Eligibility For Admission
A pass in the B.Sc. Botany with any ancillary subject from any recognized university with minimum aggregate of 45% marks.

Duration of the course
Two years (Non-Semester Pattern).

Personal Contact Programmes (PCP)
During each academic year, there will be personal contact programmes. Theory (90 hrs) and practical (90 hrs) classes will be held on these days. The contact programmes will be conducted in the University campus. Attendance is compulsory for the contact programmes.

Examinations
The examination for the degree shall consist of theory and practicals. The practical examinations will be conducted at the end of the contact programme. The theory examinations will be conducted at the end of first year (Paper I-IV) and second year (Paper V-VIII). The candidate have to submit laboratory record notebooks for the evaluation during the practical examination. All the theory papers are of 3 hours duration each for a maximum of 100 marks with passing minimum of 50 marks. Practical examinations are also for 3 hours duration.

Classification of Candidates:
A candidate who obtains not less than 50% of total marks in each paper shall be declared to have passed in that paper.
A candidate who secures 50% or more but less than 60% of aggregate marks shall be placed in Second Class.
A candidate who secures 60% and more of aggregate marks shall be placed in First Class.

Completion of the Course:
The students have to complete their course within five years from the year of completion of the course, failing which their registration will stand automatically cancelled and they have to register afresh, if they want to continue the course subject to the availability of the programme during that time.
Failed Candidates:
A candidate who fails in any paper / papers may appear again in that paper / those papers alone as per the University rules. The marks once awarded for records, Herbarium and submission will remain the same and will be considered for any reappearance.

Other Regulations:
Besides the above, the common regulations of the University shall also be applicable to this programme.

Scheme of Examination: First year

<table>
<thead>
<tr>
<th>Name of the Paper</th>
<th>Duration (hrs)</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory: Paper-I Plant diversity</td>
<td>3</td>
<td>100</td>
</tr>
<tr>
<td>Theory: Paper-II Taxonomy of angiosperms and economic botany</td>
<td>3</td>
<td>100</td>
</tr>
<tr>
<td>Theory: Paper-III Microbiology and plant pathology</td>
<td>3</td>
<td>100</td>
</tr>
<tr>
<td>Theory: Paper-IV Cell biology genetics, plant breeding and evolution</td>
<td>3</td>
<td>100</td>
</tr>
<tr>
<td>Practicals -I For the courses I &amp; II</td>
<td>3</td>
<td>80+20*=100</td>
</tr>
<tr>
<td>Practicals -II For the courses III to IV</td>
<td>3</td>
<td>80+20*=100</td>
</tr>
<tr>
<td><strong>Total Marks</strong></td>
<td></td>
<td><strong>600</strong></td>
</tr>
</tbody>
</table>

*For Record Note book, herbarium and submission

Scheme of Examination: Second Year

<table>
<thead>
<tr>
<th>Name of the Paper</th>
<th>Duration Hours</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory: Paper-V Plant physiology and biochemistry</td>
<td>3</td>
<td>100</td>
</tr>
</tbody>
</table>
**Theory: Paper-VI**  
Plant anatomy and embryology  
3  
100

**Theory: Paper-VII**  
Plant Ecology, phytogeography and biodiversity conservation  
3  
100

**Theory: Paper-VIII**  
Plant biotechnology  
3  
100

**Practicals-III**  
For the Papers V&VI  
3  
80+20* =100

**Practicals-IV**  
For the Papers VII& VIII  
3  
80+20* =100

Total Marks  
600

*For Record Notebook and submission

### Syllabus

#### First year

**Paper I: PLANT DIVERSITY (Algae, Fungi, Pteridophytes, Pteridophytes and Gymnosperms)**

**Phycology:** General account (habitat, thallus organization, cell structure and reproduction). Criteria for classification: pigments, food reserves and flagella. Classification (Fritsch). Salient features of Cynophyta, Chlorophyta, Bacillariophyta, Phaeophyta and Rhodophyta. Ecological significance; Economic importance

**Mycology:** General characters; sustrate relationship, structure, cell wall composition, nutrition, and reproduction, heterothallism, paraseuxuality; recent trends in classification. General account: Mastigomycotina, Zycomycotina, Ascomycotina, Basidiomycotina Deuteromycotina. Outline of ecological significance and economical importance of fungi. Lichens - general account; economical importance.

**Bryology:** Morphology, structure and reproduction; distribution-Classification;. Characteristic features of Hepaticopsida, Anthocerotopsida and Bryopsida. Ecological significance; Economical importance.

