

# BOTANY

## B.Sc. Part I

### Paper-I FUNGI, BACTERIA, VIRUSES AND LICHENS

#### Unit-I Fungi

1. General Structure, nutrition and reproduction in fungi
2. Outlines of classification of fungi with particular reference to Ainsworth
3. Economics importance of fungi.

#### Unit-II Life Cycle of Fungi

1. Systematic position, occurrence, structure and mode of reproduction in following genera : *Achlya*, *Albugo*, *Aspergillus*, *Peziza*, *Agaricus*, *Ustilago*, *Alternaria* and *cercospora* (Development details are not required).

#### Unit-III Bacteria and Viruses:

1. Classification, structure, nutrition and mode of reproduction in Bacteria
2. General symptoms, structure and multiplication of viruses with special reference to TMV.
3. Structure and multiplication of Bacteriophages.

#### Unit-IV Lichens

1. General account of Lichens: Structure and types (forms) of lichens, Reproduction in Lichens.
2. Economic importance of Lichens.

#### Practical's:

Study of prescribed genera in theory course with the help of permanent slides and by preparing suitable slides.

Practical Examination based on Paper I, II and III

1. Section cutting, double staining and identification of a Gymnosperms/Pteridophyte material. Mounting to be done in glycerin.
2. Preparation, staining and mounting of reproductive part of Gymnosperms/Pteridophyte material.
3. Minor preparation and identification of bryophytes.
4. Minor preparation and identification of bryophytes,
5. Preparation and identification of fungal material.
6. Comment upon the spots 1-6 representing various groups (atleast one from Palaeobotany, Bacteria/Viruses/Lichens).

7. Viva-Voce
8. Class-Record
9. Model/Cart/Collection

## **Paper-II ALGAE AND BRYOPHYTES**

### **Unit-I** Algae

1. Brief Classification of algae with special reference to Fritch's classification.
2. Range of Thallus organisation of algae:
3. Life Cycle pattern of algae.

### **Unit-II**

1. Systematic position, occurrence, structure and mode of reproduction in the following genera : *Scytonema*, *Gloeocapsa*, *Chlamydomonas*, *Volvox*, *Oedogonium*, *Voucheria*, *Chara*, *Ectocarpus*, *Sargassum*, *Batrachospermum* (Development details are not required).
2. Elementary knowledge of algal culture.
3. Economic importance of algae.

### **Unit-III** Bryophytes

1. Outlines of classification of Bryophytes.
2. Systematic position, occurrence, morphology anatomy and reproductive structure in *Riccia*, *Marchantia*, *Pellia*, *Anthoceros* and *Sphagnum* (Development details are not required).

### **Unit-IV**

1. A general account of evolution of Sporophyte in Bryophytes.
2. Economic importance of Bryophytes.

#### **PRACTICAL**

Algae : Study of algal types with the help of temporary and permanent preparations prescribed in theory course.

Bryophytes: Study of the types with the help of suitable preparations, Section cutting, mounting and permanent slides based on theory syllabus.

**Paper-III PTERIDOPHYTES, GYMNOSPERMS AND PALAEBOTANY.**

**Unit-I Pteridophytes**

1. Classification upto order as given by Reimer.
2. Stelar system and its evolution in Pteridophytes.
3. Heterospory and seed habit.

**Unit-II** Systematic position, occurrence, morphology, anatomy and reproductive structure in the following taxa : *Selaginella*, *Equisetum*, *Marsilea*.  
(Developmental details are not required)

**Unit III** Gymnosperms

1. General characteristics, affinities and classification of Gymnosperms upto orders as given by D. Drant (1957).
2. Systematic position, occurrence, morphology, anatomy and structure of reproductive organs of the following taxa : *Cycas*, *Pinus*, *Ephedia*,  
(Developmental details are not required).
3. Economic, importance of Gymnosperms.

**Unit-IV** Palaeobotany

1. A general account of Palaeobotany, Geological eras (time scale),
2. Process of fossilization, Types of fossils.
3. Morphology and phylogenetic importance of Rhynia.

**Practicals** Study of the specimens, photographs, section cutting and preparation of temporary/permanent slides as prescribed in syllabus.

## BOTANY

### B.Sc. Part II

#### Paper-I PLANT TAXONOMY AND ECONOMIC BOTANY

##### Unit-I Plant Taxonomy

1. Classification as proposed by Bentham and Hooker and Hutchinson.
2. Preservation of Plant Material and Herbarium Techniques.
3. Binomial Nomenclature.
4. Systematic position, distinguishing characters and economic importance of the following families.

##### (A) Dicotyledons:

Polypetalae: Ranunculaceae, papaveraceae, caryophyllaceae, Kutaceae, Cucurbitaceae, Rosaceae, Apceae.

##### Unit-II

1. **Gamopetalae:** Rubiaceae, Apocynaceae, Asclepiadaceae, Solanaceae, Convolvulaceae, Acanthaceae, Lamiaceae & Asteraceae.

