

Programme Outcomes and Course Outcomes

B.Sc. Botany

Programme Outcome

This programme 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.

It will increase the ability of critical thinking, development of scientific attitude, handling of problems and generating solution, improve practical skills, enhance communication skill, social interaction, increase awareness in judicious use of plant resources by recognizing the ethical value systems.

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 graduate preparation for national as well as international competitive examinations, especially UGC-CSIR NET, UPSC Civil Services Examination, IFS, NSC, FCI, BSI, FRI etc.

New Syllabus Course Outcomes

B.Sc. Year-1: Semester-1:

Course Code: B040101T Course Title: Microbiology & Plant Pathology Course outcomes:

After the completion of the course the students will be able to:

1. Develop understanding about the classification and diversity of different microbes including viruses, Algae, Fungi & Lichens & their economic importance.
2. Develop conceptual skill about identifying microbes, pathogens, biofertilizers & lichens.
3. Gain knowledge about developing commercial enterprise of microbial products.
4. Learn host –pathogen relationship and disease management.
5. Learn Presentation skills (oral & writing) in life sciences by usage of computer of computer & multimedia
6. Gain Knowledge about uses of microbes in various fields.
7. Understand the structure and reproduction of certain selected bacteria algae, fungi and lichens
8. Gain Knowledge about the economic values of this lower group of plant community.

Course Code: B040102P Course Title: Techniques in Microbiology & Plant Pathology Course outcomes:

After the completion of the course the students will be able:

1. Understand the instruments, techniques, lab etiquettes and good lab practices for working in a microbiology laboratory.
2. Develop skills for identifying microbes and using them for Industrial, Agriculture and Environment purposes.
3. Practical skills in the field and laboratory experiments in Microbiology & Pathology.
4. learn to identify Algae, Lichens and plant pathogens along with their Symbiotic and Parasitic associations.
5. Can initiate his own Plant & Seed Diagnostic Clinic
6. Can start own enterprise on microbial products.

B.Sc. Year-1: Semester-2:

Course Code: B040201T Course Title: Archegoniates and Plant Architecture Course outcomes:

After the completion of the course the students will be able to:

1. Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms 2. Understanding of plant evolution and their transition to land habitat. 3. Understand morphology, anatomy, reproduction and developmental changes therein through typological study and create a knowledge base in understanding the basis of plant diversity, economic values & taxonomy of plants 4. Understand the details of external and internal structures of flowering plants.

Course Code: B040202P Course Title: Land Plants Architecture

After the completion of the course the students will be able to:

1. The students will be made aware of the group of plants that have given rise to land habit and the flowering plants. Through field study they will be able to see these plants grow in nature and become familiar with the biodiversity. 2. Students would learn to create their small digital reports where they can capture the zoomed in and zoomed out pictures as well as videos in case they are able to find some rare structure or phenomenon related to these plants. 3. Develop an understanding by observation and table study of representative members of phylogenetically important groups to learn the process of evolution in a broad sense. 4. Understand morphology, anatomy, reproduction and developmental changes therein through typological study and create a knowledge base in understanding plant diversity, economic values & taxonomy of lower group of plants 5. Understand the composition, modifications, internal structure & architecture of flowering plants for becoming a Botanist.

B.Sc. Year-2: Semester-3:

Course Code: B040301T Course Title: Flowering Plants Identification & Aesthetic Characteristics

Course outcomes: After the completion of the course the students will be able to:

1. To gain an understanding of the history and concepts underlying various approaches to plant taxonomy and classification. 2. To learn the major patterns of diversity among plants, and the characters and types of data used to classify plants. 3. To compare the different approaches to classification with regard to the analysis of data. 4. 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. 5. To discover and use diverse taxonomic resources, reference materials, herbarium collections, publications. 6. For the entrepreneur career in plants, one can establish a nursery, Start a landscaping business, Set up a farm Or Run a plantation consultancy firm.

Course Code: B040302P Course Title: Plant Identification technology Course outcomes:

After the completion of the course the students will be able: 1. To learn how plant specimens are collected, documented, and curated for a permanent record. 2. To observe, record, and employ plant morphological variation and the accompanying descriptive terminology. 3. To gain experience with the various tools and means available to identify plants. 4. To develop observational skills and field experience. 5. To identify a taxonomically diverse array of native plants. 6. To recognize common and major plant families. 7. To Understand aesthetic characters of flowering plants by

making-landscapes,gardens,bonsai,miniatures 8. Comprehend the concepts of plant taxonomy and classification of Angiosperms.

