

## **B.SC. (HONS) BOTANY**

### **Programme Out Come**

The programme is form to gain knowledge and technical skills to study plants in a holistic manner student would get training in various discipline of plant science using a combination of core and elective paper with significant interdisciplinary components. Besides this the students will be developed intellectual, personal, professional skills in plant sciences.

The student should be able to acquire core competency, critical thinking and problem-solving ability, digital knowledge and ethical and psychological strengthening, analytical ability and digital knowledge

## Course Outcome

Class/Paper/ Semester	Course Code	Title	Course Outcome
BOTANY Honours Sem I Core Course 1	UG-H-BOT-CC-T-01	Biomolecules & Cell Biology	<p><b>By the end of the course, the students would be able to gain a deep insight into</b></p> <ul style="list-style-type: none"> <li>• Structure, properties and functions of carbohydrates, lipids, proteins &amp; nucleic acids.</li> <li>• Laws of thermodynamics, bioenergetic reactions, structure &amp; role of ATP.</li> <li>• Structure and classification of enzymes, mechanism of enzyme action, enzyme inhibition &amp; factors affecting enzyme activity.</li> <li>• Meaning of cell, cellular theory, structure and function of cell, origin of eukaryotic cell.</li> <li>• Structure &amp; function of plant cell wall. Membrane function and chemical composition, membrane transport &amp; model.</li> <li>• Structure &amp; function of cell organelles.</li> <li>• Concept of cell division and regulation of cell cycle.</li> </ul>
	UG-H-BOT-CC-P-01	Biomolecules & Cell Biology	<ul style="list-style-type: none"> <li>• Qualitative tests of carbohydrates and protein</li> <li>• Study of cell structure, cell size determination and counting of cells, plasmolysis and de-plasmolysis.</li> <li>• Cytochemical staining of DNA.</li> <li>• Stages of cell division.</li> </ul>
BOTANY Honours Sem I Core Course 2	UG-H-BOT-CC-T-02	Plant Morphology & Anatomy	<p><b>By the end of the course, the students would be able to gain a deep insight into</b></p> <ul style="list-style-type: none"> <li>• Different types of leaves, stipules, inflorescence, flowers &amp; floral parts, fruits &amp; seeds.</li> <li>• Structure &amp; composition of cell wall with special reference to their growth &amp; thickening, apoplast and symplast.</li> <li>• Tissue system, ergastic substances &amp; stomatal types</li> <li>• Apical meristem, primary &amp; secondary plant body</li> <li>• Adaptive &amp; protective system</li> <li>• Scope of plant anatomy</li> </ul>

	UG-H-BOT-CC-P-02	Plant Morphology & Anatomy	<ul style="list-style-type: none"> <li>• Identification of different types of stipules, inflorescence, flowers &amp; fruits.</li> <li>• Parenchyma, collenchyma &amp; sclerenchyma in plant tissue</li> <li>• Normal and anomalous secondary growth in some selected stems and goods</li> <li>• Anatomical structure of different types of leaves</li> <li>• Microscopic identification of vascular tissues, epidermal system, secretory tissues and ergastic substances.</li> </ul>
BOTANY Honours Sem II Core Course 3	UG-H-BOT-CC-T-03	Diversity of Microbes & Algae	<p><b>By the end of the course, the students would be able to gain a deep insight into</b></p> <ul style="list-style-type: none"> <li>• Diversity of microbes along with its mode of nutrition, growth and metabolism.</li> <li>• Characteristics, structure, type, reproduction &amp; economic importance of bacteria and viruses</li> <li>• Characteristics, distribution, classification, life cycle of algae &amp; their role in agriculture, industry and biotechnology</li> </ul>
	UG-H-BOT-CC-P-03	Diversity of Microbes & Algae	<ul style="list-style-type: none"> <li>• Types of Bacteria and viruses and their production</li> <li>• Preparation of bacteriological media</li> <li>• Subculturing of bacterial culture</li> <li>• Isolation and examination of bacteria from natural sources</li> <li>• Vegetative and reproductive structures of some selected alga</li> <li>• Identification of some selected alga</li> </ul>