2. **Monochlamydeae:** Euphorbiaceae

##### (B) Monocotyledons

Areaceae, Poaceae

##### Unit-III Economic Botany

1. Economic importance with special reference to plants yielding :  
Food: Cereals (Rice, Wheat, Maize), Millets (Pennesetum & Sorhum), Potato, Sugarcane, Legumes- (Soya Bean, Gram and Pea) Oil Yielding Plants (Sason, Coconut, Castor, Groundnut, Fruits (Apple, Peach and Citrus).

##### Unit-IV

1. Common Fibre Yielding Plants : Cotton, Sunhemp, Jute and Coir.
2. Medicinal Plants (Papaver somniferum, Rauwolfia serpentina and Atropa bellodena).
3. Common timber yielding plants: Pinus sp., Cedrus deodara, Shorea robusta, Delbergia sisso, Tectonagrandis.

##### Practical

1. Taxonomy: Detailed description and identification of locally available plants of the families as prescribed in theory course.
2. **Economic Botany:**

- a. Identification and comment on the plants and plant products belonging to cereals, legumes, fruits, potato, sugarcane, fibre plants, timbers and medicinal plants.
- b. Submission of Herbarium collection of atleast 25 local wild plants.

## **Paper-II Plant Physiology and Biochemistry**

### **Unit-I Plant Physiology**

1. Diffusion, osmosis, permeability, imbibition plasmolysis osmotic potential and water potential.
2. Types of soil, water, waterholding capacity, wilting coefficient.
3. Absorption of water, Passive and active absorption.
4. Ascent of sap.
5. Transpiration, closing and opening mechanism of stomata and diffusion capacity of the stomata significance of transpiration, guttation, Factors affecting transpiration.
6. Mechanism of absorption of minerals salts.

### **Unit-II**

1. Elementary knowledge of the macro and micro-element.
2. Symptoms of mineral deficiency, Hydroponics and sand cultures.
3. Mechanism of translocation of solutes.
4. Plant growth regulators- Auxins, Gibberellins, Cytokinins and Abscissic acid.
5. Physiology of flowering : Photoperiodism and Vernalization.
6. Seed dormancy and germination.
7. Plant movement.

### **Unit-III**

1. Photosynthesis: Importance of the process, role of the pigments, light and dark reactions, photophosphorylation and electron transport system path of carbon, factors affecting photosynthesis C<sub>3</sub>, C<sub>4</sub>, C<sub>5</sub> plants anatomy cycle), Chemosynthesis.
2. Respiration Glycolysis, Krebs' cycle, factors affecting respiration, fermentation.

### **Unit-IV Biochemistry**

1. Enzymes: Nomenclature and classification, action, kinetics, Active sites, Micheelsconstant, Co-factors and co-enzymes, factors affecting enzyme activity.
2. Classification, properties and biological roles of carbohydrates and proteins.
3. Elementary knowledge of lipids.

#### Practical

#### **Physiology**

1. Cell Physiology: Demonstration of slides of Rbec discolor (alternatively), Onion epidermis with pasmolysed cells, Experimentation.
2. Water, Soil and Plant relations: Demonstration of root pressure and Guttation, permanent, temporary wilting, seeding growth in clay.
3. Phsynthesis: Demonstration, Co<sub>2</sub> factor, light factors and chlorophyll factors, oxygen evolution in red, blue, green and orange light. Experimentation, Starch in chloroplast, TLC-slides, chromatography of chlorophylls.
4. Respiration: Aerobic, anaerobic respriation, RQ of different seeds.
5. Growth and Development : Geotropism by Clinostat.

#### **Biochemistry:**

1. Colour test, micro tests for Carbohydrates, Proteins and lipids.
2. Chromatography of amino acids by TLC slides or paper strips.
3. Detection of Ca and P in milk.
4. Enzyme activity (diastase and Urease).
5. Colloidal ture, Dialysis Tyndal Phenomenon.
6. Thermolability
7. Specificity.

#### **Paper-III Cytology, Genetics, Molecular Biology**

##### **Unit-I Cytology**

1. Ultra structure of typical plant cell organelles.
2. Chromosome and chromosomal variations.
3. Mitosis and Meiosis.

##### **Unit-II Genetics**

1. Linkage and Crossing over.
2. Interation of gene

### **Unit-III**

1. Sex determination
2. Mutations

### **Unit-IV Molecular Biology**

1. Structure of DNA and RNA, replication of DNA, DNA as a genetic material.
2. Concept of gene.
3. Genetic code, protein synthesis in prokaryotes and Eukaryotes and its regular.

### **PRACTICAL**

1. Identification of cell organelles under microscope or through photographs.
2. Gene interaction and modified dihybrid ratios. (Numerical)
3. Stages of mitosis and meiosis in plants by temporary & permanent slides.
4. Experiments on monohybrid and dihybrid ratios (Numericals)
5. Hybridization.

### **B.Sc. II**

### **PRACTICAL**

Practical examination scheme based in paper I, II & III

1. Description of two flowering plants in semi technical language. Identification of families giving floral diagram and floral formula.
2. One experiments on Plant Physiology to be performed by students.
3. One physiological experiments to be set up and to be described by students or Colour test/Chromatography
4. Acetocamine smear preparation of root tips/flower buds for study of mitosis/meiosis.
5. Comment upon spots (1-6)  
(3 from Economic Botany and 3 from Cytology & Genetics)
6. Viva-Voce
7. Records
8. Collection/Model/Charts.