B.Sc. Year-2: Semester-4:

Course Code: B040401T Course Title: Economic Botany, Ethnomedicine and Phytochemistry

Course outcomes: After the completion of the course the students will be able to:

1. Understand about the uses of plants –will know one plant-one employment 2. Understand phytochemical analysis related to medicinally important plants and economic products produced by the plants 3. know about the importance of Medicinal plants and its useful parts, economically important plants in our daily life and also about the traditional medicines and herbs, and its relevance in modern times.

Course Code: B040402P Course Title: Commercial Botany & Phytochemical Analysis

Course outcomes: After the completion of the course the students will be able to:

1. Know about the commercial products produced from plants. 2. Gain the knowledge about cultivation practices of some economic crops. 3. Understand about the ethnobotanical details of plants. 4. Learn about the chemistry of plants &herbal preparations 5. Can become a protected cultivator, aromatic oil producer, Pharmacologist or quality analyst in drug company.

B.Sc. Year-3: Semester-5:

Course Code: B040501T Course Title: Plant Physiology, Metabolism & Biochemistry

Course outcomes: After the completion of the course the students will be able to: 1. Understand the role of Physiological and metabolic processes for plant growth and development. 2. Learn the symptoms of Mineral Deficiency in crops and their management. 3. Assimilate Knowledge about Biochemical constitution of plant diversity. 4. Know the role of plants in development of natural products, nutraceuticals, dietary supplements, antioxidants.

Course Code: B040502T Course Title: Molecular Biology & Bioinformatics

Course outcomes: After the completion of the course the students will be able to: 1. Understand nucleic acids, organization of DNA in prokaryotes and Eukaryotes, DNA replication mechanism, genetic code and transcription process. 2. Know about Processing and modification of RNA and translation process, function and regulation of expression. 3. Gain working knowledge of the practical and theoretical concepts of bioinformatics.

Course Code: B040503P Course Title: Experiments in physiology, Biochemistry & molecular biology

Course outcomes: After the completion of the course the students will be able to:

1. Know and authentic the physiological processes undergoing in plants along with their metabolism 2. Identify Mineral deficiencies based on visual symptoms 3. Understand and develop skill for conducting molecular experiments for genetic engineering.

Course Code: - B040504R Course Title: Project in Botany for Pre-graduation

Course outcomes: Project work will supplement field experimental learning and deviations from classroom and laboratory transactions. project work will enhance the capability to apply gained knowledge and understanding for selecting, solving and decision-making processes. It will promote creativity and the spirit of enquiry in learners. They will learn to consult Scientists, libraries, laboratories and herbariums and learn importance of discussions, Botanical & field trips, print and electronic media, internet etc. along with data documentation, compilation, analysis & representation in form of dissertation writing. It will enhance their abilities, enthusiasm, and interest.

B.Sc. Year-3: Semester-6:

Course Code: B040601T Course Title: Cytogenetics, Plant Breeding & Nanotechnology

Course outcomes: After the completion of the course the students will be able:

1.Acquire knowledge on ultrastructure of cell. 2. Understand the structure and chemical composition of chromatin and concept of cell division. 3. Interpret the Mendel's principles, acquire knowledge on cytoplasmic inheritance and sex linked inheritance. 4. Understand the concept of 'one gene one enzyme hypothesis' along with molecular mechanism of mutation. 5.Interpret the concept of Lemarkism, Neo Lamarkism, Darwinism and also understand the concept of natural selection.

Course Code: B040602T Course Title: Ecology & Environment

Course outcomes: 1. acquaint the students with complex interrelationship between organisms and environment; 2. make them understand methods for studying vegetation, community patterns and processes, ecosystem functions, and principles of phytogeography. 3. This knowledge is critical in evolving strategies for sustainable natural resource management and biodiversity conservation.

Course Code: B040602T Course Title: Ecology & Environment

Course outcomes:

1. acquaint the students with complex interrelationship between organisms and environment; 2. make them understand methods for studying vegetation, community patterns and processes, ecosystem functions, and principles of phytogeography. 3. This knowledge is critical in evolving strategies for sustainable natural resource management and biodiversity conservation.

Course Code: - B040604R Course Title: Project in Botany for Graduation

Course outcomes: After completing this course a student will have:

Project work will supplement field experimental learning and deviations from classroom and laboratory transactions. project work will enhance the capability to apply gained knowledge and understanding for selecting, solving and decision-making processes It will promote creativity and the spirit of enquiry in learners. They will learn to consult Scientists, libraries, laboratories and herbariums and learn importance of discussions, Botanical & field trips, print and electronic media, internet etc. along with data documentation, compilation, analysis & representation in form of dissertation writing It will enhance their abilities, enthusiasm, and interest.