BOTANY Honours Sem II Core Course 4	UG-H-BOT-CC-T-04	Diversity of Fungi & Plant Pathology	<p><b>By the end of the course, the students would be able to gain a deep insight into</b></p> <ul style="list-style-type: none"> <li>• Characteristics, thallus structure, nutrition, classification, reproduction of fungi with special reference to Ascomycota, Basidiomycota, Oomycota.</li> <li>• Mushroom cultivation, bioluminescence</li> <li>• Symbiotic association with special reference to lichens and mycorrhizae</li> <li>• Basic concept of slime moulds</li> <li>• Application of fungi in industry, agriculture and biotechnology</li> <li>• Disease causing pathogens, symptoms caused by them, disease cycle and management practices.</li> <li>• Post pathogen interaction</li> </ul>
	UG-H-BOT-CC-P-04	Diversity of Fungi & Plant Pathology	<ul style="list-style-type: none"> <li>• Studying of some common fungi with respect to their vegetative and reproductive structures.</li> <li>• Identification of macroscopic fungi, lichen and mycorrhiza</li> <li>• Identification and study of viral, bacterial and fungal diseases of some selected plants</li> </ul>
BOTANY Honours Sem III Core Course 5	UG-H-BOT-CC-T-05	Diversity of Bryophytes and Pteridophytes	<p><b>By the end of the course, the students would be able to gain a deep insight into</b></p> <ul style="list-style-type: none"> <li>• Characteristics, classification and reproduction of certain selected Bryophytes and Pteridophytes</li> <li>• Origin and evolution of Bryophytes and Pteridophytes</li> <li>• Ecological and economic importance of Bryophytes and Pteridophytes</li> </ul>
	UG-H-BOT-CC-P-05	Diversity of Bryophytes and Pteridophytes	<ul style="list-style-type: none"> <li>• Morphological &amp; anatomical details of vegetative &amp; reproductive structures of certain selective Bryophytes and Pteridophytes.</li> <li>• Sectional study of certain selected early land plants.</li> </ul>

BOTANY Honours Sem III Core Course 6	UG-H-BOT-CC-T-06	Diversity of Gymnosperms and Palaeobotany	<p><b>By the end of the course, the students would be able to gain a deep insight into</b></p> <ul style="list-style-type: none"> <li>• General account of Progymnosperms and gymnosperms</li> <li>• Classification, origin and evolution of gymnosperms</li> <li>• Vegetative and reproductive structures of some selected genera of gymnosperms</li> <li>• Study of plant fossils and their age determination by different methods</li> <li>• Evolutionary theories and mass extinction</li> <li>• Concept of Gondwana land, Indian Gondwana system and major mega fossil assemblages.</li> </ul>
	UG-H-BOT-CC-P-06	Diversity of Gymnosperms and Palaeobotany	<ul style="list-style-type: none"> <li>• Morphology and anatomical studies of certain selected gymnosperm species</li> <li>• External and internal morphology of some fossil plant groups</li> </ul>
BOTANY Honours Sem III Core Course 7	UG-H-BOT-CC-T-07	Reproductive Biology of Plants	<p><b>By the end of the course, the students would be able to gain a deep insight into</b></p> <ul style="list-style-type: none"> <li>• Internal Structures and structure and function of reproductive organs in plants</li> <li>• Palynology and its scope</li> <li>• Pollination and fertilisation</li> </ul>
	UG-H-BOT-CC-P-07	Reproductive Biology of Plants	<ul style="list-style-type: none"> <li>• Structures of reproductive organs of plants</li> <li>• Intra-ovarian pollination</li> </ul>