## BOTANY

### B.Sc. Part III

#### **Paper-I MICROBIOLOGY AND PLANT PATHOLOGY**

##### **Unit-I**

1. Introduction and significance Microbiology.
2. Methods of isolation and culturing of microbes.
3. An elementary study of immunology and serology.
4. Classification and distribution of microorganism in nature.

##### **Unit-II**

1. Decomposition of organic matter in soil, Role of microorganism in the cycle of carbon and nitrogen.
2. Industrial utilization of microorganisms. Elementary idea of microbiology of milk, alcohol, antibiotics, vitamins and organic acids.

##### **Unit-III Plant Pathology**

1. History and scope of plant pathology.
2. General symptoms of fungal, bacterial and viral diseases.
3. Mode of infection, disease resistance and control.

##### **Unit-IV**

1. A study of following diseases with reference to symptoms, causal organisms, diseases cycle and control. Late blight of Potato, Powdery mildew of pea. Tikka disease of ground nut, yellow vein mosaic of bhindi, Bacterial blight of rice, Red rot of sugar cane, Little leaf.

##### **Practical**

1. Isolation of microorganisms from natural resources.
2. Staining and measurement of microbial cells.
3. Study of host parasite relationship of plant diseases listed above.

#### **PAPER-II ECOLOGY, ENVIRONMENTAL POLLUTION, CONSERVATION AND FORESTRY:**

##### **Unit-I**

1. Basis principles of ecology
2. Ecological factors: climate, edaphic, biotic and topographic factors.
3. Biotic communities and developments of vegetation, Halophytes and Epiphytes.

**Unit-II Ecosystem Ecology**

1. Ecosystem with reference to grass land, forest and pond, idea of food chain, pyramids of number and biomass.
2. Energy flow and productivity.
3. Biogeochemical cycles, C.N.P. and Hydrological cycle.

**Unit-III Atmospheric Pollution**

1. Brief idea of Lithosphere, hydrosphere and atmosphere.
2. Brief idea of biospheric pollution causes and effects, water pollution air pollution, noise pollution.
3. Techniques and devices to control different types of pollutions.

**Unit-IV Conservation**

1. Conservation of soil and renewable resources.
2. Major forest types of India and their characteristic features.
3. Afforestation, Agro forestry and social forestry in India.

**Practical**

Study of communities by quadrat method to work out frequency, density and abundance.

Biomass estimation

Determination of physical and chemical characteristics of water and air.

Determination of sound levels at different places.

Study of acute symptoms in the plants growing along road sides.

**PAPER-III PLANT ANATOMY & EMBRYOLOGY****Unit-I Plant Anatomy**

1. Meristems.
2. Leaf anatomy.
3. Origin, structure and function of the vascular cambium including anomalous behaviour.
4. Structure of Xylem and Phloem.

**Unit-II**

1. Cork cambium activity and its products.
2. Structure and characteristics of wood.

**Unit-III Embryology**

1. Structure of anther, microsporogenesis and development of the male gametophyte.
2. Structure of ovule, megasporogenesis and development of the female gametophyte with particular reference to polygonum type.

#### **Unit-IV**

1. Fertilization, Endosperm and embryo development (onagrad type)
2. Apomixis, Polyembryony and Parthenocarpy.

#### **PRACTICAL**

1. Plant Anatomy, Anatomy of normal Dicot and Monocot roots and stems.  
Anatomy of anomalous structure of stems of: Bignonia, Nyctanthes, Achyranthes, Boerhaavia, Dracaena.

#### **Paper-IV**

##### **Unit-I**

1. Elementary idea of gene synthesis.
2. Tools and techniques of recombinant DNA Technology, Vectors and restriction enzymes.
3. General principles of gene cloning.

##### **Unit-II**

Characterization and analysis of clone, blotting techniques, PCR and its application in DNA finger printing.

Application of genetic engineering to human welfare.

Transgenic plants and gene transfer technology in them.

##### **Unit-III**

Elementary idea of cell culture and its nutrient media, protoplast fusion and hybridomas.

Practical application of tissues and organ culture.

Micropropagation : axillary bud, short tip and meristem culture, factors affecting the micropropagation.

Haploid production and their application.

##### **Unit-IV**

Spectrophotometry, Biosensor, Cryoelectron microscopy.

Application of X-ray crystallography and NMR (Biology) spectroscopy.

Separation techniques – chromatography.

## **Practicals**

Preparation of various nutrient media for tissue culture.

Estimation of DNA, RNA from plant samples.

Demonstration of photographs of

DNA Structure and replication

Gene cloning

Cellus

Micropropagation

Demonstration of cellus formation from pith of carrot root.

Separation of cell constituents by using chromatography techniques.

### **Practical Examination Scheme Based on Paper I, II, III and IV**

Microbiology experiment

Plant pathology (i) Host parasite relationship

Experiment on Ecology/Environmental Biology/Forestry.

Temporary mounting of a double stained section of material for anatomical studies. Identification of material with suitable comments and sketch.

Embryo dissection.

