

M.Sc : BOTANY

**New Curriculum According To U.G.C.**

*(with minor revision and rearranged paper sequence)*

**M.Sc. Examination**

**Annual System**

☞ **An Out- Line**

**First Year :**

- Course- I (Paper-I) - Biology & diversity of lower plants (cryptogams) - I (Algae & Bryophyta, Morphogenesis).
- Course- II (Paper-II) - Biology & diversity of lower plants-II (Fungi & Microbiology).
- Course- III (Paper-III) - Biology & diversity of vascular plants (Pteridophyta/Gymnosperm/ Palaeobotany)
- Course- IV (Paper-IV) - Plant Physiology, Biochemistry and Fundamental Process.
- Course- V (Paper-V) - Plant Ecology, Soil Science & Phytogeography.

**Second Year :**

- Course- I (Paper-I) - Techniques in Biology & Genetic Engineering.
- Course- II (Paper-II) - Diversity and taxonomy of seed plants- Angiosperms (Taxonomy, Anatomy, Embryology.)
- Course- III (Paper-III) - Cell Biology/Genetics/Plant Breeding/ Statistics.
- Course- IV (Paper-IV) - Plant Resource utilization and Applied Botany.
- Course- V (Paper-V) - Elective- Specialization paper  
(Anyone Optional)
  - i) Advanced Plant Physiology.
  - ii) Molecular Plant Pathology
  - iii) Environment and Plant Response





**M.Sc. (PREVIOUS) BOTANY**

**PAPER-I**

**(BIOLOGY & DIVERSITY OF LOWER PLANTS: CRYPTOGAMS (ALGAE & BRYOPHYTA)**

**UNIT I ALGAE**

Algae in diversified habitat.

Principles, criteria (pigments, flagellation, food reserve and eye spots) and systems of classification.

Cyanophyceae: Cyanophyta: cell structure, heterocyst and akinete development, chromatic adaptation, thallus organization and reproduction, and Salient features of Gloeocapsa, Microcystis, Anabaena, Gloeotrichia, Nostoc, Rivularia, Scytonema.

A brief account of thallus organization, structure and reproduction in Chlorophyta, Phaeophyta and Rhodophyta; alternation of generation in Phaeophyta and post-fertilization development and site of meiosis in Rhodophyta.

A brief account of Proto Chlorophyta, Chlorophyta, Xanthophyta, Bacillariophyta,

Phaeophyta: Ectocarpales (Ectocarpus); Laminariales (Laminaria); Dictyotales (Dictyota, Padina); Fucales (Fucus and Sargassum)

Rhodophyta: Bangioideae (Porphyra); Florideae (Batrachospermum, Polysiphonia)

Economic importance of algae  
(Algae as food, biofertilizers and source of phycocolloids.)

**UNIT II BRYOPHYTA**

Classification of Bryophytes

Comparative account of gametophyte structure

Sporophytic structure and evolution; Peristome structure and its significance in the classification of Mosses

Morphology, structure reproduction, life history, distribution and phylogeny of bryophytes based on following:-

(A) Hepaticopsida (i) Sphaerocarpales (Sphaerocarpus), (ii) Marchantiales (Riccia, Marchantia, Cyathodium, Plagiochasma, Lunularia, Astrella), (iii) Monocleales (Monoclea).



(iv) Jungermaniales (Pellia, Porella, Fossombronia), (v) Calobriales (Calobryum); (vi) Takakiales (Takakia).

(B) Anthocerotopsida: Anthocerotales (Anthoceros and Notothylas).

(C) Bryopsida: Sphagnales (Sphagnum), Andreales (Andreaea), Bryales (Funaria), Buxbaumiales (Buxbaumia).

### UNIT III: Morphogenesis

1. Meristem (Apical meristem of root, stem and leaf.)
2. Polarity (As expressed in external structure. Its manifestation and developmental pattern.)
3. Symmetry (Radial, bilateral, dorsiventral, development of symmetry and form.)
4. Totipotency
5. Somaclonal variation and its applications.

**PRACTICAL:** Practicals related to this paper will be based on plant types prescribed in each section (i.e. algae and bryophyta).