BOTANY Honours Sem III Skill Enhancement Course 1	UG-H-BOT-SEC-T-01	A Biofertilizers	<p><b>By the end of the course, the students would be able to gain a deep insight into</b></p> <ul style="list-style-type: none"> <li>• Different microbes used as biofertilizers</li> <li>• Production technology of biofertilizers using different beneficial microbes and their quality control</li> <li>• Concept of AM as biofertilizers</li> <li>• Production of organic fertilizers using several waste organic materials</li> <li>• Bio compost making methods with special reference to vermicompost</li> </ul>
	UG-H-BOT-SEC-T-01	B Plant diversity and Human Welfare	<p><b>By the end of the course, the students would be able to gain a deep insight into</b></p> <ul style="list-style-type: none"> <li>• Meaning, types, scope, values and ethics of plant diversity</li> <li>• Loss and management of diversity</li> <li>• Organisation associated with biodiversity management</li> <li>• Biodiversity conservation, awareness and sustainable development</li> <li>• Importance of plants in human welfare</li> </ul>
	UG-H-BOT-SEC-T-01	C Floriculture	<p><b>By the end of the course, the students would be able to gain a deep insight into</b></p> <ul style="list-style-type: none"> <li>• Meaning of floriculture. Its importance, scope and management</li> <li>• Different types of flowering plants and foliage, indoor gardening and bonsai</li> <li>• Garden design and landscaping</li> <li>• Commercial floriculture, diseases and pests of ornamental plants</li> </ul>
BOTANY Honours Sem IV Core Course 8	UG-H-BOT-CC-T-08	Taxonomy of Angiosperms and Plant systematics	<p><b>By the end of the course, the students would be able to gain a deep insight into</b></p> <ul style="list-style-type: none"> <li>• Plant systematics, nomenclature and classification</li> <li>• Modern trends in plant taxonomy (phenetics and cladistics).</li> <li>• Some selected plant families (both monocotyledons and dicotyledons).</li> </ul>

	UG-H-BOT-CC-P-08	Taxonomy of Angiosperms and Plant systematics	<ul style="list-style-type: none"> <li>• Work out of some plants belonging to different families</li> <li>• Identification of some common wild plants</li> </ul>
BOTANY Honours Sem IV Core Course 9	UG-H-BOT-CC-T-09	Plant Ecology and Phytogeography	<p><b>By the end of the course, the students would be able to gain a deep insight into</b></p> <ul style="list-style-type: none"> <li>• Origin, formation, composition, components and importance of soil; importance and states of water</li> <li>• Ecosystem and its functional aspects, ecology, plant communities</li> <li>• Phytogeographical regions of India, major biomes and endemism</li> </ul>
	UG-H-BOT-CC-P-09	Plant Ecology and Phytogeography	<ul style="list-style-type: none"> <li>• Principles and function of instruments for microclimatic variables.</li> <li>• Detection of pH of soil and water, carbonate, nitrate content and base deficiency of different soil samples</li> <li>• Determination of water holding capacity of soil and DO of water</li> <li>• Ecological adaptations</li> <li>• Determination of water</li> </ul>
BOTANY Honours Sem IV Core Course 10	UG-H-BOT-CC-T-10	Economic Botany and Pharmacognosy	<p>By the end of the course, the students would be able to gain a deep insight into</p> <ul style="list-style-type: none"> <li>• Origin of cultivated plants</li> <li>• General account including sources, origin, morphology, processing, uses of different types of economically important plants</li> <li>• Introduction to pharmacognosy, drugs and their evolution, constituents and adulteration</li> <li>• Study of certain selected drug plants</li> </ul>
	UG-H-BOT-CC-P-10	Economic Botany and Pharmacognosy	<ul style="list-style-type: none"> <li>• Morphology, microanatomy of some common economically important plants.</li> <li>• Morphological and microscopical observations of some medicinal plants, plant parts and powder</li> </ul>

