

FOUR YEAR UNDERGRADUATE PROGRAMME AS PER NEP-20

PROGRAMME: B.SC. BOTANY

Programme Specific Outcomes (PSOs):

1. Graduates will demonstrate advanced understanding and proficiency in specialized areas of botanical sciences, such as plant taxonomy, plant physiology, plant pathology and microbiology, plant genetics, or plant ecology.
2. Graduates will possess the ability to design and conduct independent research projects in botany, including formulating research questions, designing experiments, collecting, and analyzing data, and drawing scientifically valid conclusions.
3. Graduates will be able to interpret and analyze complex botanical data using statistical and computational methods, and effectively communicate their findings through written reports and oral presentations.
4. Graduates will have acquired proficiency in a wide range of laboratory techniques and methodologies commonly used in botanical research, including microscopy, molecular biology techniques, tissue culture, chromatography, and spectroscopy.
5. Graduates will demonstrate competence in fieldwork methodologies, plant specimen collection, preservation, and identification, and possess taxonomic expertise in the classification and identification of plant species.
6. Graduates will develop strong analytical and critical thinking skills, enabling them to identify and address complex botanical problems, evaluate scientific literature, and propose innovative solutions to real-world challenges in plant sciences.
7. Graduates will be able to communicate botanical concepts and research findings effectively to both specialist and non-specialist audiences through written reports, scientific papers, conference presentations, and outreach activities.
8. Graduates will adhere to ethical principles and professional standards in all aspects of their work, including research integrity, respect for intellectual property rights, and consideration of ethical implications in decision-making.
9. Graduates will collaborate effectively with colleagues from diverse disciplines, integrating botanical knowledge with other scientific fields to address multidisciplinary challenges in environmental science, agriculture, biotechnology, and conservation.
10. Graduates will demonstrate a commitment to lifelong learning and professional development, staying abreast of advancements in botanical sciences, engaging in continuing education, and contributing to the advancement of the field through scholarly activities and professional networking.

Course Outcomes (COs)

Semester 1

Paper: BOT-101 (Plant and Microbial Diversity)

Course Objective:

This paper will explain the origin of life, the diversity of Bacteria, Viruses, Algae, Fungi & Lichen, Bryophytes, Pteridophytes, Gymnosperms, and Angiosperms on the planet, and how they may be related to each other. The emphasis will also be on the hands-on approach and laboratory techniques for identification of the plant and microbial groups using various morphological features.

Course outcomes:

On successful completion of the course, students will have:

1. Knowledge with the concept of different kingdoms and the theories behind how life began.
2. Basic understanding of the characteristics, distribution, classification, reproduction, and current status of various microbial and plant communities.
3. Good understanding of virus, algae, fungus, bryophyte, and pteridophyte cell structures, dicotyledonous and monocotyledonous leaf venation patterns, and inflorescence and fruit features.
4. Knowledge to identify various groups of organisms in the laboratory through morphological analysis.

Semester 2

Paper: BOT-151 (Cell Biology and Biomolecules)

Course Objective:

This paper will explain biomolecules, the basic building blocks of living organisms, with a focus on their structural organization, molecule properties, biological roles, and functions. The emphasis will be on the relationship between the structure and function of various biomolecules at the chemical level with a biological perspective, as well as a hands-on approach and laboratory techniques.

Course outcomes:

On successful completion of the course, students will be:

1. Able to obtain knowledge of structure, classification, and physicochemical properties of biomolecules and enzymes.
2. Detailed knowledge of the structure, properties, and functions of a cell and its components.
3. Acquainted with practical knowledge of properties of cell and cell membranes, DNA staining techniques, and microscopy of the plant cell.
4. Able to identify various biomolecules in the laboratory by qualitative tests of biomolecules.

Semester 3

Paper: BOT-201 (Laboratory and Field Techniques in Plant Science)

Course Objective:

This paper will provide basic knowledge and understanding of good laboratory practices, laboratory waste management, understanding hazards and risks to ensure a safe laboratory environment, measurements, units, and common mathematical calculations, sampling and data collection, and instrument operation and maintenance.

Course outcomes:

On successful completion of the course, students will be:

1. Able to learn fundamental skills important for performing laboratory and field experiments.
2. Able to prepare, analysis of data and interpretation of results.

