

# **COURSE, PROGRAM OUTCOMES & PROGRAM SPECIFIC OUTCOMES OF BOTANY**

**[B. SC. (BOTANY)]**

## **Programme outcomes (POs):**

Curriculum is outcome-oriented, fostered with discovery- learning, equipped with practice & skills to deal with practical problems and versed with recent pedagogical trends in education including e-learning, flipped class and hybrid learning to develop students into responsible citizens for nation-building and transforming the country towards the future with their knowledge gained in the field of plant science.

**PO1** - Syllabus with a combination of general and specialized education will introduce the concepts of breadth and depth in learning.

**PO2-** It will produce competent plant biologists who can employ and implement their gained knowledge in basic and applied aspects that will profoundly influence the prevailing paradigm of agriculture, industry, healthcare and environment to provide sustainable development.

**PO3-** It will increase the students' ability of critical thinking, development of scientific attitude, handling of problems and generating solutions, improve practical skills, enhance communication skill, social interaction, and increase awareness in judicious use of plant resources by recognizing the ethical value system.

**PO4** -The training provided to the students will make them competent enough for doing jobs in govt. and private sectors of academia, research and industry along with preparation for national as well as international competitive examinations, especially UGC-CSIR NET, UPSC Civil Services Examination, IFS, NSC, FCI, BSI, FRI etc.

**PO5** -Lifelong learning is achieved by drawing attention to the vast world of knowledge of plants and their domestication.

## **B. Sc I Semester**

## **Programme Specific Outcomes:**

**PSO 1:** The course will provide knowledge on various fields of basic botany.

**PSO 2:** The syllabus is prepared to enable students for competitive exams in frontier areas of plant sciences.

**PSO 3:** Students will be able to know about habit, habitat morphology, anatomy and reproduction of various plant groups.

**Course outcomes of B. Sc I sem:**

**CO1:** Students will be able to develop understanding about the classification and diversity of different microbes including viruses, algae, fungi & lichens & their economic importance.

**CO2:** Students will be able to develop conceptual skill about identifying microbes, pathogens & lichens.

**CO3:** Students will be able to gain knowledge about developing commercial enterprise of microbial products.

**CO4:** Students will be able to learn about host -pathogen relationship and disease management.

**CO5:** Students will be able to gain knowledge about uses of microbes in various fields.

**CO6:** Students will be able to understand the structure and reproduction of certain selected bacteria algae, fungi and lichens.

**Course outcomes of B. Sc II sem:**

**CO1:** Students will be able to develop critical understanding of morphology, anatomy and reproduction of bryophytes, pteridophytes and gymnosperms.

**CO2:** Students will be able to develop an understanding of plant evolution and their transition to land habitat.

**CO3:** Students will be able to learn the major patterns of diversity among plants, and the characters and types of data used to classify plants.

**CO4:** Students will be able to compare the different approaches of classification with regard to the analysis of data.

**B.Sc. II Year**

**Programme Specific Outcomes:**

**PSO 1:** This programme will provide knowledge on plant morphogenesis, anatomy embryology and plant genetics.

**PSO 2:** This programme will provide laboratory sessions following theory that will provide easy understanding of internal structure of various plant parts, structural organization, reproductive

biology and genetics.

**PSO 3:** This course will help students become plant morphologists.

**Course outcomes of B. Sc II Year:**

**Paper I: Taxonomy, Plant Anatomy and Embryology**

**CO1:** Students will be able to develop critical understanding on morphology, anatomy and reproduction of angiosperms.

**CO2:** Students will be able to become familiar with major taxa and their identifying characteristics, and to develop in depth knowledge of the current taxonomy of a major plant family.

**CO3:** Students will be able to discover and use diverse taxonomic resources, reference materials, herbarium collections, publications.

**CO4:** Students will be able to understand anatomy and embryology of plants.

**CO5:** Students will be able to understand role of tissues in plant functions.

**CO6:** Students will be able to understand the composition, modifications, internal structure & architecture of plants.

**CO7:** Students will be able to understand reproduction and developmental changes in plants.

**Paper II: Cytogenetic, Plant Breeding and Biotechnology**

**CO1:** Students will be able to understand the structure and chemical composition of chromatin and concept of cell division.

**CO2:** Students will be able to interpret the Mendel's principles; acquire knowledge on cytoplasmic inheritance and sex-linked inheritance.

**CO3:** Students will be able to understand the plant breeding systems and heterosis and mutation in plant breeding.

**CO4:** Students will be able to understand the basic tools and techniques used in plant tissue culture.

## **B. Sc III Year**

### **Programme Specific Outcomes:**

**PSO 1:** The learning outcomes of three year graduation programme will provide understanding of plant systematic, economic botany, developmental biology, ecology, statistics, physiology, biochemistry.