BOTANY Honours Sem IV Skill Enhancement Course		A. Medicinal Botany	By the end of the course, the students would be able to gain a deep insight into <ul style="list-style-type: none"> <li>• History, scope and importance of medicinal plants</li> <li>• Ayurveda, Siddha and Unani system of treatment</li> <li>• Conservation of medicinal and endangered plants</li> <li>• Ethnobotany and folk medicine</li> </ul>
		B. Mushroom Culture	<ul style="list-style-type: none"> <li>• Mushroom types and nutritional value</li> <li>• Cultivation technology of some selected mushrooms</li> <li>• Storage of mushrooms</li> <li>• Foods from mushrooms</li> </ul>
		C. Intellectual Property Rights	<ul style="list-style-type: none"> <li>• Concept of intellectual property rights and IT related IPR</li> <li>• Patents, copyrights, trademarks and GI</li> <li>• Concept of traditional knowledge and protection of plant varieties</li> <li>• Biotechnology and IPR</li> </ul>
BOTANY Honours Sem V Core Course 11	UG-H-BOT-CC-T-11	Plant Physiology	By the end of the course, the students would be able to gain a deep insight into <ul style="list-style-type: none"> <li>• Water relation in plant cells, absorption, transport and control mechanism</li> <li>• Plant growth regulators and their role in agriculture and horticulture</li> <li>• Growth and other related physiological aspects like circadian rhythm, photo periodism and vernalization.</li> <li>• Seed dormancy types and its significance.</li> </ul>
	UG-H-BOT-CC-P-11	Plant Physiology	<ul style="list-style-type: none"> <li>• Determination of osmotic potential, water potential from plant tissue</li> <li>• Stomatal frequency, rate of transpiration and effect of some factors on it.</li> <li>• Imbibition of water and germination frequency of seeds</li> <li>• Demonstration of amylase activity, IAA in plant parts</li> <li>• Bolting of plants and viability of seeds</li> </ul>

BOTANY Honours  Sem V  Core Course 12	UG-H-BOT-CC-T-12	Plant Metabolism	By the end of the course, the students would be able to gain a deep insight into <ul style="list-style-type: none"> <li>• Scope and importance of plant metabolism</li> <li>• The process of different modes of photosynthesis and the energy relating steps in respiration</li> <li>• Metabolism of different biomolecules in plant system and ATP synthesis</li> <li>• Concept of mechanism of signal transaction</li> </ul>
	UG-H-BOT-CC-P-12	Plant Metabolism	<ul style="list-style-type: none"> <li>• Determination of rate of photosynthesis under varied conditions</li> <li>• Respiration and RQ determination</li> <li>• Estimation of amino acid, glucose, catalase and urease from different plant sources.</li> <li>• Estimation of protein</li> <li>• Separation of photosynthetic pigments.</li> </ul>
BOTANY Honours  Sem V  Discipline Specific Elective	UG-H-BOT-DSE-T-01	A. Analytical Techniques in Plant Science	<b>By the end of the course, the students would be able to gain a deep insight into</b> <ul style="list-style-type: none"> <li>• Use of different analytical techniques in biological research.</li> <li>• Characterisation of protein and nucleic acid.</li> <li>• Statistical data analysis.</li> </ul>
	UG-H-BOT-DSE-P-01	A. Analytical Techniques in Plant Science	<ul style="list-style-type: none"> <li>• Basic molecular biological techniques like southern blotting, northern blotting</li> <li>• Separation of amino acids and pigments</li> <li>• Protein estimation</li> <li>• Use of double staining methods in preparation of permanent slides</li> </ul>
	UG-H-BOT-DSE-T-01	B. Industrial and Environmental Microbiology	<ul style="list-style-type: none"> <li>• Use of microbes in production of industrial manufactures.</li> <li>• Fermentation and its process</li> <li>• Microbes in different habitats with special reference to extreme condition</li> <li>• Microbiology of soil, air and water</li> <li>• Bioremediation of contaminated soil and mycorrhizae.</li> </ul>
	UG-H-BOT-DSE-P-01	B. Industrial and Environmental Microbiology	<ul style="list-style-type: none"> <li>• Instruments used in microbiological laboratory</li> <li>• Preparation of nutrient media</li> <li>• Isolation of microbes from soil, root, root nodules and curds</li> </ul>