**Pteridology:** General account: Morphology, structure and reproduction. Classification of Pteridophytes; Stelar evolution; Heterospory and origin of seed habit. General account of fossil Pteridophytes: Salient features of Psilopsida, Lycopsida, Sphenopsida and Pteropsida.

**Gymnosperms:** Introduction: general characteristics, distribution, classification(Sporne) and Evolution of gymnosperms. Salient features of *Pteridospermales, Cycadeoidales* and *Cordaitales*. Structure and reproduction in *Cycadales, Ginkgoales, Coniferales, Ephedrales Welwitschiales* and *Gnetales*; Economical importance.

**Text books:**
5. Watson, E.V. 1979. The structure and Life of Bryophytes. B.I. publication

**Reference books:**


**Paper II: TAXONOMY OF ANGIOSPERMS AND ECONOMIC BOTANY**


Study of the Polypetalae families: Magnoliaceae, Menispermaceae, Papaveraceae, Polygalaceae, Tiliaceae, Geraniaceae, Mimosaceae, Myrtaceae, Meliaceae and Sapindaceae.

Study of the Gamopetalae families: Sapotaceae, Rubiaceae, Asteraceae, Apocynaceae, Convolvulaceae, Bignoniaceae, Scrophulariaceae and Verbenaceae


Text books:


Reference Books:


**Paper III: MICROBIOLOGY AND PLANT PATHOLOGY**


Cultivation of microbes: Nutritional types of microbes. Media, Sterilization –Physical and chemical sterilizing agents –Principle, Mode of action and application. culturing techniques, cultivation of bacteria, algae, fungi and viruses


Defense mechanism of plants against infection – preexisting structures (wax, cuticle, epidermis etc); Anatomical – cork layer, Tyloses, abscission layer; Biochemical – phenolics, phytoalexins. Molecular biological aspects – PR proteins and avr genes. Effect of infection on the physiology of the host plant(Permeability changes, photosynthesis, respiration, enzyme activity, nitrogen metabolism, phenol metabolism).

Text books:

Reference books:

Paper IV: CELL BIOLOGY GENETICS, PLANT BREEDING AND EVOLUTION

Structural Organization: Prokaryotic and Eukaryotic cell. Cell wall- Primary and Secondary structure, model and function. Plasma membrane – Channels, Pumps and
Receptors; Plasmodesmata. Cell organelles - structure and functions; Ultra structure and semi autonomous nature of Chloroplast and mitochondria.


Plant breeding: Introduction and scope, Pure line selection - Mass selection pedigree method, Bulk method, Back cross method and Clonal selection and hybridization

Origin of life - theories of evolution – Lamarckism, Darwinism, Mutation theory, modern synthetic theory - types of evolution and evolution in action - Speciation – types and mechanism of speciation – adaptation, polymorphism and co-evolution

Text books

Reference Books:
Practical - I - (Paper I & II)

Paper I: Plant Diversity

1. **Phycology**: Structure, reproduction and identification characteristics of: *Oscillatoria, Spirulina, Desmid, Diatoms, Ulva, Caulerpa, Sargassum, Polysiphonia* and *Gracilaria*.

2. **Mycology**: Structure, reproduction and identification characteristics of: *Rhizopus, Mucor, Pilobolus, yeast, Aspergillus, xylaria, Penicillium, Trichoderma, Fusarium, Curvularia, Alternaria, Agaricus, Polyporus* and *Peziza*.

3. **Lichens**: Study of the thallus structure of Crustose, Foliose and Fruticose lichens.

4. **Bryology**: Structure, reproduction and identification characteristics of: *Marchantia, Porella* and *Pellia, Funaria*.

5. **Pteridology**: Structure, reproduction and identification characteristics of: *Equisetum Lygodium, Pteridium, Marsilea*.

6. **Gymnosperms**: Structure, reproduction and identification characteristics of: *Cycus, Cupressus, Podocarpus, Araucaria* and *Gnetum*.

Paper II: Taxonomy of Angiosperms and Economic Botany

1. **Taxonomy**: Detailed study of the families mentioned in the theory with representative species from a. local flora.
   - Identification of the families using punch-cards
2. Calculation of taxonomic distances based on numerical taxonomy
3. Chemotaxonomic identification of plants using starch grains and Raphides
   - Identification of stored/preserved and herbarium specimens.