Semester 4

Paper: BOT-251 (Plant Resources and Economic Botany)

Course Objective:

This paper will provide an understanding of major introduced plant species, concept of centre of origin and their importance, domestication of crops and loss of genetic diversity, evolution of new crops /varieties. This paper will also provide knowledge on germ plasm diversity, importance of ethnobotany and economic importance of various plants.

Course outcomes:

On successful completion of the course, students will:

1. Know the centre of origin, domestication, and loss of genetic diversity
2. Understand the evolution of new crops /varieties
3. Know about the germplasm diversity
4. Understand the economic values of various plant species.
5. Understand the importance of ethnobotany in the present context.

Paper: BOT-252 (Microbiology)

Course Objective:

1. To give concise knowledge on basic microbiology
2. To give practical knowledge on handling of microorganisms
3. To inculcate knowledge on usefulness of microorganisms for sustainable development

Course outcomes:

1. Knowledge on microbial diversity and distribution in different habitats
2. Knowledge on ecological and economic importance of microorganisms in our day-to-day life
3. Knowledge on growth, reproduction and life cycles of viruses and microorganisms
4. Knowledge on genetic recombination of bacteria
5. Practical knowledge on microscopy, slide preparation, staining and morphological study of microorganisms
6. Knowledge on pathogenic microorganisms, host-pathogen interaction, and immunity
7. Practical knowledge on isolation and pure culture of bacteria/fungi from soil samples

Paper: BOT-253 (Morphology and Anatomy of Angiosperms)

Course Objective:

This paper will explain the detailed account on the morphological and anatomical features of Angiosperms.

Course outcomes:

1. Knowledge on morphology of angiosperms and developmental biology of plant body.
2. Knowledge on structural and anatomical organization of tissue system in plants and their classification.
3. Practical knowledge on inflorescences and fruits of angiosperms.
4. Practical knowledge on anatomical features of plant body parts.

Paper: BOT-254 (Mycology and Phytopathology)

Course Objective:

This paper will explain the general characteristics and reproductive procedures of fungi from different groups such as Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina. The paper will also focus on the basic idea of host-pathogen interaction during disease development, along with symptomology and the disease cycle of common fungal,

bacterial, and viral diseases. Furthermore, the role of fungi in various biotechnological aspects, pharmaceuticals, and agriculture will be highlighted.

Course outcomes:

On successful completion of the course, students will have:

1. Knowledge on general features of fungi and their classification
2. Knowledge on different classes of fungi, symbiotic fungi, and their characteristics
3. Knowledge on the application of fungi in different fields
4. Knowledge of plant pathogens and some important plant diseases
5. Practical knowledge on different classes of fungi based on their morphological and reproductive features
6. Practical knowledge on morphology, anatomical features of symbiotic fungi and locally available important plant pathogens.
7. Understanding biotechnological applications of fungi in industry, agriculture, and medicine.

Semester 5

Paper: BOT-301 (Molecular Biology)

Course Objective:

To have detailed knowledge of DNA, RNA and central dogma of molecular biology

Course outcomes:

1. Knowledge of structure, organization, and replication mechanism of DNA
2. Detailed knowledge of central dogma, mechanism of transcription and processing of different types of RNA
3. Knowledge of genetic code, molecular mechanisms associated with various steps in protein synthesis and post translational modifications
4. Ability to isolate genomic DNA from plant samples

Paper: BOT-302 (Plant Systematics)

Course Objective:

This paper will provide an understanding of knowledge on plant systematics, basic understanding of plant identification, classification systems and plant nomenclature, significance of systematics in different fields/branches of botany, phylogenetic and evolutionary relationships of angiosperms. The paper will also focus on knowledge about herbaria and botanical gardens in India and abroad and their significant role in plant identification.

Course outcomes:

On successful completion of the course, students will be:

1. Able to obtain knowledge on plant identification and classification systems, plant nomenclature.
2. Detailed knowledge of the phylogenetic and evolutionary relationships of angiosperms.
3. Able to obtain knowledge on various herbaria and botanical gardens in India and abroad, their role in plant systematics.
4. Acquainted with practical knowledge on vegetative and reproductive structures of angiosperms.
5. Acquainted students with practical knowledge on vegetation of an area.