**PSO 2:** It will provide expertise in conservation biology and reproduction biology.

**PSO 3:** After completing this course successfully, students will be able to contribute positively to the field of plant sciences. The research project will help to develop research aptitude for higher education and scientific research.

### **Course outcomes of B. Sc III Year:**

#### **Paper I: Plant Physiology, Morphogenesis and Biochemistry**

**CO1:** Students will be able to understand the role of physiological and metabolic processes for plant growth and development.

**CO2:** Students will be able to learn the symptoms of mineral deficiency in crops and their management.

**CO3:** Students will be able to assimilate knowledge about biochemical constitution of plant diversity.

**CO4:** Students will be able to know the role of plants in development of natural products, nutraceuticals, dietary supplements, antioxidants.

#### **Paper II: Ecology, Biostatistics and Economic Botany**

**CO1:** Students will be able to know about the importance of medicinal plants and their useful parts, economically important plants in our daily life and also about the traditional medicines and herbs, and their relevance in modern times.

**CO2:** Students will be able to acquaint the students with complex interrelationship between organisms and environment.

**CO3:** Students will be able to understand methods for studying vegetation, community patterns and processes, ecosystem functions, and principles of phytogeography.

**CO4:** Students will be able to understand the strategies for sustainable natural resource management and biodiversity conservation.

**CO5:** Students will be able to gather practical knowledge of the different statistics tools and techniques.

### **M. Sc. (Botany)**

#### **Programme outcomes (POs):**

After the successful completion of M.Sc. degree in Botany, the students will be able to:

**PO1:** Understand structure, function and life-cycle patterns of different plant life-forms.

**PO2:** Achieve an up-to date level of understanding of plant physiology, ecology and biochemistry.

**PO3:** Identify plant diseases, causing organisms and their control measures.

**PO4:** Identify plants in their natural habitats, their economic and ethno-botanical importance.

**PO5:** Differentiate between different types of ecosystems and their structural components.

**PO6:** Evaluate services provided by different ecosystems in Himalayan region.

**PO7:** Understand and solve problems related to climate change and global warming.

**PO8:** Isolate and identify phytochemicals in different plant species and their antimicrobial potential.

**PO9:** Analyze regeneration status of different tree species in their natural habitat.

**PO10:** Develop strategies for conservation of rare and threatened plant species.

**PO11:** Develop protocol for propagation of economically and medicinally important plant species through plant tissue culture.

#### **Programme Specific Outcomes:**

After the successful completion of M.Sc. degree in Botany, the students will be able to:

**PSO 1:** Apply knowledge of botany in many applied fields like agriculture, horticulture, sericulture, forestry, pharmacology and medicine.

**PSO 2:** Qualify for competitive exams like UPSC, NET, SET, GATE etc.

**PSO 3:** Understand the multi-functionality of plants in production of secondary metabolites and there widespread industrial applications.

**PSO 4:** Correlate biodiversity to habitat, climate change, and land and forest degradation and develop conservation measures.

#### **Course Outcomes of Botany M. Sc. I Semester**

### **Paper I: Microbiology: Bacteria, Virus and Lichens**

**CO1:** Students will be able to understand the occurrence, general characters, types, reproduction and life cycles of the major microbial groups and their role in food, clinical and industrial microbiology.

**CO2:** Students will be able to apply practical skills in basic microbiological techniques.

**CO3:** Students will be able to evaluate the classificatory approaches and advances in bacterial, viral and lichen taxonomies.

### **Paper II: Phycology**

**CO1:** Students will be able to understand the contributions of famous Indian phycologists and centers of Algal Research in India.

**CO2:** Students will be able to understand the classificatory approaches and advances in algal taxonomy.

**CO3:** Students will be able to understand the general features of algae and its different groups and their representative genera.

**CO4:** Students will be able to study the ecological and economic importance of their study.

### **Paper III: Mycology**

**CO1:** Students will be able to understand the general characters, structure, nutrition, reproduction and the principles on classifications of fungi.

**CO2:** Students will be able to study fungal associations and fungal physiology.

**CO3:** Students will be able to understand the economic and pathological importance of fungi.

**CO4:** Students will be able to understand the occurrence, general characters, types, reproduction and life cycles of the major fungal groups.

### **Paper IV: Bryophytes and Pteridophytes**

**CO1:** Students will be able to understand the origin, diversity and evolution of bryophytes and pteridophytes.

**CO2:** Students will be able to understand the different classificatory systems of bryophytes and pteridophytes.

**CO3:** Students will be able to understand the general characters and the structure of the plant body of the types of bryophytes and pteridophytes mentioned in the syllabus.

**CO4:** Students will be able to study the ecological and economic importance of bryophytes and pteridophytes that will help them understand their role in ecosystem functioning.