**M.Sc. (PREVIOUS) BOTANY**

**PAPER-II**

**(BIOLOGY & DIVERSITY OF LOWER PLANTS-II (FUNGI & MICROBIOLOGY))**

**UNIT-I FUNGI**

1. General characteristics, nutrition (saprophytic, symbiotic, biotrophic), reproduction, and recent trends of classification of fungi.
2. Heterothallism, Heterokaryosis, Parasexuality, Physiological specialization.
3. Systematic study of structure and reproduction, life cycle, phylogeny and affinities of main groups of fungi with special reference to following.
  - (i) Myxomycetes (Trichiales, Stemonitales, Physarales).
  - (ii) Plasmodiophoromycetes- (Plasmodiophorales).
  - (iii) Oomycetes: Saprolegniales (Saprolegnia, Achlya), Peronosporales (Phytophthora, Peronospora).
  - (iv) Chytridiomycetes: Chytridiales, Blastocladales, Monoblepharidales.
  - (v) Zygomycetes: Mucorales (Pilobolus), Entomophthorales.
  - (vi) Ascomycetes: Protomycetales (Protomyces), Endomycetales, (Saccharomyces), Taphrinales (Taphrina), Eurotiales (Aspergillus, Penicillium), Erysiphales (Erysiphe, Phyllactenia), Sphaeriales (Xylaria), Clavicipitales, Laboulbeniales, Pleosporales, Pezizales (Morchella).
  - (vii) Basidiomycetes: Tremellales, Ustilaginales (Ustilago, Urocystis), Uredinales (Puccinia, Melampsora, Uromyces, Ravenelia).
  - (viii) Deuteromycetes: Spheropsidales, Melanconiales (Colletotricum), Moniliales (Helminthosporium, Alternaria, Cercospora, Fusarium).
  - (ix) Economic importance of fungi.
- (4) Lichens: A general account with particular reference to mode of life, thallus structure, reproduction, classification and economic importance.

**UNIT-II Microbiology**

Introduction: A brief idea of microbial diversity; present status and future challenges; a general account of Archaea and Eubacteria.

Nutritional types of microorganisms, *Rhizobium*-legume symbiosis and mycorrhiza.





Anoxygenic photosynthesis with special reference to light reaction in purple bacteria; methanogenesis.

Genetics of bacteria: Genetic recombination- an overview; mechanisms of transformation, conjugation, and transduction in bacteria.

Viruses: Characteristics and ultrastructure, isolation and purification of viruses, transmission, and multiplication.

Lytic cycle in T even phages and its regulation; lysogeny and its regulation in lambda phage; a brief account of viroids and prions.

Phytoplasma:- General characteristics and role in causing plant diseases.

**PRACTICAL EXERCISE:**

1. Practicals related to this paper will be based on plant types of each section.
2. Symptomatology of important fungal, bacterial and viral diseases of plants.
3. Identification of fungal cultures of possible/available fungal types.
4. Gram staining of bacteria.
5. Study of foliose and other types of lichen thalli.





**M.Sc. (PREVIOUS) BOTANY**

**PAPER-III**

**(BIOLOGY & DIVERSITY OF VASCULAR PLANTS)**

(Pteridophyta, Gymnosperm, Palaeobotany)

**UNIT-I PERIDOPHYTA:**

Classification of pteridophytes.

Morphology, anatomy and reproduction, phylogenetic relationships with emphasis on detailed study of following:

- (i) Psilopsida- (Psilophytales, Psilotales)
- (ii) Lycopsidea- (Lycopodiales, Sellaginales, Lepidodendrales, Isoetales, Pleuromiales).
- (iii) Sphenopsida- (Equisetales, Hyeniales, Sphenophyllales, and Calamitales).
- (iv) Pteropsida- (A general account): Eusporangiate ferns, leptosporangiate ferns.

Brief account of the range of structure and reproduction in Ferns.

Telome concept, apogamy and apospory, heterospory and seed habit

Evolution of stele in pteridophytes.

Economic importance of Pteridophytes.

**UNIT-II GYMNOSPERMS & PALAEOBOTANY**

Classification, distribution, morphology, life history of gymnosperms.

Brief Account of the families of Pteridospermales (Lyginopteridaceae, Medullosaceae, Caytoniaceae, and Glassopteridaceae).

Comparative study of Cycadales, Bennettitales, Ginkgoales, Coniferales (Pinaceae, Cupressaceae, Araucariaceae, Podocarpaceae, Cephalotaxaceae, Taxodiaceae), Taxales and Gnetales (Gnetaceae, Ephedraceae and Welwitschiaceae) etc.

Distribution of conifers in India and their economic importance.

Principles of palaeobotany, fossil forms and fossilization, techniques to study fossils, geological time scale.

