

## Expected Learning Outcomes

### (Programme Outcomes, Programme Specific Outcomes, Course Outcomes )

#### B.Sc. Botany

### Programme Outcomes

**PO1. Knowledge and understanding of:** 1. The range of plant diversity in terms of structure, function and environmental relationships. 2. Plant classification. 3. Plant pathology and physiology. 4. Genetics and biotechnology 5. The role of plants in the functioning of the global ecosystem. 6. Statistics as applied to biological data. 7. Modern techniques to study plants 8. Current trends in plant sciences

**PO2. Intellectual skills Students able to:** 1. Think logically and organize tasks into a structured form. 2. Assimilate knowledge and ideas based on wide reading and through the internet. 3. Transfer of appropriate knowledge and methods from one topic to another within the subject. 4. Understand the evolving state of knowledge in a rapidly developing field. 5. Construct and test hypothesis. 6. Plan, conduct and write a report on an independent term project.

**PO3. Practical skills:** Students learn to carry out practical work, in the field and in the laboratory, with minimal risk. They gain introductory experience in applying each of the following skills and gain greater proficiency in a selection of them depending on their choice of optional modules. 1. Interpreting plant morphology and anatomy. 2. Plant identification. 3. Vegetation analysis techniques. 4. A range of physiochemical analyses of plant materials in the context of plant physiology and biochemistry. 5. Analyze data using appropriate statistical methods. 6. Plant pathology to be added for sharing of field and lab data obtained.

**PO4. Transferable skills:** 1. Use of IT (word-processing, use of internet, statistical packages and databases). 2. Communication of scientific ideas in writing and orally. 3. Ability to work as part of a team. 4. Ability to use library resources. 5. Time management. 6. Career planning.

**PO5. Scientific Knowledge:** Apply the knowledge of basic science, life sciences and fundamental process of plants to study and analyze any plant form.

**PO6. Problem analysis:** Identify the taxonomic position of plants, formulate the research literature, and analyze non reported plants with substantiated conclusions using first principles and methods of nomenclature and classification in Botany.

**PO7. Design/development of solutions:** Design solutions from medicinal plants for health problems, disorders and disease of human beings and estimate the phytochemical content of plants which meet the specified needs to appropriate consideration for the public health.

**PO8. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and development of the information to provide valid conclusions.

**PO9. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern instruments and equipments for Biochemical estimation, Molecular Biology, Biotechnology, Plant Tissue culture experiments, cellular and physiological activities of plants with an understanding of the application and limitations.

**PO10. The Botanist and society, Effective Citizenship:** Apply reasoning informed by the contextual knowledge to assess plant diversity, its importance for society, health, safety, legal and environmental issues and the consequent responsibilities relevant to the biodiversity conservation practice.

**PO11. Environment and sustainability:** Understand the impact of the plant diversity in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PO12. Ethics:** Apply ethical principles and commit to environmental ethics and responsibilities and norms of the biodiversity conservation.

**PO13. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO14. Communication:** Communicate effectively on complex forms and functions of plants with Botanists community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO15. Self-directed and Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of plant study.

## **Programme Specific Outcomes: (PSO)s of B.Sc. Botany:**

**PSO 1.** Critically evaluation of ideas and arguments by collection relevant information about the plants, so as recognize the position of plant in the broad classification and phylogenetic level.

**PSO 2.** Identify problems and independently propose solutions using creative approaches, acquired through interdisciplinary experiences, and a depth and breadth of knowledge/expertise in the field of Plant Identification.

**PSO 3.** Accurately interpretation of collected information and use taxonomical information to evaluate and formulate a position of plant in taxonomy.

**PSO 4.** Students will be able to apply the scientific method to questions in botany by formulating testable hypotheses, collecting data that address these hypotheses, and analyzing those data to assess the degree to which their scientific work supports their hypotheses.

**PSO 5.** Students will be able to present scientific hypotheses and data both orally and in writing in the formats that recommended for research.

**PSO 6.** Students will be able to access the primary literature, identify relevant works for a particular topic, and evaluate the scientific content of these works.

**PSO 7.** Students will be able to apply fundamental mathematical tools (statistics, calculus) and physical principles (physics, chemistry) to the analysis of relevant biological situations.

**PSO 8.** Students will be able to identify the major groups of organisms with an emphasis on plants and be able to classify them within a phylogenetic framework. Students will be able to compare and contrast the characteristics of plant groups, and differentiate them from each other and from other forms of life.