	UG-H-BOT-DSE-T-02	A. Stress Biology	<ul style="list-style-type: none"> <li>• Different plant stress and the stress factors.</li> <li>• Stress sensing and signalling pathways in plants</li> <li>• Production of reactive oxygen species and defence mechanism in plants</li> <li>• Physiological mechanism to confer environmental stress in plants</li> <li>• Underline mechanism of phytoremediation.</li> </ul>
	UG-H-BOT-DSE-P-02	A. Stress Biology	<ul style="list-style-type: none"> <li>• Estimation of proline level.</li> <li>• Estimation of peroxidase, superoxide dismutase, and catalase activity in plant tissue</li> <li>• Knowing important phytoremediating plants.</li> </ul>
	UG-H-BOT-DSE-T-02	B. Plant Breeding and Biometry	<ul style="list-style-type: none"> <li>• Concept of plant breeding and overview of hybridization technique.</li> <li>• Role of plant breeding and biotechnology in crop improvement.</li> <li>• Analysis of statistical data to understand the nature of inheritance.</li> </ul>
	UG-H-BOT-DSE-P-02	B. Plant Breeding and Biometry	<ul style="list-style-type: none"> <li>• Different hybridization techniques</li> <li>• Method of pollen staining</li> <li>• Analysis of statistical data</li> <li>• Determination of goodness of fit.</li> </ul>
BOTANY Honours Sem VI Core Course 13	UG-H-BOT-CC-T-13	Genetics	<p><b>By the end of the course, the students would be able to gain a deep insight into</b></p> <ul style="list-style-type: none"> <li>• Explain Mendelian theory of inheritance and pattern of inheritance.</li> <li>• Chromosome map construction</li> <li>• Relate variations in chromosome number and structure to phenotypic variations.</li> <li>• Comprehend the underlying mechanism of gene mutation.</li> <li>• Understand about replication of DNA and protein synthesis.</li> </ul>
	UG-H-BOT-CC-P-13	Genetics	<ul style="list-style-type: none"> <li>• Study of meiosis, Mendelian laws and chromosome mapping.</li> <li>• Study of blood typing.</li> <li>• Aneuploidy study.</li> <li>• Study of anomalous chromosomal division.</li> </ul>

BOTANY Honours Sem VI Core Course 14	UG-H-BOT-CC-T-14	Plant Molecular Biology and Biotechnology	<p><b>By the end of the course, the students would be able to gain a deep insight into</b></p> <ul style="list-style-type: none"> <li>Principles, types, requirements, scientific and commercial applications of plant tissue culture.</li> <li>Concept of restriction endonuclease and cloning vectors.</li> <li>Understand different gene transfer techniques.</li> <li>Development of transgenic plants by using R-DNA technology</li> </ul>
	UG-H-BOT-CC-P-14	Plant Molecular Biology and Biotechnology	<ul style="list-style-type: none"> <li>Preparation of TC medium, surface sterilisation and inoculation of explants.</li> <li>Study of tissue culture types and method of gene transfer.</li> <li>Steps of genetic engineering.</li> </ul>
BOTANY Honours Sem VI Discipline Specific Elective	UG-H-BOT-DSE-T-03	A. Biodiversity and Conservation	<p><b>By the end of the course, the students would be able to gain a deep insight into</b></p> <ul style="list-style-type: none"> <li>Natural resources and its sustainable utilisation.</li> <li>Biodiversity and conservation</li> <li>Modern practice in resource management.</li> </ul>
	UG-H-BOT-DSE-P-03	A. Biodiversity and Conservation	<ul style="list-style-type: none"> <li>Qualitative and quantitative data collection techniques</li> <li>Study of measurement of dominance of woody species</li> <li>Ecological footprint calculation and analysis.</li> </ul>
	UG-H-BOT-DSE-T-03	B. Coastal Biology	<ul style="list-style-type: none"> <li>Concept of coastal zones and its formation</li> <li>Floral and faunal diversity with special reference to microbial ecology</li> <li>Biology of mangroves, its importance, loss and conservation strategies</li> <li>Coastal zone agriculture and forestry</li> </ul>
	UG-H-BOT-DSE-P-03	B. Coastal Biology	<ul style="list-style-type: none"> <li>Coastal zone monitoring instruments.</li> <li>Identification of major fauna and flora especially mangroves</li> <li>Analysis of water and sediment.</li> </ul>

	UG-H-BOT-DSE-T-04	A. Research Methodology	<ul style="list-style-type: none"> <li>• Methodologies and techniques used in plant science research</li> <li>• Observe, document and interpret data</li> <li>• Study of plant cell and tissue by different methods</li> <li>• Write research related documents</li> </ul>
	UG-H-BOT-DSE-P-04	A. Research Methodology	<ul style="list-style-type: none"> <li>• Photomicrography and field photography</li> <li>• Poster presentation</li> <li>• Technical Writing</li> </ul>
BOTANY Honours Sem VI Discipline Specific Elective	DSE – P -04	Dissertation / Project	<ul style="list-style-type: none"> <li>• Apply the knowledge gain through different courses in practical field.</li> <li>• Write and report in standard academic formats.</li> </ul>

### **BSc BOTANY (Generic Elective Course)**

**PSO:** This course's objective is to provide students with a current understanding of plant science. The students will be able to show that they have the knowledge necessary to comprehend plant science research and to solve real-world issues in a variety of multidisciplinary plant science domains.

