

DEPARTMENT OF BOTANY
COURSE OUTCOME (CBCS), 2022-23

COURSES	OUTCOMES
BOT-HC-1016: Phycology and Microbiology	<ul style="list-style-type: none"> ➤ Detailed knowledge on microbes, viruses and bacteria, and their importance in agriculture and medicine ➤ Knowledge on Algal classification, Economic and ecological importance of Algae ➤ Practical knowledge on structure of T-Phage and TMV, lytic and lysogenic life cycle. ➤ Practical knowledge on microscopy of bacteria and algae
BOT-HC-1026: Biomolecules and Cell Biology	<ul style="list-style-type: none"> ➤ Knowledge on structure, classification and physicochemical properties of biomolecules and enzymes. ➤ Detailed knowledge on structure, properties and functions of cell and its components. ➤ Practical knowledge on properties of cell and cell membrane, DNA staining techniques and microscopy of plant cell. ➤ Knowledge on qualitative tests of biomolecules
BOT-HC-2016: Mycology and Phytopathology	<ul style="list-style-type: none"> ➤ Detailed knowledge on different classes of fungi, their structure, classification, life cycle and reproduction. ➤ Knowledge on diseases in plants caused by viruses, bacteria and fungi and biotechnological applications of fungi. ➤ Structural analysis of different classes of fungi and their reproductive stages. ➤ Knowledge on structures of symbiotic associations (Lichens, Mycorrhiza)
BOT-HC-2026: Archegoniate	<ul style="list-style-type: none"> ➤ Detailed knowledge on morphology, anatomy, classification and properties of bryophytes, pteridophytes and gymnosperms. ➤ Knowledge on reproduction and economic importance and ecological significance of bryophytes, pteridophytes and gymnosperms. ➤ Practical knowledge on morphology and reproductive structures of archegoniates. ➤ Spore morphology analysis and detailed knowledge on male and female reproductive structures in gymnosperms
BOT-HC-3016: Morphology and Anatomy of Angiosperms	<ul style="list-style-type: none"> ➤ Knowledge on morphology of angiosperms and developmental biology of plant body. ➤ Knowledge on structural and anatomical organization of tissue system in plants and their classification. ➤ Practical knowledge on inflorescences and fruits of angiosperms. ➤ Practical knowledge on anatomical features of plant body parts
BOT-HC-3026: Economic Botany	<ul style="list-style-type: none"> ➤ Knowledge on morphology, uses and economic importance of crop plants. ➤ Knowledge on uses of industrially important plants. ➤ Practical knowledge on economically important plant parts and

	their products.
BOT-HC-3036: Genetics	<ul style="list-style-type: none"> ➤ Knowledge on Mendelian concepts in genetics; structure, functions and properties of chromosome; chromosomal aberration. ➤ Knowledge on gene structures and gene mutations, population genetics. ➤ Practical knowledge on chromosomal mapping and gene interaction studies. ➤ Practical visualization of chromosomal anomalies
BOT-HC-4016: Molecular Biology	<ul style="list-style-type: none"> ➤ Detailed knowledge on architecture of nucleic acids, organization of DNA in organisms, models of replication and the factors associated with it. ➤ Detailed knowledge on transcriptional and post transcriptional events in a cell, translation of proteins. ➤ Practical acquaintance of isolation and quantification of DNA from plants. ➤ Knowledge on photographic study of RNA polymerases and RNA modification machinery.
BOT-HC-4026: Plant Ecology and Phytogeography	<ul style="list-style-type: none"> ➤ Knowledge on origin, formation and properties of abiotic components of the ecosystem, interactions and adaptation of plants with biotic and abiotic factors. ➤ Knowledge on properties of communities in a population and trophical and habitat organization in an ecosystem. ➤ Practical knowledge on property analysis of abiotic components of the ecosystem. ➤ Practical knowledge on vegetation study and different ecological sites.
BOT-HC-4036: Plant Systematics	<ul style="list-style-type: none"> ➤ Knowledge on plant identification and classification systems, plant nomenclature. ➤ Knowledge on phylogenetic and evolutionary relationships of angiosperms. ➤ Practical knowledge on foliar morphology and taxonomical study of angiosperms.
BOT-HC-5016: Reproductive Biology of Angiosperms	<ul style="list-style-type: none"> ➤ Knowledge on detailed morphological and anatomical study of reproductive structures of angiospermic plants. ➤ Knowledge on embryology and embryological abnormalities in angiosperms. ➤ Structural documentation of reproductive structures of angiosperms. ➤ Practical knowledge on developmental biology of embryo and endosperms.
BOT-HC-5026: Plant Physiology	<ul style="list-style-type: none"> ➤ Knowledge on mechanisms of water, minerals and nutrient absorption of plants. ➤ Knowledge on roles of plant hormones and mechanism of