Paper: BOT-303 (Plant Ecology, Phytogeography and Climate Change)

Course Objective:

This course will provide an understanding on ecology and ecosystems, biotic and abiotic interactions, ecosystem processes, terrestrial and aquatic environment, population and community interactions, plant distribution and effect of climate change on natural environment. Emphasis will be given on the hands-on approach, field, and laboratory techniques.

Course outcomes:

On successful completion of the course, students will:

1. Understand the concept of ecology, ecosystems, and importance of factors.
2. Understand the population, community, biodiversity, and conservation strategies.
3. Understand the concept of phytogeography, endemism, and floristic distributions.
4. Understand the science of climate change and sustainable development strategies.
5. Know the adaptation and mitigation against climate change-induced phenomena.

Paper: BOT-304 (Genetics)

Course Objective:

To gain knowledge on classical and modern concepts of genetics.

Course outcomes:

1. Knowledge of Mendelian and non- Mendelian inheritance in organisms.
2. Knowledge of gene and chromosomal mutations
3. Knowledge of basic concepts of population and evolutionary genetics
4. Ability to work out problems related to Mendel's experiments, Chromosome mapping and gene interaction

Semester 6

Paper: BOT-351 (Plant Metabolism and Biochemistry)

Course Objective:

Students will be acquainted with the elaborate concept of plant metabolism and biochemical pathways, by studying this paper. The paper will highlight the carbon assimilation pathways as well as carbon oxidation and ATP synthesis mechanisms in plant body. It will provide the detailed idea of pathways and mechanisms of carbohydrate, lipid, and nitrogen metabolism in plants. Furthermore, this paper will explain the various aspects and cascades of signal transduction mechanism. Additionally, the paper will also focus on the biosynthesis and physiological roles of secondary metabolites in plants.

Course outcomes:

1. Knowledge in basic understanding of plant metabolism and their regulation
2. Knowledge in concepts of carbon assimilation, oxidation, ATP synthesis
3. Knowledge in basic concepts of carbohydrate, Lipid and Nitrogen metabolism
4. Knowledge in basic concepts of signal transduction
5. Practical knowledge in separation of pigments, estimation of sugars, rate of respiration.
6. Ability to perform experiments on chromatographic techniques, spectrophotometric analysis.

Paper: BOT-352 (Applied Plant Biology)

Course Objective:

To gain knowledge on plant tissue culture, recombinant DNA technology and applications of genetic engineering techniques.

Course outcomes:

1. Knowledge of various methods of Plant tissue culture and their application
2. Knowledge of gene cloning, recombinant DNA technology and various methods of gene transfer in plants
3. Knowledge of the application of genetic engineering techniques for agriculture.
4. Ability to demonstrate tissue culture technique; isolate plasmid DNA and to carry out DNA manipulation using restriction enzymes

Paper: BOT-353 (Plant Physiology)

Course Objective:

Students will be able to learn the plant and water relation and thus will be able to elucidate the crucial role of water in diverse physiological functions of plants, by studying this paper. The paper will also highlight the importance of mineral elements in plant physiology and various mechanisms applied to uptake mineral elements by plants. It will provide the basic idea of pathways and mechanisms of translocation of organic solutes synthesised in plant. Furthermore, this paper will explain the role and mechanisms of action of various plant growth regulators as well as physiology

of flowering and dormancy of seeds. Additionally, the paper will also focus on the different abiotic and biotic stresses encountered by the plants in their environment as well as various stress mitigation strategies employed by plants to overcome the effects of stress.

Course outcomes:

1. Knowledge on mechanisms of water, minerals, and nutrient absorption of plants
2. Knowledge on roles of plant hormones and mechanism of flowering in plants
3. Practical knowledge on effects of growth regulators on plant parts
4. Practical knowledge on determination of osmotic and water potential

Paper: BOT-354 (Reproductive Biology of Angiosperm)

Course Objective:

This paper will explain the detailed accounts on reproductive and developmental characteristics of Angiosperm.

Course outcomes:

1. Knowledge on detailed morphological and reproductive structures of angiosperm.
2. Knowledge on embryology and embryological abnormalities in angiosperms.
3. Practical knowledge on developmental biology of embryo and endosperms.