Experiments on Genetic Engineering and instrumentation.

Identify and comment upon spots (1 to 8).

Viva-Voce.

Records

Collection/Model/Charts.

## BOTANY

### M.Sc. (Previous)

#### Paper-I VIRUSES, BACTERIA, FUNGI AND LICHENS

##### Section A-Fungi

1. Status of fungi, principles of important systems of classification of fungi upto the rank of Classes. Detailed study of the classification of Alexopoulos and Mims 1970.
2. A study of the Myxomycetes, Plasmodiophoromycetes, Phycomycetes, Oomycetes, Zygomycetes, Ascomycetes, Basidiomycetes and Deuteromycete with reference to:
  - a. Classification upto the rank of order.
  - b. Range of structure and organisation of vegetative and reproductive bodies.
  - c. Ultra structure of fungal cells.
  - d. Method of reproduction.
  - e. Variations in life-cycle.
3. Modes of nutrition of fungi and their physical and chemical requirement for growth and reproduction.
4. Hetero Caryosis, Parasexuality, Heterothallism, Variation in fungi, Hormonal control of sexual reproduction.
5. Economic importance of fungi :
  - a. Utilization of fungi by man as food, in food processing, in production of organic acid, alcohols, antibiotics, Vitamins and Enzyme.
  - b. Harmful activities, Deterioration of materials by fungi, Fungi as agents of Plant and Human diseases.
  - c. Role of Fungi is environmental maintenance methods of isolation and culturing of fungi.

##### Section B- Lichens.

1. A general account of lichens and its symbionts, thallus structure, physiology, reproduction, classification and Chemistry of lichens, isolation of symbionts, synthesis of food and economic importance.

##### Section C-Viruses

1. Nature of plant viruses and symptoms caused by them, microscopic, histological and cytological.

2. Transmission of plant viruses, their relationship with Vectors.
3. Physiology of virus infected plants; serology and its applications.
4. Isolation, purification, morphology and structural components of viruses.
5. Replication movement and virus related organisms (mycoplasma & viruses)
6. Nomenclature classification and control measures.
7. Phages-structures mode of infection and multiplication in their hosts.

#### **Section D-Bacteria**

1. Classification : A general account of their mode of nutrition, cytology, reproduction, genetical importance of bacteria.
2. Economic importance and industrial uses of bacteria.

## **Paper-II ALGAE AND BRYOPHYTA**

### **Section A-Algae**

1. Principles of important systems of classification of algae to the rank of classes.
1. Occurrence and distribution.
2. Range of the organisation.
3. Algal pigments, its significance in classification.
4. Algal reproduction and life cycles.
5. Economic and environmental aspects of algae.
6. Study of the following class :
  - a. Cyanophyceae (Blue-green algae) : occurrence and habitat cellular organisation, reproduction, classification up to the rank of order, phylogeny, brief knowledge of the following genera :  
**Chroococcus, Gloeotrichia Nostoc, Cyllindrospermum, Stigonema.**
  - b. Chlorophyceae, (green algae) : General features, range of vegetative structure, reproduction, classification upto the order, phylogeny, brief knowledge of the following genera :  
**Chlorella, Hydrodictyon, Enteromorpha, Sphaeroplea Cladophora, Stigeoclonium, Draparnaldiopsis, Cephaleuros, Fritschiella, Trentepohlia, Acetabularia, Valonia, Caulerpa, Closterium, Zygnema, Mougeotia and Nitella.**
  - c. Phaeophyceae (Brown Algae) : General features, range of vegetative structure, reproduction, classification upto the order, brief knowledge of the following genera :  
**Pylialla, Dictyota, Laminaria, Fucus**
  - d. Rhodophyceae (Red Algae) External features, life histories, classification upto the rank of orders brief knowledge of the following genera :  
**Porphyra, Nemalion, Gelidium Polysiphonia**
  - e. Xanthophyceae : General features, brief knowledge of the following genera :  
**Botrydium, Vaucheria**
  - f. Bacillariophyceae General features, brief knowledge of the following genera :

## **Peridinium, Ceratium**

### **Section B-Bryophytes**

1. Origin and evolution of bryophytes.
2. Classification and geographical distribution of bryophytes with special reference to India.
3. Bryophytes and environmental pollution, their economic importance.
4. A comparative study morphology, anatomy, physiology life history, classification and phylogeny of the following groups with special reference to India. Hepaticopsida, Anthocerotopsida, Bryopsida.
5. Fossil History of Bryophytes.

## **Paper-III PTERIDOPHYTES, GYMNOSPERMS AND PALAEBOTANY**

### **Section A-Pteridophytes**

1. Classification and origin of pteridophytes.
2. The vegetative sporophytes : Microphylls stelar theory, telome theory.
3. The fertile sporophytes : sporangia position ontogeny, types and structure.  
Sorus evolution of sorus in ferns Heterospory-occurrence, and significance.
4. The gametophyte :  
General organography of pteridophyte gametophyte physiology of germination of fern spore development of fern prothallus.
5. Embryogeny : General organography of pteridophyte embryos.
6. Characteristic features of Rhyniaceae, Psilotaceae Pleuromiaceae, Lepidodendraceae, Sphenophyllaceae, Calamitaceae, Protopteridaceae, Ophioglossaceae, Gleicheniaceae, Azzollaceae.
7. Distribution of ferns, ecology of pteridophytes, apogamy, apospory.