	<p>flowering in plants.</p> <ul style="list-style-type: none"> ➤ Practical knowledge on effects of growth regulators on plant parts. ➤ Practical knowledge on determination of osmotic and water potential.
BOT-HC-6016: Plant Metabolism	<ul style="list-style-type: none"> ➤ Detailed knowledge of metabolic events of photosynthesis and nutrient metabolism. ➤ Knowledge of signalling molecules and pathways in the plant cell. ➤ Practical knowledge on different types of chromatographic techniques. ➤ Estimation of TAN, sugar and protein contents in plant sample.
BOT-HC-6026: Plant Biotechnology	<ul style="list-style-type: none"> ➤ Knowledge on applications of tissue culture techniques, construction of recombinant DNA and transformation into hosts, construction of DNA libraries. ➤ Knowledge on development of transgenic plants for agricultural or industrial use. ➤ Practical utility on isolation of plasmid DNA, its digestion and separation of fragments through gel electrophoresis. ➤ Preparation of media for tissue culture techniques and photographic study of plant tissue culture. ➤ Photographic study of generating transgenic plants for agriculture
	Discipline Specific Elective (DSE) Papers
BOT-HE-5016: Natural Resource Management	<ul style="list-style-type: none"> ➤ Comprehensive knowledge on different types of natural resources and their ecological, economical and socio-cultural values. ➤ Basic understandings of land, water and forest resources. ➤ Overall knowledge on resource degradation, their judicious use and management for sustainability. ➤ Knowledge on biodiversity - its importance, management and Bioprospecting. ➤ Knowledge on IPR, and global arena on resource management, conservation and benefit Sharing. ➤ Hands on experience on the domestic solid waste estimation and determining its impact of land degradation. ➤ Hands on experience on forest study using tools like GPS/GIS, and understanding of ecological importance of forest resources
BOT-HE-5026: Horticultural Practices and Post-Harvest Technology	<ul style="list-style-type: none"> ➤ Basic understandings on Horticultural science and its importance in employment generation and socio-economic development. ➤ Classification of horticultural crops, identification of potential horticultural crops – their cultivation, production, management and commercialization. ➤ Knowledge on horticultural techniques, landscaping and

	<p>gardening.</p> <ul style="list-style-type: none"> ➤ Overall knowledge on post-harvest technology, disease management, and germplasm management for horticulture. ➤ Field knowledge of gardening, nurseries, standing crops of horticultural importance
BOT-HC-6016: Plant Metabolism	<ul style="list-style-type: none"> ➤ Students can gain extensive knowledge of photosynthesis and nutrition metabolism metabolic events. ➤ Understanding of signaling molecules and pathways in the plant cell.
BOT-HC-6026:Plant Biotechnology	<ul style="list-style-type: none"> ➤ Students can learn about the creation of DNA libraries, recombinant DNA construction and host transformation, PCR, Gel electrophoresis and applications of tissue culture techniques. ➤ Students can also gather knowledge on the creation of transgenic plants for commercial or agricultural use.
BOT-HE-6016: Industrial and Environmental Microbiology	<ul style="list-style-type: none"> ➤ Understanding the roles of microbes in industries and environment. ➤ Basic knowledge of different kinds of bioreactors and fermentation processes. ➤ Knowledge on production processes of some microbial products in industries through site visits. ➤ Knowledge on application of enzymes in industries. ➤ Diversity and distribution of microbes in air, water and soil. ➤ Basic understandings on water microbiology and water analysis methods. ➤ Usefulness of microbes in agriculture and bioremediation of contaminated soils. ➤ Practical experiences on basic microbiological techniques and handlings
BOT-HE-6036: Project Work/ Dissertation	<ul style="list-style-type: none"> ➤ Students can gather practical knowledge on addressing relevant scientific questions through experimentation. Hands on training will help them in understanding the actual field of work.
	Generic Papers
BOT-HG-1016: Biodiversity (Microbes, Algae, Fungi and Archegoniate)	<ul style="list-style-type: none"> ➤ Knowledge on structure and reproduction of viruses and bacteria, and their economic importance. ➤ Describe general characteristics, morphological diversity, thallus organization, life cycles, ecological and economic importance of algae. ➤ Describe general characteristics, morphological diversity, thallus organization, life cycles, ecological and economic importance of fungi. ➤ General characteristics, classification, morphological diversity and evolutionary significance of bryophytes. ➤ General characteristics and classification of pteridophytes; evolution of stele, heterospory and seed habit in pteridophytes.