**PRACTICAL EXERCISES:**

1. Comparative and monographic study of the anatomy of vegetative and reproductive parts of Cycas, Ginkgo, Cedrus, Abies, Picea, Cupressus, Araucaria, Cryptomaria, Taxodium, Podocarpus Agathis, Taxus, Ephedra and Gnetum.
2. Study of fossil forms with the help of permanent slides.
3. Monographic study of Pteridophyte based on theory papers.



## M.SC. PREVIOUS

### PAPER IV

#### (PLANT PHYSIOLOGY, BIOCHEMISTRY, & FUNDAMENTAL PROCESSES)

##### UNIT-I PLANT PHYSIOLOGY

**Water relation to plants:** (Water potential and component potentials, its role in hydrodynamics, Absorption and translocation of water).

**Mineral relation to plant:** (Macro and Micronutrient elements, Active transport across membrane, Carrier Proteins).

**Photosynthesis** - Light harvesting complexes; mechanisms of electron transport; photoprotective mechanisms; CO<sub>2</sub> fixation-C<sub>3</sub>, C<sub>4</sub> and CAM pathways.

**Respiration and photorespiration** - glycolysis, Citric acid cycle; plant mitochondrial electron transport and ATP synthesis; alternate oxidase; photorespiratory pathway.

**Nitrogen metabolism** - Nitrogen cycle, nitrate and ammonium assimilation, amino acid biosynthesis.

**Metabolism of lipids, amino acids, nucleotides.**

**Plant hormones** - Biosynthesis, storage, breakdown and transport; physiological effects and mechanisms of action.

**Sensory photobiology** - Structure, function and mechanisms of action of phytochromes, cryptochromes and phototropins; stomatal movement; photoperiodism and biological clocks.

**Solute transport and photoassimilate translocation** - uptake, transport and translocation of water, ions, solutes and macromolecules from soil, through cells, across membranes, through xylem and phloem; transpiration; mechanisms of loading and unloading of photoassimilates.

**Secondary metabolites** - Biosynthesis of terpenes, phenols and nitrogenous compounds and their roles.

**Stress physiology** - Responses of plants to biotic (pathogen and insects) and abiotic (water, temperature and salt) stresses.





## **UNIT-II BIOCHEMISTRY & FUNDAMENTAL PROCESSES**

Bioenergetics, thermodynamics, coupled reaction, group transfer, biological energy transducers.

Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes

**Conformation of proteins** (Ramachandran plot, secondary structure, domains, motif and folds).

**Conformation of nucleic acids** (helix (A, B, Z), t-RNA, micro-RNA).

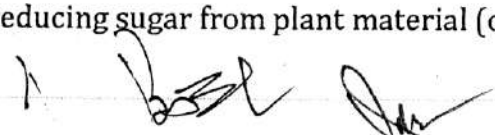
**DNA replication, repair and recombination** (Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication).

**RNA synthesis and processing** (transcription factors and machinery, formation of initiation complex, transcription activator and repressor, RNA polymerases, capping, elongation, and termination, RNA processing, RNA editing, splicing, and polyadenylation, structure and function of different types of RNA).

**Protein synthesis and processing** (Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, and translational proof-reading, translational inhibitors, Post-translational modification of proteins).

**Control of gene expression at transcription and translation level** (regulating the expression of phages, viruses, prokaryotic and eukaryotic genes, role of chromatin in gene expression and gene silencing).

### **PRACTICAL EXERCISES:**

1. Effect of time, enzyme concentration, substrate concentration on enzyme activity (diastase, catalase, nitrate reductase).
  2. To show substrate inducibility of enzyme nitrate reductase.
  3. Extraction of chloroplast pigments and separation of chlorophylls and carotenoids by paper chromatography.
  4. Extraction and isolation of seed protein and test by biurete reagent.
  5. Determination of osmotic potential of cell sap using epidermal peelings-plasmolytic method.
  6. Determination of osmotic potential of storage tissue-plasmolytic method.
  7. To study frequency of stomata and transpiration (potometer method).
  8. To determine real rate of photosynthesis by continuous air stream method.
  9. To determine rate of respiration in germinating seeds by continuous air stream method.
  10. To isolate and estimate reducing sugar from plant material (onion bulb) by using Fehling's reagent.
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**M.SC. PREVIOUS  
PAPER V**

**(ECOLOGY, SOIL SCIENCE, & PHYTOGEOGRAPHY)**

**UNIT-I ECOLOGICAL PRINCIPLES**

**The Environment:** Physical environment; biotic environment; biotic and abiotic interactions.

**Habitat and Niche:** Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement.

**Population Ecology:** Characteristics of a population; population growth curves; population regulation; life history strategies ( $r$  and  $K$  selection); concept of metapopulation – demes and dispersal, interdemic extinctions, age structured populations.