### **Section B-Gymnosperms**

1. Classification distribution and economic importance of gymnosperms with special reference to India.
2. General accounts of the structure and reproduction of the following taxa :
  - a. Pteridospermae
  - b. Glossopteridales
  - c. Cycadales with special reference to Zamia
  - d. Bennetitales with special reference to Williamsonia, Cycadeoidea.
  - e. Pentoxylae
  - f. Cordaitales
  - g. Ginkgoales-with special reference to Ginkgo.
  - h. Coniferae with special reference to Lebachia Abies, Araucaria, Cryptomeria, Cupressus, Thuja and Cephalotaxus.
  - i. Taxales with special reference to Ephedra
  - j. Ephedrales with special reference to Gnetum
3. Origin and evolutionary tendencies in Gymnosperms.

### **Section C-Palaeobotany**

1. Types of fossils and methods of study.
2. Applied palaeobotany; carbon dating, palaeobotany of coal and petroleum, palynology.

3. Study of Indian fossil flora, Gondwana, flora the Rajmahal flora, Deccan Intertrappean flora and other Indian ritor flora.
4. Theory of conntental drift.

## **Paper-IV ECOLOGY, SOIL SCIENCE & PHYTO-GEOGRAPHY**

### **Section A-Ecology**

1. Ecology its scope and approach of study.
2. The environment, interaction of factors & ecological niche.
3. Auteological studies with emphasis on Indian work.
4. Phytosociology analytic & synthetic characters of vegetation.
5. Life-forms and biological spectrum.
6. Plant communities dynamics and development succession and climax.  
Methods of study and classification of plant communities.
7. Ecological adaptation and plant indicators.
8. Population ecology & gene ecology.
9. Ecosystem concept and idea of major ecosystem.
10. Ecosystem functioning Ecological energetics, production ecology, measurement of primary productivity principles of Biogeochemical cycles.
11. Ecological environment pollution.

### **Section B-Soil Science**

1. Soil and its origin and development.
2. Processes of soil formations and soil profile.
3. Soil properties in relation to plant growth
  - a. Physical, Texture, Structure, density, porosity, permeability to air, water and roots.
  - b. Soil water, energy concept of soil, water, soil water, quantities and their measurement.
  - c. Biological, soil organisms, their role in plant soil relationship.
  - d. Soil classification, Outlines of different system of soil classification, soil types of India with special reference to U.P.
4. Soil erosion and conservation, causes of soil erosion & its effects on environment, methods of soil conservation & their impact vegetation and environment.

### **Section C-Phytogeography**

1. Plant Geography : Distribution Patterns, barriers endemi area hypothesis.
2. Vegetational and floristic regions of India.

## **Paper-V CYTOGENETICS & BIOSTATISTICS**

### **Section A-Cytogenetics**

1. Cell division, Cell Cycle, chromosome pairing mechanism and synaptonemal complex.
2. Cytoskeleton and chromosome movements, structure function and assembly of microtubules, basal bodies and centrioles, spindle organisation movements of chromosomes.
3. Special Chromosomes
4. Numerical variation in chromosomes, Euploidy and aneuploidy significance of polyploidy in relation to crop improvement.
5. Modifications of Mendel's Law of inheritance, Interaction of genes and quantitative inheritance.
6. Linkage crossing-over and chromosomes maps.
7. Population, genetics, gene pools and gene-frequency
8. Inbreeding and out breeding hybrid vigour and Its Significance.
9. Mutation and mutagens.
10. Genetics of micro-organism (Bacteria, Neurospora Virus)
11. Recombination DNA techniques & its application in genetic Engineering.
12. Tissue culture and somatic hybridization.

### **Section B-Biostatistics**

1. Measure of dispersion, mean deviation, variation standard deviation and error.
2. Test of significance.
  - a. T-Test paired and unpaired sample.
  - b.  $X^2$ -Test, goodness of fit, Test of Independence, test of heterogeneity.
  - c. F-Test : Variance ratio of two populations, analysis of variance (Mono and bivariate)
  - d. Regression and correlation.

## **Paper-V ENVIRONMENTAL BOTANY**

### **Section A-General**

1. **Introduction** : relation of man with environment, National and International efforts on environmental problems, applied aspects of environmental Botany.

2. **Ecosystem** : Concepts and components classification, general idea of different ecosystems.
3. **Environment**, concept of environment, environmental segments, Biosphere, Atmosphere, Hydrosphere, and edaphic environment, biogeographical cycle.

### **Environmental Pollution**

- a. General idea about pollution and pollutants.
- b. Water pollution-physico-chemical properties of polluted water, heavy metal pollution, biological characterization of polluted water, water quality for drinking and quality of water of Indian rivers.
- c. Soil pollution, degradation of soil, erosion, pollution, air borne source, bioacides, solid wastes.
- d. Air pollution-Ozone, sulphur dioxide PAN, and green house gasses, particulate pollutants of air, impact on plants.
- e. Radioactive pollution—General idea about hazardous impacts of radiations and radioactive fallouts.
- f. Noise pollution, general idea about various levels of noise pollution and human response.