4. **Economic Botany**:
   - Identification of family, genus, species and morphology of the economically useful parts

   *Note: Submission of 30 herbarium sheets*

Practical - II - (Paper III & IV)

Paper III: Microbiology and Plant Pathology

**Microbiology**

1. Acid fast staining.
2. Gram positive staining.
3. Gram negative staining
4. Preparation of culture media
5. Serial dilution techniques
6. Isolation of microbes from soil and water
7. Root nodule studies-Isolation of Rhizobia, Frankia and Glomus

**Plant Pathology**

8. Isolation of plant pathogens from infected plant materials.
10. Red rust and white rust.
11. Leaf spot of groundnut.
12. Mildew and Leaf spot of Banana.
Paper IV: Cell Biology, Genetics, Plant Breeding and Evolution

Cell Biology
1. Study of mitosis and meiosis - squash and smear technique
2. Chromosomal aberrations
3. Special types of chromosomes - permanent slides

Genetics
4. Genetic problems:
   a) Gene interaction
   b) Quantitative inheritance
   c) Multiple alleles
   d) Sex linkage
   e) Genetic maps

Plant Breeding
1. Vegetative propagation techniques
   a) Cutting
   b) Layering
   c) Budding
   d) Grafting

Evolution
1. Experiment to prove Hardy Weinberg equilibrium
2. Demonstration of Natural selection in species evolution

Note: Collection of plant pathology specimens – 10 sheets.

Paper V: Plant Physiology and Biochemistry


Plant growth regulators: Structure, physiological role and mode of action (in brief) of Auxins, Gibberellins, Cytokinins, Ethylene, Abscisic acid and Brassinosteroids - Phytochromes - Photoperiodism - Vernalization.


Enzymes: classification, nomenclature - mechanism of enzyme action - Michaelis constant - enzyme inhibitors - compatible and non-compatible, allosteric control of enzymes.

Carbohydrates - classification and general properties mono, di and polysaccharides - biosynthesis of carbohydrates (outline) - Lipids - Classification, structure and properties. Fatty acids - saturated and unsaturated fatty acids: biosynthesis and degradation

Text books:


Reference Books:


PAPER VI: PLANT ANATOMY AND EMBRYOLOGY


Ovule: Structure and development. Female gametophyte: Ontogeny of embryo sac, nutrition and morphology of embryo sac.

Fertilization: Ultra structural studies on fertilization- sexual incompatibility- Endosperm: Types, Haustorial organization and cytology-Xenia and Metaxenia- Ruminate endosperm.
Embryo: Proembryo, primitive embryo, one example of advanced embryo in dicot and monocot, views on monocot embryo, grass embryo - agamospermy and polyembryony.

Culture methods: Prospects and significance of anther, ovary, ovule, nucellus, embryo and endosperm culture - Isolation and culture of protoplast- Fruit :Biochemical,Physical factors in fruit development-structure of pericarp and parthenocarp

Role of IAA in differentiation-factors influencing morphogenesis: polarity, - Plant Galls: Classification, types- Plant tumours: General features.

Text books


Reference Books:


PAPER VII: PLANT ECOLOGY, PHYTOGEOGRAPHY AND BIODIVERSITY CONSERVATION

Ecosystem: Ecosystem concept and scope – Abiotic and biotic components, Concept of food chain and food web – community organization – Concept of habitat, functional role and concept of niche – ecotone – edge effect – ecological succession- seral communities- climax vegetation

Population biology: Basic concepts, survivorship curves, life table, self regulating mechanisms. Species interaction - inter-specific competition, competition coexistence, Negative interaction: predation, herbivory, parasitism - Positive interaction - commensalisms and mutualism.

Phytogeographical regions of the world, island biogeography theory, continental drift, continuous and discontinuous distribution, endemic distribution - floristic regions World. Forest geography - factors influencing the distribution of forest – productivity and nutrient cycling, forests and environment.
Biodiversity - definition - patterns of diversity: Genetic diversity, Species diversity, Ecosystem diversity, Guild diversity - Ecosystem stability; equilibrium and non equilibrium - succession - patterns of specie richness during succession – biotic interaction and succession. Species richness gradients - abiotic and biotic theories, Global species richness, rarity and abundance, Biodiversity hot spots - indicator species - keystone species.

IUCN categories of extinction - red data book - Causes for species extinction – Conservation: In situ Conservation - Biosphere reserve - National Parks - Wild life sanctuaries; Ex situ conservation - cryopreservation - Germplasm conservation, gene bank, seed bank, pollen bank, tissue culture, community gene bank; In situ On farm conservation - Community gardens, home gardens; Ecotourism.