**Species Interactions:** Types of interactions, interspecific competition, herbivory, carnivory, pollination, symbiosis.

**Community Ecology:** Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones.

**Ecological Succession:** Types; mechanisms; changes involved in succession; concept of climax.

**Ecosystem Ecology:** Ecosystem structure; ecosystem function; energy flow and mineral cycling (C, N, P); primary production and decomposition; structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, estuarine).

**Biogeography:** Major terrestrial biomes; theory of island biogeography; biogeographical zones of India.

**Ecological Stability:** Concept, ecological perturbations, and ecology of plant invasion.

**Ecological Management:** Concept, sustainable development, and plant indicators.

**Applied Ecology:** Environmental pollution, global environmental change, biodiversity: status, monitoring and documentation, major drivers of biodiversity change, biodiversity management approaches.

**UNIT-II (SOIL SCIENCE & PHYTOGEOGRAPHY)**

Soil types, Soil profile, Soil formation (Gleization, Podzolization and Laterization), Soil texture, soil humus.



Soil moisture constants.

Soil erosion and conservation.

Phytogeography-Distribution pattern, barriers, endemism and Age-Area hypothesis.

**PRACTICAL EXERCISES:**

1. To find out minimum size and number of quadrat required for reliable estimate of grassland vegetation.
2. Study of quantitative characteristics of grassland vegetation by quadrat and point frame method.
  - (i) Frequency and relative frequency.
  - (ii) Density and relative density.
  - (iii) Dominance and relative dominance.
  - (iv) Importance value Index (IVI)
3. Comparison of leaf area index of two types of vegetation.
4. To find out association between important grassland species using chi-square-test.
5. Estimation of standing biomass of a local vegetation by any standard method.
6. To determine net phytoplankton productivity by light and dark bottle method.
7. To determine, soil moisture content, water holding capacity of soil collected from different location.
8. To determine percent organic carbon in soil sample of cropland and grassland, titrimetrically.
9. To determine dissolved oxygen in water samples by Winkler's method.
10. Rapid test of pH, carbonate, N.P.K. and base deficiency.





### M.Sc. (Previous) Botany Practical

**Scheme of Practical Examination :** There will be two practical examinations of 125 marks each Part-A will include the experiments related in to theory papers I, II and III and Part -- B will be based on theory paper IV and V.

#### Part - A

**Time : 5 hours**

**Max Marks : 125**

- |   |    |
|---|----|
| Q.1 Identification and study of four specimous from mixture - A (Algae)   | 20 |
| Q.2 Identification and study of structure with suitable sketches of specimen 'B' and 'C' (Fungi)                  | 15 |
| Q.3 Identification, and study of structure, (vegetative and reproductive parts) of specimen D & E. (Bryo phytes). | 15 |
| Q.4 Monographic study of speciment 'F' (Pleridophyte or Gymosperm).   | 20 |
| Q.5 Identify and comment upon spots 1-10  | 20 |

- |                                   |    |
|-----------------------------------|----|
| Q.6 Viva-Voce                     | 15 |
| Q.7 Class records and collection. | 20 |

#### Part - B

**Time : 5 hours**

**Max. Marks : 125**

- |  |    |
|--|----|
| Q.1 To perform a Plant Ecology experiment  | 20 |
| Q.2 To perform one soil science experiment | 20 |
| Q.3 One Plant Physiology experiment.       | 20 |
| Q.4 One Plant Biochemistry experiment.     | 20 |
| Q.5 Comment upon spots (1-5)               | 15 |
| Q.6 Viva voce                              | 10 |
| Q.7 Class record & tour report             | 20 |





# M.SC. (FINAL) BOTANY

**Paper – I : Microtechnique, Biotechnology, Genetic Engineering :**

**Max : 100**

## **Unit – I (Microtechnique) :**

1. Techniques of collection, fixation, embedding, dehydration, microtomy and staining of plant materials.
2. Techniques for preparation of herbarium and museum specimens and their maintenance.
3. Microtomy and use of Camera Lucida.
4. Histo chemical and cyto Chemical techniques for localization of protein, carbohydrate, fat, nucleic acid and ascorbic acid.
5. Literature review and preparation of reference cards.