### **Section B : Environmental Management**

#### Control of Environmental Pollution

1. Environmental monitoring (Bioindicators)
2. Water management of aquatic ecosystem and purification of water, sewage treatment.
3. Soil conservation, solid waste and their disposal, waste collection, reclamation and cycling process.
4. Air-methods for monitoring air pollutants, air quality management and air pollution control device, role of plants in air pollution abatement.
5. Radioactive-Radioactive waste treatment.
6. Noise-Noise abatement.

### **Conservation**

- a. Conservation of forest, forestation, deforestation and social forestry
- b. Endangered and threatened species.
- c. Renewable energy sources
- d. Non conventional energy sources
- e. Population explosion and environment.

- f. Development of natural parks and biosphere reserves.
- g. Reducing pollution by biotechnological methods, objectives and guiding principles of environmental education.

**Environmental education and information**

The environmental education in India.

**Environmental Legislation**

Control of environmental pollution through law, merits and demerits.

BOTANY  
M.Sc. (Final)

**Paper-I PLANT PHYSIOLOGY & BIOCHEMISTRY**

**Section A-Plant Physiology**

1. Water relations absorption transpiration of water, osmotic quantities and hydrodynamics of plant cell.
2. Mineral metabolism essential and beneficial nutrients, availability deficiency and toxicity. Their role in plant metabolism, their absorption and translocations.
3. Plant membranes – their structure and function.
4. Photosynthesis chloroplast,  $\text{CO}_2$  reduction cycle in green plants. Hill reaction, Photophosphorylation chemosynthesis & Bacterial Photosynthesis.
5. Translocation of organic solute including experimental, evidences.
6. Respiration Mitochondrial, Anaerobic respiration, fermentation aerobic respiration, respiration insucculant, photorespiration, respiratory enzyme, Oxidative phosphorylation, Electron transport.
7. Fat metabolism, Alpha & Beta, Oxidations mechanism of fat synthesis and degradation.
8. Physiology of Dormancy senescence, seed germination and fruit ripening.

**Section-B Biochemistry**

1. Method of Biochemistry Analysis:
  - a. Chromatography
  - b. Colorometry
  - c. Radio-Technique
  - d. Spectrophotometry
2. Introduction to Bioenergetics
  - a. Laws of thermodynamics and concept of entropy.
  - b. Chemical equilibrium and chemical energetic.
  - c. Energetic coupling and energy rich compounds.
  - d. Dynamic equilibrium and steady state.
  - e. Redox System and redox potential
  - f. Measurement of energies.
3. Enzymes:
  - a. Chemical nature of enzymes.

- b. Modern nomenclature and modern classification of Enzymes.
  - c. Mechanism of enzyme action and Michaelis concept.
  - d. Factors affecting enzyme reactions.
  - e. Structure and functions of co-enzymes and prosthetic groups.
4. Classification and Biochemistry of Carbohydrates.
  5. Amino Acids and Proteins:
    - a. Amino acids and their synthesis.
    - b. Biosynthesis and degradation of nucleotides and proteins and their properties.
    - c. Primary secondary & tertiary structures of proteins and properties.
    - d. Denaturation, Degradation and renaturation of proteins and nucleic acids.

**Note: 2 Questions from each Section are necessary**

**Paper-II      ANGIOSPERMS-TAXONOMY, ECONOMIC BOTANY,  
MORPHOLOGY**

**Section-A Taxonomy**

1. History of plant taxonomy.
2. Systems of classification : History, outlines of basis, importance and shortcomings of following classifications.
  - a. Bentham and Hooker..... (in detail)
  - b. Hutchinson
  - c. Takhtajan
  - d. Conquist
3. Rules of botanical Nomenclature.
4. Field and herbarium techniques, Herbaria and Botanical Gardens of India and World. Organisation and activities of Botanical survey of India.
5. General knowledge of the distinguishing features of the following families with special reference to best flora :
  - a. Dicotyledones,      Ranunculaceae,      Magnoliaceae,      Nymphaeaceae  
     Annoniaceae,      Cayophyllaceae,      Capparidaceae,      Iamaricaceae,  
     Mimosaceae,      Lythraceae,      Onagraceae,      Rubiaceae,      Asteraceae,  
     Primulaceae,      Sapotaceae,      Oleaceae,      Salvadoraceae,      Asclepiadaceae,  
     Boraginaceae,      Scrophulariaceae,      Lentibulariaceae,      Bignoniaceae,  
     Convolvulaceae      Pedaliaceae,      Acanthaceae,      Verbenaceae,      Labiateae,

Polygonaceae, Nyctaginaceae, Loranthaceae, Euphorbiaceae, Moraceae, and Caricaceae.

- b. Monocotyledons, Hydrocharitaceae, Orchidaceae, Musaceae, Amaryllidaceae, Palmae, Commelinaceae, Lemnaceae, Alismaceae, Cyperaceae.