	<ul style="list-style-type: none"> ➤ Classify gymnosperms, and describe their general characteristics and economic importance. ➤ Practical knowledge on staining and slide preparation to study bacteria, algae and fungi under the microscope. ➤ Practical knowledge on vegetative and reproductive structures of some representative bryophytes, pteridophytes and gymnosperms
<p>BOT-HG-2016: Plant Ecology and Taxonomy</p>	<ul style="list-style-type: none"> ➤ Understanding soil, water, light and temperature as ecological factors. ➤ Knowledge on adaptive characters of hydrophytes and xerophytes. ➤ Knowledge on plant community types and their succession. ➤ Knowledge on ecosystem, trophic levels and energy flow in ecosystems. ➤ Knowledge on biogeochemical cycling with an emphasis on carbon, nitrogen and phosphorus cycles. ➤ General idea on phytogeography and endemism. ➤ Knowledge on plant taxonomy, principles, ICN rules, ranks and hierarchy. ➤ Knowledge on different systems of plant classification and cluster analysis. ➤ Practical knowledge on soil temperature measurement, humidity measurement, rainfall estimation and light intensity measurement. ➤ Adaptive morphological characterization of hydrophytes and xerophytes. ➤ Quadrature size determination for herbaceous plant studies in ecology. ➤ Estimation of frequency distribution of herbaceous plants using quadrature method, ➤ Practical knowledge on plant identification upto the family level that belongs to Brassicaceae, Solanaceae and Lamiaceae; Preparation of herbarium specimens.
<p>BOT-HG-3016: Plant Physiology and Metabolism</p>	<ul style="list-style-type: none"> ➤ Understanding the roles of water in plant physiology, transpiration, and guttation. ➤ Knowing of macro- and micro-nutrients and mineral uptakes in plants. ➤ Understanding the transportations of minerals and foods in plants. ➤ Knowledge on photosynthetic pigments, photosynthetic reactions and photorespiration. ➤ Understanding of respiration processes – glycolysis, TCA and PPP pathways. ➤ Knowledge on enzyme properties, actions and inhibitions. ➤ Knowledge on biological nitrogen fixation. ➤ Knowledge on plant hormones, and plant responses to light and temperature. ➤ Determine osmotic potentials of plant cells and effect of light

	<p>on transpiration.</p> <ul style="list-style-type: none"> ➤ Calculate stomatal index and frequency. ➤ Demonstrate the effect of pH and concentrations in catalase activity. ➤ Demonstrate the effect of bicarbonate concentration on O₂ evolution in photosynthesis
BOT-HG-3026: Environmental Biotechnology	<ul style="list-style-type: none"> ➤ Knowledge on environment and the cause of environmental pollutions. ➤ Knowledge on the methods of pollution measurement and bioremediation. ➤ Knowledge on waste water treatment processes. ➤ Knowledge on xenobiotics – their types and bioremediation. ➤ Knowledge on application of immobilized cells/enzymes in industries. ➤ Knowledge on national legislations and international treaties for environmental protection and pollution management. ➤ Practical knowledge on determining basic properties of soil and water like DO, salinity, pH, total hardness, etc. ➤ Practical knowledge on gravimetric analysis of effluents. ➤ Practical knowledge on the assessment of microorganisms in air and water samples
BOT-HG-4016: Plant Anatomy and Embryology	<ul style="list-style-type: none"> ➤ Knowledge on different types of tissues and their organizations in plants. ➤ Knowledge on secondary growth and anomalous structures in plants. ➤ Knowledge on adaptive and protective characters of plants. ➤ Understanding the reproductive units of a flower; ovule types, ovary types, pollination and fertilization mechanisms; embryo and endosperm developments and functions. ➤ Hands on experiences on slide preparation for anatomical studies of leaf, stem and root. ➤ Flower dissection and study of flower reproductive parts and events
BOT-HG-4026: Economic Botany and Plant Biotechnology	<ul style="list-style-type: none"> ➤ Understanding the concept of ‘centre of origin of crop plants’ and their distribution with aspecial emphasis on wheat ➤ Overall knowledge on economically important crops with their botanical characters and parts <p>Used.</p> <ul style="list-style-type: none"> ➤ Knowledge on plant tissue culture and the basic molecular techniques used in biotechnology. ➤ Basic concept of bioinformatics and its application <p>Skill Enhancement Paper</p>
	Skill Enhancement Paper
BOT-SE-3014: Biofertilizers	<ul style="list-style-type: none"> ➤ Basic knowledge on the microbes used as biofertilizer and understand the process of their isolation, identification, mass