**PSO 9.** Students will be able to use the evidence of comparative biology to explain how the theory of evolution offers the only scientific explanation for the unity and diversity of life on earth. They will be able to use specific examples to explicate how descent with modification has shaped plant morphology, physiology, and life history.

**PSO 10.** Students will be able to explain how Plants function at the level of the gene, genome, cell, tissue, Flower development. Drawing upon this knowledge, they will be able to give specific examples of

the physiological adaptations, development, reproduction and mode of life cycle followed by different forms of plants.

**PSO 11.** Students will be able to explain the ecological interconnectedness of life on earth by tracing energy and nutrient flow through the environment. They will be able to relate the physical features of the environment to the structure of populations, communities, and ecosystems.

**PSO 12.** Students will be able to demonstrate proficiency in the experimental techniques and methods of analysis appropriate for their area of specialization within biology.

## **Course Outcomes of B.Sc. Botany**

After completion of course following learning outcomes are expected.

### **F.Y. B. Sc.**

#### **Semester I USBO101 Paper I -- Plant Diversity 1**

##### **UNIT I ALGAE**

The students will be able to

Understand the distribution, range of thallus, reproduction and life cycle of Chlorophyta algae

Learn External and internal morphology, reproduction and life cycle of *Nostoc* and *Spirogyra*

Economic importance of algae

##### **UNIT II FUNGI**

The students will be able to

Understand Occurrence, structure, reproduction and life cycle of Phycomycetes Fungi

Learn Structure, reproduction, life cycle and systematic position of *Rhizopus* and *Aspergillus*

##### **UNIT III BRYOPHYTA**

The students will be able to

Understand General characters of Hepaticae and Structure, reproduction, life cycle and systematic position of *Riccia*.

#### **Semester I USBO102 Paper II – Forms and Functions- 1**

##### **UNIT I- CELL BIOLOGY**

Students will be understand

Biology, Cell, types of cells, structure of cell and organelles of Eukaryotic cell.

### **UNIT II- ECOLOGY**

Students will get the knowledge of

Interaction between living and non-living component of the environment, types of ecosystems and how the energy trapped in living system and transferred to the next organism i.e. trophic level.

### **UNIT III-GENETICS**

Students will be able to understand

Genotype governed phenotype, Mendelian Genetics, non-Mendelian genetics and Multiple alleles.

## **Semester II USBO201 Paper I -- Plant Diversity 1**

### **UNIT I PTERIDOPHYTES**

The students will be able to

Understand general characters of Pteridophytes and stellar evolution among them, Structure, reproduction, life cycle and systematic position of *Nephrolepis*.

### **UNIT II GYMNOSPERMS**

The students will be able to

Understand general characters and economic importance of Gymnosperms, Structure, reproduction, life cycle and systematic position of *Cycas*.

### **Unit III ANGIOSPERMS**

The students will be able to

Understand morphology of Angiosperms viz. leaf and inflorescence and salient features and economic importance of Malvaceae, Amaryllidaceae families.

## **Semester II USBO202 - Paper II – Forms and Function -1**

### **UNIT I- ANATOMY**

Students will be understand

Meaning of anatomy, types of tissues, primary structure of monocot and dicot root, stem and leaf with epidermal tissue system.

### **UNIT II- PHYSIOLOGY**

Students will get the knowledge of

Interaction of light with green plant parts, preparation of food with the help of carbon dioxide and water by using various pathways.

### **UNIT III- MEDICINAL BOTANY**

Students will be able to understand

Primary and secondary metabolites with differences, plants used in Grandma's Pouch.

## S. Y. B. Sc.

### **Semester III USBO301 Paper I -- Plant Diversity 2**

#### **Unit I : Thallophyta (Algae) & Bryophyta**

The students will be able to

Understand General Characters of Phaeophyta Algae and Structure, reproduction, life cycle and systematic position of *Sargassum*

Understand General Characters of Class Anthocerotae and Musci Bryophytes and Structure, reproduction, life cycle and systematic position of *Anthoceros* and *Funaria*

#### **Unit II: Angiosperms**

The students will be able to

Understand Plant systematic, Plant Nomenclature and Taxonomy in relation to different branches

Understand salient features and economic importance of Leguminosae, Asteraceae, Amaranthaceae and Palmae families

#### **Unit III: Modern Techniques to Study Plant Diversity**

The students will be able to

Understand Preservation methods and Microscopy, Chromatography and electrophoresis techniques

### **Semester III USBO302 Paper II – Forms and Function – 2**

#### **UNIT I- CELL BIOLOGY**

Students will be understand

Ultrastructure and functions of mitochondria, Peroxisomes, Glyoxisomes and ribosomes.