## **Unit – II : (Biotechnology & Genetic Engineering) :**

1. **Basic Concepts** : Principles and scope.
2. **Plant cell and Tissue Culture** : General account, and scope.
3. **Somatic hybridization** : Protoplast isolation, culture, achievements and limitations of technique.
4. **Recombinant DNA technology** : Gene cloning, principle and scope, construction of genomic/cDNA library.
5. **Genetic Engineering in plants** : Aims, strategies for development of transgenics, chloroplast transformation and its utility, genetic engineering of industrial microbes and fermentation



technology.

**6. Biofertilizers :** Source, use and application in soil fertility.

**Suggested Practical Exercise :**

1. Preparation of blocks for microtomy, sectioning of block and preparation of permanent slides.
2. Use of Camera Lucida for drawing sketches of microscopic slides.
3. Demonstration of tissue and organ culture.
4. Isolation of Rhizobium from root nodules.
5. Demonstration of Hydroponic cultivation of economically important plant, principle and scope of technique.
6. Study of E. coli culture : Growth characteristics using planting and turbidimetric method.
7. Effect of temperature and osmoticum on protoplast culture.
8. Cocultivation of plant material (e.g. leaf discs) with agrobacterium and study of GUS activity histochemically.

**Paper – II : Diversity and Taxonomy of Seed Plants : Angiosperm  
(Taxonomy, Anatomy, Embryology) :**

**M.M. 100**

**Section – I :**

**(Taxonomy & Phylogeny) :**

1. Phylogeny of angiosperm, evolution and differentiation of species.
2. Species concept, taxonomic units, species, genus, family, order, delimitation of taxa and attribution of rank.
3. Morphology of flower (with special reference to carpel and inferior ovary).
4. **Taxonomic Tools :** Herbarium, Flora, Role of histology cytology, phytochemistry in taxonomic studies.
5. **System of angiosperm Classification :** Phenetic and phylogenetic systems. Merits and Demerits of major systems of classification (e.g. Bentham and Hooker, Engler and Prantle, Bessy and Hutchinson.)
6. Recent trends in Plant taxonomy.
7. General knowledge of distinguishing features of important families with special reference to local flora.



- a) *Dicotyledons*: Ranunculaceae, Annonaceae, Papaveraceae, Brassicaceae, Capparidaceae, Caryophyllaceae, Maliaceae, Linaceae, Rutaceae, Meliaceae, Vitiaceae, Anacardiaceae, Fabaceae, Rosaceae, Myrtaceae, Apiaceae, Rubiaceae, Asteraceae, Cucurbitaceae, Primulaceae, Boraginaceae, Convolvulaceae, Solanaceae, Scrofulariaceae, Bignoniaceae, Acenthaceae, Verbinaceae, Lamiaceae, Asclpiadaceae, Polygonaceae, Nyctaginaceae, Lorantheaceae, Euphorbiaceae.
- b) *Monocotyledon*: Orchidaceae, Liliaceae, Musaceae, Palmae, Alismaceae, Cyperaceae, Graminae (Poaceae), etc.
8. Botanical Survey of India, Important Herbaria and Botanical gardens.

## Section – II

### (Anatomy & Embryology) :

1. **Primary Meristem** : Organization of shoot and root apex.
2. Structure of wood in relation to its weight, strength, durability and its taxonomic significance.
3. Anomalous secondary growth.
4. Cork cambium and its products.
5. Anatomy in relation to taxonomy/floral anatomy.
6. Development of male and female gametophyte.
7. Fertilization, development of embryo in dicot and monocot, Endosperm.
8. Apomixis, Polyembryony, Parthenocarp.
9. Seed development and fruit growth.
10. Embryology in relation to taxonomy.

### Suggested Practicals:

1. Describing of plant specimen from representative locally available families.
2. Identification of taxa upto family using flora and identification of genus and species with, the help of available keys.
3. Collection of plants and preparation of herbarium, through field trips within and local area around campus.
4. Preparation of smears for study of male gametophyte.
5. Study of embryological permanent slides.

6. Embryo dissection.
  7. Study of angiospermic plant materials with particular reference to anatomical features of special interest.
- Paper – III (Cell Biology, Genetics, Plant Breeding, Statistics)**

M.M. 100

### Unit – I : (Cell Biology) :

1. Cell : Dynamic characteristic, structural organization of plant cell types, cell cycle.
2. Study of structural organization of plasma membrane and organelles, (Mitochondria, Nucleus, ribosome).
3. Tools and techniques for study of cell structure.
4. Structure of genetic material (DNA)
5. Cell division, crossing over, Synaptonemal complex spindle dynamics.