COURSE OUTCOME OF OLD COURSE

B.Sc. Part I: Paper I (B-101) Diversity Viruses, Bacteria and Fungi

After completing this paper students will be able to understand and explain:

- History, nature and classification of Viruses
- Genome organization and replication of TMV, Bacteriophages and viroids
- Techniques in plant viruses - purification, serology and electron microscopy
- Economic importance of viruses
- History, nature and classification, bacterial genome and plasmids of Bacteria
- Bacterial reproduction, techniques of sterilization and staining
- Economic importance of Bacteria
- History, nature and classification, thallus organization and reproduction of fungi
- Economic importance of fungi.
- The life cycles of *Albugo*, *Pythium*,; *Saccharomyces*, *Aspergillus*; *Ascobolus*; *Ustilago*, *Puccinia*, *Polyporus*, *Agaricus*; *Fusarium*, *Cercospora*.

B.Sc. Part I: Paper II (B-102) Diversity of Algae, Lichens and Bryophytes

After completing this paper students will be able to understand and explain:

- General characters and range of thallus organization of Algae
- Classification and ultrastructure of eukaryotic algal cell and cyanobacterial cell
- Economic importance of Algae
- The characteristics and life cycles of *Oscillatoria*, *Volvox*, *Hydrodictyon*, *Oedogonium*, *Chara*, *Navicula*, *Vaucheria*, *Ectocarpus*, *Saragassum* and *Polysiphonia*.
- Classification and thallus organization of Lichens
- Reproduction and physiology, ecological and economic importance of lichens.
- General characters, classification, reproduction and affinities of Bryophytes.
- Gametophytic and sporophytic organization of *Riccia*, *Marchantia*, *Anthoceros* and *Pogonatum*.

B.Sc. Part I: Paper III (B-103) Diversity of Pteridophytes, Gymnosperms and Elementary Palaeobotany

After completing this paper students will be able to understand and explain:

- General features, classification, stelar system (with its evolution) of Pteridophytes
- Heterospory and seed habit.
- Comparative study of morphology, anatomy, development, vegetative and reproductive systems of *Lycopodium*, *Selaginella*; *Rhynia*, *Pteridium*, *Equisetum*, *Marsilea*.
- General characters, classification, affinities and relationship and evolutionary significance of Gymnosperms
- Comparative study of morphology, anatomy, development of vegetative and reproductive parts in: *Cycas*, *Pinus* and *Ephedra*.
- Elementary Palaeobotany: general account, types of fossils, methods of fossilization and geological time scale.

B.Sc. Part II: Paper I (B-201) Diversity of Angiosperms: Systematics, Development & Reproduction

After completing this paper students will be able to understand and explain:

- Principles of classification, Binomial nomenclature; comparative study of different classification systems, viz. Linnaeus, Bentham & Hooker, Engler & Prantl, Hutchinson, and Cronquist. Herbarium techniques and important Botanic Gardens.
- Taxonomic study of following families and their economic importance (Dicots): Ranunculaceae, Malvaceae, Brassicaceae, Cucurbitaceae, Rosaceae, Leguminosaceae, Myrtaceae, Rutaceae, Apiaceae, Apocynaceae, Asclepiadaceae, Solanaceae, Convolvulaceae, Acanthaceae, Lamiaceae, Asteraceae, Rubiaceae, Verbenaceae, Euphorbiaceae, and Amaranthaceae.
- Monocots: Cyperaceae, Poaceae, Arecaceae, Liliaceae.
- External morphology of vegetative and floral parts; modifications – phyllodes, cladodes, and phylloclades.
- Meristems-kinds study of tissue system - epidermal, ground, and vascular.
- Anatomy of roots, stems, and leaves. Cambium - its function and anomalies in roots and stems; root - shoot transition.
- Structure and development of male and female gametophytes – microsporogenesis microgametogenesis, megasporogenesis, and megagametogenesis, embryo sac types.
- Double fertilization development of embryo, endosperm development and its morphological nature, apomixis and polyembryony.

B.Sc. Part II: Paper II (B-202) Cytology, Genetics, Evolution & Ecology

After completing this paper students will be able to understand and explain:

- Cell structure: cell organelles, nucleus, chromosome structure, nucleosome and solenoid model, salivary gland, lampbrush and B chromosomes.
- Cell division: mitosis, meiosis; their significance, chromosomal aberrations, cell cycle.
- Genetics: laws of inheritance; gene interaction; linkage and crossing over;
- Cytoplasmic inheritance; sex determination.
- Mutation: spontaneous, induced mutations, molecular mechanism and evolutionary significance;
- Polyploidy origin, kinds and role in evolution.
- Evidences and theories of evolution.
- Ecology, relation with other disciplines.
- Plant types: Hydrophytes - *Hydrilla*, *Eichhornia*, *Nymphaea*, *Typha*.
- Xerophytes – *Nerium*, *Casuarina*, *Asparagus*, *Calotropis*, *Parkinsonia*.
- Plant succession – xeroseres, hydroseres.
- Ecosystems - concept, basic types, components, & functioning.
- Food chain, food web, energy flow and productivity.