Text books


Reference Books

PAPER VIII: PLANT BIOTECHNOLOGY

Plant cell-totipotency, culture of plant cells- tissue and organs; scope, historical review. Aseptic techniques; Culture media: preparation and composition. Methods of sterilization; methods to overcome phenolic oxidation; inoculation, incubation and hardening.

Cell and organ differentiation; Clonal propagation or micropropagation (artificial seeds, virus free plants); Somaclonal variation; Overcoming crossing barriers (Pre fertlization and post fertilization barriers including in-vitro pollination/fertilization and embryo rescue); Other uses of tissue culture (endosperm, nucellus culture, anther culture, ovule culture and bulbosum technique, germplasm storage including cryopreservation).

Isolation of protoplasts; Purification of protoplasts; Visibility and plating density of protoplasts; Protoplast culture and regeneration of plants; Protoplast fusion and somatic hybridization (techniques of fusion, selection of fused protoplasts, chromosome status of fused protoplasts, uses of somatic hybrids); Cytoplasmic hybrids or Cybrids; Genetic modification of protoplasts.

Target cell for crop improvement; vectors for gene transfer (based on Ti and Ri plasmids; co integrate, intermediate and helper plasmids; binary vectors; viruses as vectors); gene transfer techniques using Agrobacterium; selectable and scorable markers (genes); Agroinfection and gene transfer; Physical delivery methods.

Transgenic plants for crop improvement (dicots and monocots including maize, rice, wheat, oats, etc.; resistance to herbicide, insecticide, virus and other diseases; transgenic plants for molecular farming; transgenic plants to regulated gene expression, Chloroplast and Mitochondrion engineering.

Text Books:

Reference Books
Practical III (Paper V and VI)

Paper V: Plant Physiology and Biochemistry

**Plant Physiology**
1. Water potential by gravimetric method.
2. Water potential by falling drop method.
3. Osmotic potential by plasmolytic method.
4. Quantitative estimation of total chlorophyll content in leaves.
5. Quantitative estimation of carotenoid content in flowers.
6. Absorption spectrum of chlorophylls
7. Absorption spectrum of β-carotene.
8. Estimation of proline content in normal and senescent leaves.
10. Effect of light on photosynthesis

**Biochemistry**
1. Preparation of buffer solution
2. Quantitative estimation of carbohydrates
3. Qualitative test for amino acids
4. Separation plant pigments – paper chromatography
5. Estimation of protein – calorimetric method
6. Quantification of enzyme activity - Nitrate reductase

Paper VI: Plant Anatomy and Embryology

**Plant Anatomy**
1. Dissection of apical meristem
2. Maceration techniques
3. Peeling techniques
5. Anamalous secondary growth
   a) Aristolochia  
   b) Bougainvillaea  
   c) Boerhavia
6. Different types of pits
7. Different types of nodes

**Embryology**
1. Micro-preparation (by using locally available specimens):
   a) anther
   b) embryo
   c) endosperm
   d) polyembryony
   e) endosperm haustoria
2. Dissection of embryo
   a) *Tridax*  
   b) *Crotalaria*  
   c) *Cleome*

**Practical IV (Paper VII and VIII)**

**Practical IV (Paper VII & VIII)**

**Paper VII: Plant Ecology, Phytogeography and Biodiversity conservation**

**Plant Ecology**

1. Vegetation analysis in different communities
   a) Quadrat method
   b) Transect method
2. Calculation of density, frequency, basal area and Importance value Indices
3. Diversity and dominance indices
4. Identification of plants adapted to various habitats: hydrophytes, xerophytes and succulents
5. Diagnostic features of forest types
6. Analyses of soil physico-chemical characteristics
   a) particle size classification  
   b) bulk density  
   c) pH  
   d) organic matter  
   e) available nitrogen  
   f) available phosphorus  
   g) Potassium

**Plant Biotechnology**

1. General introduction and laboratory organization
2. Tissue culture media (composition and preparation).
3. Role of plant hormones in tissue culture.
4. Surface sterilization of explants for culture initiation
5. Initiation and maintenance of callus and suspension culture
6. Micro-propagation techniques
7. Isolation of genomic DNA

**Question paper pattern**

Maximum marks: 100  
Time: 3 hours

**Part A (10×2=20)**

10 Questions (Answers need to be given for all questions; Two questions from each unit)

**Part B (7×5=35)**

(Total questions 10, out of which any seven questions need to be answered)

**Part C (3×15=45)**

(Total questions 5, out of which any three questions need to be answered)