### Unit – II (Genetics) :

1. Chromosome structure, molecular organization of centromere and telomere, euchromatin, heterochromatin, Karyotype analysis, types of chromosome (Polytene, lampbrush,  $\beta$  Chromosome, Sex chromosome.)
2. Structural and numerical alteration in chromosome.
3. Mendelism and non-mendelian inheritance.
4. Interaction of genes.
5. Sex determination and sex-linkage.
6. Cytoplasmic inheritance – a general account.
7. Gene concept, Genetic code, Gene expression, Genetic mapping.
8. Genetics of prokaryote and Eukaryote organelles.
9. Mutation (Spontaneous, and Induced mutation, physical and chemical mutagens, molecular basis of gene mutation, DNA-damage and repair mechanism.)

### Unit – III (Plant Breeding & Elementary Statistics) :

1. Principle and scope of plant breeding.
2. Inbreeding and heterosis.
3. Breeding in self pollinated and cross pollinated plants.
4. Concept of statistics and Biometry.



5. Measurement of central tendencies (mean, mode, median, standard deviation, standard error.)
6. Significance test (chi square test & t-test)
7. Diagrammatic representation of statistical data.

#### Practical Exercises :

1. To study cell structure using onion leaf peels.
2. Study of protoplasmic streaming movement (cyclosis) in *Hydrilla* and staminal hairs of *Tradescantia* flower.
3. Demonstration of prokaryotic and eucaryotic cell structure with the help of electron micrographs.
4. Examination of mitosis and meiosis using appropriate plant material (onion root – tip, flower bud of sweet pea and flix.)
5. Cytological examination of special types of chromosome.
6. Emasculation of flower bud and demonstration of hybridization technique.
7. Statistical exercise based on theory paper.

#### Paper : IV : Plant Resource Utilization & Applied Botany :

M.M. 100

#### Unit - I : Plant Resource Utilization :

1. *Plant diversity and sustainable development* : Basic concepts and status in India.
2. *Cultivation and uses of economically important plants* (with special reference to origin, evolution, cultivation and uses).
  - i) Food, Forage and fodder crops (Cereals, legumes & nuts and general account of fodder crops).
  - ii) Fibre yielding crops (Textile fibre plants and their products, its uses and cultivation in India).
  - iii) *Medicinal Plants and Aromatic Plants* : (Important related plants of medicinal importance and aromatic plants as source of essential oil - A general account).
  - iv) *Vegetable Crops* : A general Account.
  - v) *Oil Yielding Crops* : A general Account.
  - vi) *Important fire wood and timber yielding plants* : A general Account.
  - vii) *Non-Wood Forest products (NWFPs)* : (Bamboo, rattans,

raw material of paper industry, gums, tannins, dyes resins, rubber and latex-products : A General Account).

- viii) *Sugars and sugar yielding plants* : A general Account.
- ix) *Fungicides and masticatories* : A general Account.

#### Unit - II : Applied Botany :

1. *Green revolution* : Benefits and adverse conditions, innovation for meeting world food demands.
  2. *Strategies for conservation* : In situ conservation (a general account of sanctuaries, national parks, biosphere reserve wetlands, mangroves for conservation of wild bio diversity)
- Ex-situ conservation* : (Principle and practices), A general account of the activities of B.S.I., National Bureau of Plant Genetic resource (NBPGR), Indian Council of Agricultural research (ICAR) for conservation of plants and nonformal conservation efforts.
  3. Seed certification and its application in agricultural production.
  4. Application of plant breeding in agronomic practices.
  5. Induction of parthenocarpy in production of seedless fruits.

#### Suggested Practical exercise :

1. *Laboratory work* : Study of food crops (wheat, rice, maize, potato, sugar-cane with reference to its characteristics and nature of reserve food material), Forage/Fodder crops (sorghum, bajra, barseem, guarbean) Plant fibres (Textile, fibres, coir, silk cotton or kopak). Medicinal / Aromatic Plants (Select few medicinal plants - e.g., *Papaver somniferum*, *Atropa belladonna*, *Adhatoda vasica*, *Rauwolfia serpentina*, *Withania somnifera*, *Andrographis paniculata*, *Aloe barbadense*, *Mentha arvensis*, *Vitiveria zizanioides*, *Cymbopogon* spp - study with herbarium materials or visible specimens). Vegetable oils (Mustard, groundnut, coconut, sunflower, study morphological and oil characteristics).
2. *Field Survey and Scientific visits* : (Study, survey of firewood, timber yielding plants in local forests, and visit to Institutes to see their role in conservation of biodiversity (e.g. B.S.I., CSIR, NBPGR, FRI etc.)