	<p>multiplication, carrier based inoculants and knowledge on Actinorrhizal symbiosis.</p> <ul style="list-style-type: none"> ➤ Concept on the general characteristics, isolation, mass multiplication carrier based inoculants of Azospirillum and Azotobacter also the knowledge on the crop response to Azotobacter. ➤ Basic knowledge on Cyanobacteria including factors affecting growth of Cyanobacteria, concept on the nitrogen fixation and use of blue green algae in rice cultivation. ➤ Brief knowledge on the Mycorrhizal association and understand the details of various types, taxonomy, occurrence, distribution and growth parameters of Mycorrhiza. ➤ Details about the organic farming, maintenance and recycling of biodegradable waste material and understand the methods of making biocompost and vermicompost with application
BOT-SE-3024: Herbal Technology	<ul style="list-style-type: none"> ➤ Concept on the plants used as traditional medicine, and understanding the process of cultivation, harvesting, processing, storage, marketing and utilization of medicinal plants. ➤ Brief knowledge on medicinal drugs obtained from plants and comprehensive idea about systematic position, medicinal uses of Tulsi, Ginger, Fenu greek, Indian goose berry and Ashoka ➤ Concept on the phytochemistry of medicinal herbs and identification, utilization of medicinal plants. ➤ Basic knowledge on quality control, owing the medicinal properties of herbal drugs including the secondary metabolites and concept of drug adulteration, types, methods of drug evaluation. ➤ Understand the process of micro propagation of important medicinal plant species ➤
BOT-SE-4014: Nursery and Gardening	<ul style="list-style-type: none"> ➤ Brief idea about objectives, scope, infrastructure and maintenance of Nursery. ➤ Concept on structure, types and dormancy of seeds and brief idea about seed storage including types and process and knowledge on seed production technology. ➤ Knowledge on various modes of vegetative propagation and maintenance of plants in green house. ➤ Brief idea about development and maintenance of gardening including scope and types an understand the various gardening operations including management of pests and diseases. ➤ Detail knowledge on managements of seeds and seedlings and concept about cultivation, ➤ storage and marketing of important vegetables
BOT-SE-4024: Floriculture	<ul style="list-style-type: none"> ➤ Basic knowledge including history, importance and scope of floriculture ➤ Brief idea about Nursery management and garden operations and knowledge on the terms related to gardening and concept about role of plant growth regulators.

	<ul style="list-style-type: none"> ➤ Covers the knowledge of various ornamental plants and concept of cultivations of plants in pots and knowledge about Bonsai. ➤ Idea about various garden designs and features of such gardens and knowledge about some famous gardens of India. ➤ Knowledge about the process of making garden more attractive by altering the existing design in places of public importance, highways and educational institute
<p>BOT-SE-4034: Intellectual Property Rights</p>	<ul style="list-style-type: none"> ➤ Knowledge on IPR, their types and infringement. ➤ Understanding about traditional knowledge and their protection, bio-prospecting and biopiracy. ➤ Knowledge on protection of plant varieties, farmer rights. ➤ Knowledge on Information technology related IPR; data, database, chips and domain name protection. ➤ Knowledge on novelty, bio-based patenting, and moral issues associated with biotechnological inventions

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**DEPARTMENT OF BOTANY
COURSE OUTCOME
FOUR-YEAR UNDERGRADUATE PROGRAMME
(FYUGP), 2023-24**

COURSES	OUTCOMES
1ST Semester: Plant and Microbial Diversity	<ul style="list-style-type: none"> ➤ Understanding of the numerous kingdoms and hypotheses on how life began. ➤ Fundamental knowledge of features, distribution, categorization, and reproduction as well as the current state of diverse microbial and plant groups. ➤ Solid knowledge of virus, algae, fungus, bryophyte, and pteridophyte cell structures, dicotyledonous and monocotyledonous leaf venation patterns, and inflorescence and fruit characteristics. ➤ The ability to identify different groupings of organisms in the laboratory using morphological examination.
2nd Semester: Cell Biology and Biomolecules	<ul style="list-style-type: none"> ➤ Capable of acquiring information of biomolecule and enzyme structure, classification, and physicochemical properties. ➤ Thorough understanding of the structure, properties, and functions of a cell and its components. ➤ Familiar with practical knowledge of cell and cell membrane properties, DNA staining procedures, and plant cell microscopy. ➤ Capable of identifying diverse biomolecules in the laboratory using qualitative biomolecule testing.


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