### **Section B-Economic Botany**

1. Scope of economic botany, study of economically important plants and plant products.
2. Forest Products (a) Wood Timber and Lumber (b) Resins, gum, tanning, materials & cork (c) Rubber and other latex products.
3. Textile plants & products : A general account.
4. Fumitories & masticatories : A general account.
5. Narcotics & Insecticide as plant products.

### **Section C-Morphology**

1. Phylogeny & interrelationship of Angiosperms.
2. Morphology of flower with special reference to the morphology of carpel & inferior ovary.

## **Paper-III ANATOMY, EMBRYOLOGY AND MORPHOGENESIS**

### **Section-A Anatomy**

1. The cambium, its derivative tissues, differentiation of secondary, phloem and xylem.
2. Structure of woods in relation to its weight, strength, durability and taxonomic significance.
3. Anamolous secondary growth in roots and stems.
4. Cork cambium and its derivatives, function of cork, commercial cork and its uses. abscission layers.
5. Origin of lateral and adventitious roots, root-stem transition.
6. Anatomy in relation to taxonomy.

### **Section-B Embryology**

1. Male and female gametophytes.
2. Fertilization and its control with special reference to incompatibility in flowering plants.
3. Endosperm and its abnormalities, Embryo developments.

4. Apomixis, Polyembryology and its induction.
5. Induced parthenocarpy, Embryology in relation to Taxonomy.  
(Development details of different types of embryosacs Microsporangia, endosperms should be confined to important types).

### **Section-C Morphogenesis**

1. Polarity, polarity in isolated cells, plasmodia & coenocytes, Expression of polarity in external and internal structure of plants. Physiological manifestations of polarity. Role of polarity in developmental pattern.
2. Correlation Physiological genetical correlations.
3. Symmetry, Inorganic & organic symmetries, radial bilateral and dorsiventral symmetries in plant body. Development of symmetry.
4. Experimental morphology, methods and data related to organo genetic activities of shoot-apex; morphogenesis in Acetabularia.

**Paper-IV      MICROBIOLOGY    PROGRESS    OF    BOTANY    AND  
MICROTECHNIQUE**

**Section-A Microbiology (Applied)**

1. Soil Microbiology : Decomposition of organic matter in soil cycling of essential elements in nature biofertilisers.
2. Microorganism in food processing : Cheese, butter, milk, bread.
3. Microorganisms in relation to biotechnology:
  - a. Production of Alcohol, beverages, organic acids , vitamins antibiotics and enzymes.
  - b. Role of Micro-Organisms in sewage disposal and alternative source of energy.
  - c. Micro-Organism and maintenance of environment.

**Section-B Progress of Botany**

1. Progress of Botany in 20<sup>th</sup> century in India.
2. Research organisations, Gardens and Herbaria of India.
3. Important Botanical Societies and Journals of India.

**Section-C Microtechnique**

1. Theory of fixation and important fixatives, storage of fixed materials.
2. Killing, Fixation, embedding and section cutting in serial and rocking and rotary microtomes.
3. Stains and Dyes : Haematoxylin, safranin, fast-green and carmine.
4. Principle of light microscopy, resolution and magnification, use of camera lucida, research microscope, phase contrast and electron microscope (Principles).
5. Use of pH meter, oven, Incubator and autoclave.
6. Preparation of culture media : PDA, Vogel's, White's and Maintenance of cultures.

**Paper-V(A) PLANT PATHOLOGY**

**Section-A General Principles**

1. Concept and importance of plant diseases.
2. Symptoms of plant diseases caused by fungi, bacterial and viruses.
3. Mode of infections and development of pathogen in plants.
4. Enzymes and toxins in plant diseases.

5. Mechanism of defence in plants : Morphological and biochemical defence mechanism, disease resistance.
6. Variability in plant pathogens : Types of variations mechanism of variability.
7. Effect of environment on development of infectious diseases of plants : epidemiology, plant disease forecasting.
8. Transmission of plant disease.
9. Methods of study of disease of plant, isolation of pathogens and tests of pathogenicity.
10. Principles and method of plant disease control : regulatory methods, cultural and biological methods, physical means, chemical methods (fungicides chemotherapy) resistant varieties.

### **Section-B Plant Diseases**

Study of importance, symptoms causal organism, disease cycle and control of the following disease of crop plants in U.P. caused by fungi, bacteria, viruses and M.L.O.

1. Rots : Fruit and stem rot of papaya : Fungal diseases, fruit rot and die-back of chillies; rhizome rot of ginger and red rot of sugar cane.
2. Damping of seedling of crop plants.
3. Downy mildew of bajra, crucifers, pea and cucurbits.
4. powdery mildew of barley, wheat, pea, apple and cucurbits.
5. Rusts of wheat, cicer (Gram) barley and linseed.
6. Smuts and Bunts : Covered and loose smuts of barley, smuts of maize, sorghum and sugarcane, loose smut of rice and bunt of rice.
7. Wilt of arhar, cotton, gram and sugarcane.
8. Leaf spots, blights and necrosis; leaf spot of crucifers, rice and turmeric; Tikka disease of ground nut, early and late blight of potato; leaf blight of wheat; blast disease of rice, mango abnormalities.
9. Galls and other abnormalities stem, galls of coriander, ergot of bajra, leaf curl of peach and apple.