#### Special Paper - V (Elective)

#### B. Molecular Plant Pathology

M.M. : 100

#### Section A (Principles of Plant Pathology) :

1. History of plant pathology.



2. Elementary idea of infection, susceptibility, resistance, host parasite relationship, host reactions, symptomatology physiological specialization and interpretation of each aspect at molecular level.

3. Dissemination of Pathogens and disease Occurrence.
4. Plant Protection : Principle and concept of disease control, disease control prophylaxis, eradication, chemotherapy, immunization, plant quarantine, biological control of plant diseases.
5. Identification of plant diseases - Koch's postulate.

### Section - B (Crop Diseases of U.P.) :

1. Study of following diseases of principle crops of U.P.
  - i) *Rust* : (Wheat rust, and rust of gram, pea, linseed) & study of wheat rust problem in India.
  - ii) *Smut* : (Smut disease of wheat, barley, sugarcane and maize).
  - iii) *Burnt* : (of rice and wheat).
  - iv) *Blight* : (Disease of potats, cucurbits, wheat, tomato, colacacia and rice.)
  - v) *Wilt* : disease of sugarcane, linseed, pigeon-pea.
  - vi) *Leaf Spot* : of rice, ground-nut and turmeric.
  - vii) *Mildews* : of pea, cucurbits, maize and wheat.
  - viii) *Rots* : of papaya, turmeric, wheat and ginger.
  - ix) *Cankers* : of citrus, wart of potato, white rust of crusifer and stemgall of Coriander.
  - x) Viral diseases of potato, tomato, papaya, bhindi, sugar-cane and chilli.
  - xi) Diseases caused by mycoplasma.
  - xii) Elementary idea of physiological diseases and those caused by phanerogam - parasites.
2. Rapid method for diagnosis of plant diseases caused by (Viruses, Bacteria and Fungi with reference to 'ELISA' & PCR).

### Practical Exercise :

1. Collection and identification of plant diseases in local area.
2. solation, cultivation and maintenance of plant diseases.
3. Morphological and histopathological study the diseases of crops

available in local area.

4. Preparation of dried herbarium and museum specimen of plant diseases.

**Note :** Students will have to collect minimum 20 different pathological specimens and submit then at time of examination in form of pressed herbarium.

### Secipal Paper - V (Elective)

#### C : Environment and Plant Response

M.M. : 100

#### Section - A : Soil and water Environment :

1. **Soil Environment** : Soil composition, organic matter input and decomposition, soil nutrient storage and accumulation in plants, agrochemical residues and their pollutive effect.
2. **Water Environment** : hydrological cycle, primary production and productivity of different aquatic weeds, Distribution, adaptation and dynamics of fresh water and wet-land plant communities, water pollution due to sewage, agrochemicals, industrial wastes and urban solid wastes.

#### Section - B : Environment Planning and Strategies :

1. Air environment and its ecological perspective with reference to rural, urban and industrial areas.
2. Effect of air pollutants e.g.  $SO_2$ , Fluoride, photo-chemical, suspended particulates on vegetation of local area.
3. Indexing of sensitivity and resistance to pollutants, of plants.
4. Nuclear power - energy and its environmental effect.
5. Environmental planning strategies, criteria for environmental standard, monitoring techniques, control of air pollution through plants and microbes. Control of pollution of water bodies.

### Suggested Practical Exercise :

1. Estimation of soil organic matter by standard method.
2. quantitative evaluation of major soil nutrients (N,P,R.)
3. Estimation of fertilizer residue in soil.
4. Measurement of primary productivity of aquatic system by standard method.
5. Measurement of pH, soil conductivity, and level of water pollution, of different water samples.
6. Determination of BOD and COD of polluted and non-polluted water



samples.

7. Estimation of dissolved oxygen in water.
8. Sampling and assessment of particulate and gaseous pollutants (e.g., SO<sub>2</sub>, Ozone, NO, and dust)
9. Demonstration of monitoring techniques.
10. Measurement of smoke density by Ringelman charts.
11. Evaluation of hardness of water.