Cell division and its types with differences

Types of nucleic acids, structure and functions

#### **UNIT II- CYTOGENETICS**

Students will get the knowledge of

Variations in chromosome structure, sex determination, sex linked, sex limited and sex influenced traits.

Heredity of chloroplast and mitochondria with examples.

#### **UNIT III- MOLECULAR BIOLOGY**

Students will be able to understand

Autocatalytic, heterocatalytic functions of DNA in prokaryotes and eukaryotes.

### **Semester III USBO303 Paper III -- CURRENT TRENDS IN PLANT SCIENCES I**

#### **Unit1: Pharmacognosy and phytochemistry**

The students will be able to

Understand Pharmacopoeia and types, Study of Monograph from pharmacopoeia, Secondary Metabolites: Sources, properties, uses and adulterants, regional and seasonal variations and Adulterants with examples

#### **Unit 2: Forestry and Economic Botany**

The students will be able to

Understand Forestry, Outline of types of forest in India, Agro-forestry, Urban forestry, organic farming, Silviculture

Understand Economic Botany, types of fibers, Current trends in Fiber industries, Spices and condiments, Commercial market of spices

#### **Unit 3: Industry based on plant products**

The students will be able to

Understand Aromatherapy it's Uses with examples, Botanical and nutraceuticals, Enzymes industry and Biofuels.

### **SEMESTER IV USBO401 Paper I -- Plant Diversity 2**

#### **Unit I : Thallophyta: Fungi, Plant Pathology and Lichens Fungi**

The students will be able to

Understand General characters of Ascomycetae Fungi, Structure, reproduction, life cycle and systematic position of *Erysiphe* and *Xylaria*

Understand Plant Pathology and diseases- Powdery mildew and Late blight of potato

Understand Lichens - Classification, Structure, Method of Reproduction, Economic Importance and Ecological Significance of Lichens.

#### **Unit II: Pteridophyta and Paleobotany Pteridophyta**

The students will be able to

Understand Salient features and classification upto orders of Psilophyta and Lepidophyta, Structure, life cycle and systematic position of *Selaginella*

Understand Paleobotany- The geological time scale; Formation and types of fossils; Structure and systematic position of form genus *Rhynia*

#### **Unit III : Gymnosperms**

The students will be able to

Understand Salient features, classification up to orders and economic importance of Coniferophyta, Structure life cycle and systematic position of *Pinus*, Structure and systematic position of the form genus *Cordaites*.

#### **Semester IV USBO402 Paper II – Forms and Function – 2**

##### **UNIT I- ANATOMY**

Students will be understand

Meaning of Anatomy, normal secondary growth in dicot stem and root

Growth rings, periderm, lenticels, tyloses, heart wood and sap wood

Mechanical tissue systems in plants and types of vascular bundles

##### **UNIT II- PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY**

Students will get the knowledge of

Respiration, types and energetic, photorespiration and photoperiodism

##### **UNIT III- ECOLOGY AND ENVIRONMENTAL BOTANY**

Students will acquire the knowledge of

Biogeochemical cycles, ecological factors and community ecology with characters

#### **Semester IV USBO403 Paper III -- CURRENT TRENDS IN PLANT SCIENCES I**

##### **Unit I : Horticulture and Gardening**

The students will be able to

Understand Horticulture, it's branches, Gardening, different locations in the garden, Focal point, Types of garden, National Park and Botanical Garden with examples

##### **Unit II : Biotechnology**

The students will be able to

Understand plant tissue culture, Laboratory organization and techniques in plant tissue culture, Totipotency, Organogenesis, Organ cultures, R-DNA technology, Gene cloning and Enzymes and Vectors used for Gene cloning.

##### **Unit III : Biostatistics and Bioinformatics**

The students will be able to

Understand Biostatistics, The chi square test, Coefficient of correlation,

Understand Bioinformatics and tools, Information technology, History and tools of IT, Internet and its uses, Entrez, BLAST, Bioinformatics programme in India.