### **Bacterial Disease**

Citrus cankers, blight of cotton, Angular leaf spot, black and scattering blight; blight of rice, brown rot of potato red stripe of sugarcane, tundu diseases of wheat.

### **Virus Disease**

# VBS Purvanchal University Jaunpur

Mosaics of apple, cucurbits, sugarcane, papaya, potato (Potato virus A,X,Y) and tobacco veinmosaic of bhindi, Yellow mosaic of legumes.

Leaf curl of chillies, papaya, tobacco and tomato, leaf roll of potato bunchy top of banana, trimleza of citrus; tug of rice.

Disease caused by M.L.O : Little leaf of brinjal, curling of citrus, purple top of potato, sesame phyllody, grassy shoot of sugarcane.

**Note : 2 Question from section A and 2 from Section B are necessary.**

## **Paper-V (B) ADVANCED PLANT PHYSIOLOGY**

### **Section-A Plant Metabolism**

1. Photosynthesis and chemosyntheses, Oantosomes biosynthesis of chlorophyll is conversion of solar energy into chemical energy and its utilization in  $\text{CO}_2$  reduction cycles, Efficient and inefficient plants, bacterial photosynthesis and its utility in nature.
2. Organic acid metabolism, succulent, CAM pathway and their significance.
3. Plant Energetic as controlled by Photosynthesis, Respiration and Photorespiration.
4. Respiration : Biological oxidations of carbohydrates and interconversions of the products, terminal oxidation, electron transport, role of cytochromes and other heme compounds.
5. Nitrogen Metabolism : Synthesis and activation of aminoacids transcription and translations of genetic code, the template, chemical regulation and biosynthesis of proteins and enzymes, Biochemistry of biological nitrogen fixation and its significance.
6. Phosphorus metabolism, Metabolism of phosphorylated compounds and their role.
7. Lipid Metabolism I-Classification of fat and fatty acids, biosynthesis and breakdown of fat and lipids, its significance, Unsaturated fatty acids.
8. Secondary plant products and their biosynthesis.

### **Section-B Growth**

1. Growth analysis and control mechanism biological clocks.
2. Germination of photo and non photoplatic seeds; physiology of seed and dormancy.

3. Factors affecting growth and plant growth under different stresses. role of phytochrome and mechanism of its action in growth morphogenesis and differentiation.
4. Physiology of abscission; biosynthesis of auxins; gibberellins and cytokinins and their mechanism of action.
5. Physiology of Flower initiation and floral expression.
6. Physiology and biosynthesis of alkaloids vitamins and sterols.

**Note:** *At least 2 question from section A and one from section B are necessary*

### **Paper-V (C) FOREST ECOLOGY**

#### **Section-A : General**

1. An outline of forest ecosystem.
2. Phytosociological concepts and methods for studying; forest vegetation.
3. General ecological features of the main forest types of India.
4. Ecology of some important timber tree like teak, sal and deodar.
5. Regeneration of forests.
6. Factors destructive to forest ecosystem.
7. Applied forest ecology.
8. Importance of forests in maintenance of environment.

#### **Section-B : Forest Soils and micro-environment.**

1. Soil development in forests.
2. Physico-chemical properties of forest soils.
3. Forest litter, humus formation and classification of humus.
4. Forest and grassland soils.
5. Soil in relation to forest vegetation.
6. Micro-Environment of the forest.
7. Ecological, economical and biological importance of forests.

**Note :** *2 Question from each section are necessary*

### **Paper-V(D) CYTOGENETICS AND PLANT BREEDING OF CROPS**

#### **Section-A Cytogenetics**

1. Cytology-cell structure, cell division, structure of chromosomes nucleosomes concept, sex chromosomes, B chromosomes, special chromosomes.
2. Genetic Mendelism, chromosome theory of heredity, linkage, crossing over and gene mapping, Interaction of gene. Quantitative inheritance, cytoplasmic

inheritance, sex linked inheritance, role in crop improvement, chromosomal aberration, numerical changes in chromosomes-euploidy (haploidy and polyploidy) Aneuploidy and their role in plant breeding.

3. Molecular Biology and microbial genetics : Gene concept, cistron, muton, recon, DNA as genetic material structure of DNA protein synthesis genetics of fungi, Bacteria and viruses.

### **Section-B Plant Breeding**

1. Principles and concept of plant breeding; techniques of plant breeding, selection, hybridization, acclimatization, heterosis, sterility and incompatibility, chimera and graft hybrids, breeding for disease, insect and drought resistance, crop improvement and methods of breeding of wheat maize, paddy, sugarcane, Arhar, potato and cotton with special reference to work done in India.
2. In-vitro techniques in relation to plant breeding classification, meristem culture, anther and pollen culture, tissue and cell culture, cybrids (protoplast fusion, hybridomes achievements and prospects.
3. Biometry and experimental designs : Importance of biometry in plant breeding data representation, classification tabulation, frequency, Null hypothesis, chi-square test (Numericals in relation to the genetics and plant breeding) correlation and regression in relation to plant breeding) Experimental designs.