#### Special Paper - 5

#### D : Crop Genetics and Plant Breeding :

M.M. : 100

##### Section - A : Crop Genetics :

1. *Heridity and continuity of Life* : Reproduction cycle in plants.
2. *Mendelism* : (Laws of inheritance), Interaction of genes, leathality, Quantitative inheritance, chromosomal basis of inheritance.
3. Sex-determination, autosomes, chromosomal theory of sex-determination.
4. Chloroplastidic genome (molecular organization) and concept of extranuclear inheritance.
5. *Mutation and Mutagens* : Role of mutation in origin and evolution of species, spontaneous and induced mutations, numerical mutatin and chromosomal mutation, biological significance of mutation.
6. Modern concept of gene and gene expression.
7. Cytology of important crops plants.
8. role of biotechnology and genetic engineering in crop improvement and development of transgenic plants.

##### Section - B : Plant Breeding :

1. Principles and concepts : Scope of plant breeding in India.
2. Genetic basis of breeding in sexually reproducing crops.
3. Germ plasm preservation and gene-library.
4. Concept of pure line selection and hotrosis in crop improvement, inbreeding dippression, male-sterility and incompatibility, their role in plant breeding.
5. Techniques of plant breeding in self pollinating and cross pollinating crops.
6. Major achievements of plant breeding in India with reference to

wheat, rice, maize, sugarcane, potato, cotton, pea, groundnut, castor, and sunflower.

7. Recent tools and techniques of plant breeding for crop improvement (plant tissue hybridization, somatic hybridization, nutation and polyploidy).
8. Major contributin of Indian plant breeders in green revolution and future prospects.

#### Suggested Practical exercises :

1. Study floral morphology and biology of important crop plants-wheat, rice, maize, sugarcane, linseed, brassica, and cotton.
2. to perform emasculation in different crop plants including cereals, oil-crops, solanaceous-vegetable crops.

3. Study of cell division/cell cycle.

4. Use of chemical mutagens for crop plants and study of mutagenesis.
5. Demoustration of plant propogation through tissue culture technique.
6. Preparation of karyotypes from dividing root tip cell and pollen grains.

#### Scheme of Practical Examination :

**Note :** There shall be two practical examinations in M.Sc. (Final) Botany. Practical-I will be 'general' based on theory papers (I-iv), carrying 200 marks, and practical-II will be based on special (elective) paper of 50 marks only. There will be one long tour and atleast two local excursions and a detailed tour report will be submitted by students at the time of examination.

#### Practical - I (General)

##### Time : 6 Hours

M.M. : 200

1. Preparation of slide of anatomical material 'A' and identification & study of features of anatomical interest (Anatomy) 20
2. Describing flowering plant specimens 'B' and 'C' in semitechnical language, identification upto family and gems, assigning systematic position (Txonomy) 20
3. Dissection of Embryo from provided seed and study of features of embryological importance. 15
4. To perform one experiment based on paper - I 15
5. One statistical Exercise 10
6. One plant breeding exercise (e.g. Emasculation, bagging, tagging, labelling etc.) 10



7. Cytology (demonstration of stages of mitosis/meiosis) experiment 10
8. Comment upon spots (1-15) including 7 spots of economic importance (paper-IV) 30
9. viva-voce 20
10. Class records 20
11. herbarium and tour report (10 + 10) 20

Total = 200

#### Practical - II (Special)

##### A : Advanced Plant Physiology (Special)

Time : 4 hrs.

M.M. : 50

1. to perform one physiology experiment 20
2. to perform one enzymology experiment 14
3. Viva-voce 10
4. Class records 06

OR

##### B. Plant pathology (Special)

Time : 4 hrs.

M.M. : 50

1. Identification, histopathology and host-pathogen relationship of specimen - 'A' 10
2. Identification of pathogen and assessment of its effect on host in specimen 'B' and 'C' 08
3. Demonstration of pathological technique 06
4. Comment upon spots (1-5) 10
5. Viva-voce 10
6. Class record and Herbarium 06

OR

##### D : Crop Genetics and Plant Breeding (Special)

Time : 4hrs.

M.M. : 50

1. To study mutatin on muosis 15
2. To perform plant breeding experiment 15
3. Viva-voce 10
4. Records 10

OR

##### C : Environment and Plant Response (Special)

Time : 4hrs.

M.M. : 50

1. Two experiments concerning water and air studies 16
2. One experiment concerning soil studies 08
3. Comment upon spots (1-5) 10
4. Viva-voce 10
5. Class records 06