B.Sc. Part II: Paper III (B-203) Plant Physiology and Biochemistry

After completing this paper students will be able to understand and explain:

- Plant and water relationship, colligative properties of water.
- Water uptake, conduction, transpiration, mechanism and its regulation by environmental variables.

- Mineral Nutrition : Macro, and micronutrients, their role, deficiency and toxicity symptoms, plant culture practices, mechanism of ion uptake and translocation.
- Photosynthesis and Chemosynthesis : photosynthetic pigments, O₂ evolution, photophosphorylation, CO₂ fixation – C-3, C-4 and CAM plants.
- Respiration : aerobic and anaerobic respiration, respiratory pathways glycolysis, krebs 'cycle, electron transport, oxidative phosphorylation, pentose phosphate pathway, photorespiration, cyanide resistant respiration.
- Lipid biosynthesis and its oxidation.
- Nitrogen metabolism : atmospheric nitrogen fixation, nitrogen cycle, nitrogen assimilation,
- Growth: general aspects of phytohormones, inhibitors-auxins. kinetin, gibberellins, and ethylene: action and their application; photoperiodism and vernalization.
- Germination, growth movements, abscission and senescence.
- Biomolecules : Classification, properties and biological role of carbohydrates, Protein and lipids
- Chemistry of nucleic acids, vitamins.
- Discovery and nomenclature. Characteristics of enzymes, concepts of holoenzyme, apoenzyme, coenzyme and cofactors.
- Regulation of enzyme activity, Mechanism of action.
- Bioenergetics: Laws of thermodynamics, concept of Gibb's free energy and high energy compounds.

B.Sc. Part III: Paper I (B-301) Plant Resource utilization, Palynology, Plant Pathology and Biostatistics

After completing this paper students will be able to understand and explain:

- Centres of diversity of plants, origin of crop plants.
- Domestication and introduction of crop plants.
- Basic concepts of Plant Breeding, hybridization, heterosis.
- Concepts of sustainable development; cultivation, production and uses of - wheat, rice, legumes, sugarcane
- A general account of plants yielding oils, spices, beverages.
- An account of major fiber, medicinal, petro plants of Uttar Pradesh.
- Etiology of viral, bacterial, fungal and insect-pest diseases: mosaic diseases on tobacco, and cucumber, yellow vein mosaic of bhindi; citrus canker, potato scab, little leaf of brinjal; damping off of seedlings late blight of potato, red rot of sugarcane
- Integrated pest disease management
- An introductory knowledge of palynology, morphology, viability and germination of pollens.
- Classification of data, mean, median and mode. Standard deviation, standard error, variance, co-relation, χ^2 test and experimental designs

B.Sc. Part III: Paper II (B-302) Molecular biology and biotechnology

After completing this paper students will be able to understand and explain:

- Nucleic acid as genetic material, nucleotides, structure of nucleic acids
- Properties of genetic code, codons assignments, chain initiation of codons
- Mechanism of protein synthesis and its regulation
- Replication of DNA in prokaryotes and eukaryotes
- Gene expression and regulation
- Hormonal control and second messengers Ca²⁺, Cyclic AMP, IP₃ etc.

- Introduction to biotechnology, recombinant DNA technology
- Biotechnology and healthcare, IPR issues
- Plant tissue culture, methods of gene transfer, transgenic plants
- Microbial and environmental biotechnology.

B.Sc. Part III: Paper III (B-303) Environmental Botany

After completing this paper students will be able to understand and explain:

- Mineral resources of planet earth and conservation of mineral resources.
- Soils: types, properties and various problem soils;
- Water: the source of water, physico-chemical and biological properties of water.
- Sustainable management of water;
- Energy resources in India;
- Forests: global forest wealth, importance of forests, deforestation.
- Environmental pollution: air, water, soil, radioactive, thermal and noise pollutions, their sources, effects and control.
- Greenhouse effect, ozone depletion and acid rain.
- CO₂ enrichment and climate change.
- Biodiversity: biotic communities and populations, their characteristics and population dynamics.
- Phytogeography: Natural vegetation of India, static and dynamic plant geography, basic principles governing geographical distribution of plants, endemism.
- Conservation of plants resources for agriculture and forestry.
- *In situ* conservation sanctuaries, national parks, biosphere reserves, wetlands, mangroves.
- *Ex situ* conservation; *botanical gardens, field gene banks, seed banks, cryobanks.*

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