### **Courses Outcomes of Botany M. Sc. II Semester**

#### **Paper V: Gymnosperms and Paleobotany**

**CO1:** Students will be able to understand the general characters, distribution and significance of gymnosperms.

**CO2:** Students will be able to understand the morphology, anatomy and reproduction of common gymnosperms.

**CO3:** Students will be able to remember the evolutionary eras and periods.

**CO4:** Students will be able to understand the techniques and process of fossilization.

#### **Paper VI: Diversity and Taxonomy of Angiosperms**

**CO1:** Students will be able to understand about the diversity and classification of plants.

**CO2:** Students will be able to understand description, identification, nomenclature and classification of plants.

**CO3:** Students will be able to study the types of inflorescence and their origin.

**CO4:** Students will be able to understand the concepts of phytogeography, endemism, plant migration, invasions and introduction.

**CO5:** Students will be able to study the characteristic features and economic importance of some important families.

#### **Paper VII: Plant Development and Reproductive Biology**

**CO1:** Students will be able to understand the morphological characteristics of flower.

**CO2:** Students will be able to study the fundamental concepts of shoot, leaf and root development.

**CO3:** Students will be able to understand various stages of development of plants.

**CO4:** Students will be able to understand the developmental biology of male and female gametophyte, pollen-pistil interaction.

**CO5:** Students will be able to study the basic idea of embryogenesis and seed development process, apomixes and polyembryony.

### **Paper VIII: Cytogenetics and Plant Breeding**

**CO1:** Students will be able to apply the concepts of Mendelian genetics to solve problems on linkage, crossing over and gene mapping.

**CO2:** Students will be able to analyze human pedigree and apply the principles of population genetics to work out problems on genotype frequency and Hardy-Weinberg equilibrium. They will also be able to understand the chromosomal aberrations and their role in genome evolution with special reference to crop plants.

**CO3:** Students will be able to understand modern breeding methods in improving agricultural crop varieties.

**CO4:** Students will be able to understand the process of cell cycle, its regulation and the mechanism of apoptosis.

### **Course Outcomes of Botany M.Sc. III Semester**

#### **Paper IX: Plant Ecology**

**CO1:** Students will be able to understand the scope and concepts of ecology and discuss the biosphere, biomes and biogeography.

**CO2:** Students will be able to analyze the process of ecological succession.

**CO3:** Evaluate the importance of the major world ecosystems.

**CO4:** Students will be able to distinguish between species, populations, communities, ecosystem and biomes.

#### **Paper X: Plant Resource Utilization and Conservation**



**CO1:** Students will be able to describe economically important plants with binomial names, family and uses.

**CO2:** Students will be able to understand the various uses of plants, biodiversity status, and loss and management strategies.

**CO2:** Students will be able to understand the biogeography and initiatives for biodiversity conservation.

### **Paper XI: Biotechnology**

**CO1:** Students will be able to understand the process and techniques of bio- technology and plant tissue culture.

**CO2:** Students will be able to analyze the tools and techniques used in genetic engineering.

**CO3:** Students will be able to evaluate the methods and applications of recombinant DNA technology.

**CO4:** Students will be able to understand the blotting techniques, DNA sequencing, and genetic engineering of plants.

### **Paper XII: Plant Physiology**

**CO1:** Students will be able to understand the mechanism of transport and translocation of water and analyze the mechanisms of acclimation and adaptation of plants to stress conditions.

**CO2:** Students will be able to understand the process of transpiration, photosynthesis and respiration and analyze these techniques in various groups of plants.

**CO3:** Students will be able to attain awareness on the nitrogen cycle and the role of microbes and plants in the nitrogen cycle.

**CO4:** Students will be able to understand the role of plant growth regulators and photoreceptors in plant growth and development.

## **Courses Outcomes of Botany M.Sc. IV Semester**

### **Elective course/special paper:**

#### **1. Plant Pathology**

**CO1:** Students will be able to understand general characteristics of plant pathogenic organisms including fungi, bacteria, viruses and mycoplasma.

**CO2:** Students will be able to study the interaction between plant and pathogen in relation to the environment and mechanism of disease development by pathogens.

**CO3:** Students will be able to understand the genetics of host parasite interaction.

**CO4:** Students will be able to understand the various enzymes and toxins involved in disease development.

**CO5:** Students will be able to various important plant diseases, disease cycle and control measures.

## **2. Bryology**

**CO1:** Students will be able to understand the general idea about morphology, cytology and reproduction in bryophyta.

**CO2:** Students will be able to study evolutionary trends and modern systems of classification of bryophytes.

**CO3:** Students will be able to understand the ecological and economic Importance of bryophytes.

**CO4:** Students will be able to understand the ecology, physiology and chemistry of bryophytes.

**CO5:** Students will be able to study the general characters and life cycle of some important bryophytes.