ecological risk and bioethics.
- Plant cell and Tissue culture: General introduction, history, scope, cell and tissue culture techniques.
- Design and functioning of tissue culture laboratory.
- Cell proliferation measurements, cell viability testing, culture media preparation and cell harvesting methods, concepts of cellular differentiation and totipotency.
- Somatic hybridization: Protoplast isolation, fusion and culture, hybrid selection and regeneration, possibilities, achievements and limitation of protoplast research.
- Application of plant tissue culture: clonal propagation, artificial seed, production of hybrids and somaclones,
- Organ culture, production of secondary metabolites, natural products, cryopreservation and germplasm conservation.

M.Sc. (Botany) 4th Semester, Course XIII (H 4001): Modern Phytotechniques and Biostatistics

After completing this paper students will be able to understand and explain**:**

- Different types of stains, their preparation and uses: Safranin, fast green, hematoxylin, iodine, cotton blue, crystal violet, ruthenium red, Janus green, Gram's stains, Acetocarmine
- Microtomy: dehydration, clearing and embedding of material, section cutting, dewaxing.
- Collection and preparation of herbarium sheets; preservation and storage of plant materials
- Instrumentation, principle and Methods of fractionation- Cell sorting, Chromatography, Electrophoresis, Centrifugation, X- ray diffraction
- Spectrophotometry, MS, NMR, ESR, ORD/CD spectrometers,
- Radioisotopic methods: Geiger Muller & Liquid Scintillation Counters.
- Immunological methods: immunodiffusion, immuno- electrophoresis, crossed immuno-electrophoresis, counter- RIA, ELISA , Immunoblotting

- Classification and presentation of data, graphical presentation: frequency polygon and curve, & cumulative frequency curve, distribution.
- Measures of Central tendency: mean, mode, median and their properties.
- Measures of dispersion: Mean deviation, standard deviation and coefficient of variation.
- Simple correlation, coefficient and regression,
- Principle of experimental designs, randomized block and latin square designs and analysis of variance (ANOVA).
- Tests of significance, t-tests, X^2 test for goodness of fit.

M.Sc. (Botany) 4th Semester, Course XIV (H 4002): Biodiversity Conservation and Plant Resources

After completing this paper students will be able to understand and explain**:**

- Biodiversity: Definition; factors responsible for determination of Biodiversity;
- Global concern over climate change.
- Levels of Biodiversity: Genetic, Species, Ecological, Evolutionary and Agrobiodiversity.
- Diversity Measures: (Diversity Indices)- Alpha(α), Beta (β), Gamma(γ) Diversity.
- Biodiversity Conservation Initiatives
    - *In situ* Stratagy : National parks, Wild life sanctuaries, biosphere reserves and world heritage sites.
    - *Ex-situ* Stratagy : By seeds, reclamation, Afforestation, tree Plantation, seed banks, gene banks, cryobanks
    - General account of activities of BSI, NBPGR for conservation and non-formal conservation efforts
    - Restoration or Rehabilitation of Endangered species.
- Biodiversity at world level: Biodiversity at global and country level, wild plant wealth.
- Ecosystem diversity in India: Desert, forest, Grassland ecosystem, wetland, Mangroves.
- Species Diversity: Endemic species, cultivated plants/Agro- diversity, Endangered plants.
- Loss of Biodiversity:
    - Causal factors – Developmental pressure, encroachment, exploitation, human induced and natural floods, earthquake, cyclone, landslides, Disaster management.
    - Threat to Ecosystem, species and genetic Diversity.
- Categories of threats : Endangered, Vulnerable, Rare and Threatened
- Plant resources, Concept, Status and Concern
- Basic concepts of local plant diversity and its economic importance
- World centres of primary diversity of domesticated plants
- Biodiversity protection laws and policies, management of natural resources.

ELECTIVE COURSE -1

M.Sc. (Botany) 4th Semester, Course XV (H 4003): Recombinant DNA Technology

After completing this paper the students will be able to understand and explain**:**

- Genetic Engineering – Definition and explanation, restriction enzymes and restriction modification system.
- Cloning and expression vectors – Definition and explanation: plasmids, cosmids, phagemids, fd, fl, and M13 vectors, transposons vectors.
- Artificial chromosomes as vector.
- Expression vectors; Use of promotors and expression cassettes, Virus expression vectors, binary and shuttle vectors.
- Reconstruction of chimeric DNA – staggered cleavage, addition of Oligopolymer tailing, blunt end ligation.

- Cloning in bacteria vs. cloning in Eukaryotic cells.
- Preparation of molecular probes and their uses; labeling of probes, radioactive vs non-radioactive. Techniques used in probing DNA, RNA & Protein electrophoresis, Southern, Northern and Western blotting.
- Techniques of restriction mapping.
- Polymerase chain reaction – Principles, techniques and modification, gene cloning vs. PCR, application and uses of PCR.
- Chromosome walking, Chromosome jumping, Chromosome landing, map based cloning.
- Compliment DNA, its cloning and cDNA library.
- RFLPs & RAPD and their applications.
- Gene sequencing.
- Protein Engineering- definition and explanation, Steps involved, methods used, Achievements and future prospectus.
- Drug designing – methods used, blocking enzyme activity, blocking hormones receptors, inhibition of DNA/RNA synthesis.
- Chemical synthesis vs recombinant DNA technology in protein engineering and drug designing.

ELECTIVE COURSE -2

M.Sc. (Botany) 4th Semester, Course XVI (H 4004): Plant Cell, Tissue and Organ Culture

After completing this paper the students will be able to understand and explain**:**

- Planning and organization of tissue culture laboratory; Basic techniques of plant tissue culture.
- Induction and maintenance of callus and cell suspension culture.
- Study of differentiation through organogenesis and embryogenesis.

- Cell line selection through suspension culture for the production of stress resistant plants, their application in crop improvement.
- Tissue culture techniques for haploid production and their application in agriculture.
- Meristem culture for mass and clonal propagation of ornamental plants, virus resistant plants and forests trees.

- In-vitro Pollination, shotgun wedding, embryo rescue technique and embryo culture.
- Encapsulation of somatic embryos and shoot apices for artificial seeds.
- Cryopreservation techniques for germplasm conservation.

- Protoplast isolation, culture and regeneration.
- Somatic hybridization and selection mechanism for hybrids and cybrids, with special reference to crop plants.
- Delivery systems for gene transfer in plant through co-cultivation of explants and *Agrobacterium* or thorough direct methods-electroporation, silicon carbide method.

- Transgenic plants: Use of transgene for – herbicides, insecticides, virus, drought, salinity and insect resistance; male sterility and restoration systems, molecular forming.

- Industrial application of plant tissue culture for:
    - Secondary metabolism for commercial purpose.
    - Scale up and down stream processing for secondary metabolites.

Dr. Chandra Bali Patel
Head, Department of Botany
R.K. (PG) College, Shamli