Students will explore and analyze any plant form using their knowledge of biology, basic science, and basic plant processes. They are able to acquire a conceptual comprehension of the fundamentals and significance of botany. Knowledge of fundamental topics provided in these classes, such as molecular cytogenetics, physiology and biochemistry, plant diversity, and application of statistics, would be beneficial to students. Taking classes in analytical methods, plant tissue culture, and photochemistry would give students the knowledge and abilities they need to research.

For biochemical investigations, molecular biology, biotechnology, in vitro culture techniques, cytogenetics, and plant physiological activities of plants, appropriate methodologies and current instruments should be chosen and used.

Students should use their resource-based knowledge to evaluate and access plant diversity, its significance for society and ecosystem, health risks, legal considerations, and biodiversity conservation practices. They would recognise, formulate, and research complicated issues in order to get to a supported conclusion. using reason and the sciences of biology, physics, and chemistry. learning that fosters integrative and analytical problem-solving techniques.

To complete projects in interdisciplinary plant science, students should put their knowledge and principles to use in a variety of roles as team members or team leaders.

<b>Class/ Semester</b>	<b>Paper/ Paper</b>	<b>Course code</b>	<b>Title</b>	<b>Course Outcome</b>
<b>BOTANY GE Sem I Core Course I</b>		UG-BOT-G-CC-T-01	Biodiversity of Microbes, Algae, Fungi and Archegoniata	<ol style="list-style-type: none"><li>1. Recognise the variety of microbes, their methods of nutrition and reproduction, and their economic significance.</li><li>2. Understand the function that microbes play in maintaining the ecological imbalance.</li><li>3. Recognise the significance of bacteria in contemporary research and its use.</li><li>4. knowledge of the numerous metabolic processes carried out by bacteria, algae, and viruses.</li><li>5. Recognise the distinction between advantageous and hazardous microorganisms or viruses.</li><li>6. Role of good or bad viruses in study, treatment, and diagnosis as the cause of plant illnesses.</li><li>7. Research on the evolution of sporophytes (progressive and regressive conceptions); the origin of alternation of generations (homologous and antithetic hypotheses); and the origin of bryophytes.</li><li>8. to gain knowledge of general characteristics, habitat variety, and the fundamentals of homosporous and heterosporous pteridophyte life cycle patterns.</li></ol>

<p>BOTANY GE <b>Sem I</b> <b>Core Course I</b></p>	<p>UG-BOT-G-CC-P-01</p>	<p>Biodiversity of Microbes, Algae, Fungi and Archegoniatae</p>	<ol style="list-style-type: none"> <li>1. To know about types of bacteria, Lytic cycle, lysogenic cycle, Study of vegetative and reproductive structures of <i>Nostoc</i>, <i>Oedogonium</i>, <i>Vaucheria</i>, and <i>Polysiphonia</i> through temporary preparations; <i>Chlamydomonas</i> and <i>Fucus</i> through permanent slides and preserved specimens.</li> <li>2. To study Rhizopus, Puccinia, Agaricus, Penicillium, lichen and mycorrhizae.</li> <li>3. To study vegetative and reproductive structures of <i>Marchantia</i>, <i>Funaria</i>, <i>Lycopodium</i>, <i>Selaginella</i>, <i>Equisetum</i>, <i>Pteris</i> etc.</li> </ol>
<p>BOTANY GE <b>Sem II</b> <b>Core Course II</b></p>	<p>UG-BOT-G-CC-T-02</p>	<p>Plant Ecology, Morphology and Taxonomy</p>	<ol style="list-style-type: none"> <li>1. How do various environmental, climatic, physiographic, and edaphic elements affect plant life? Describe the idea of ecology.</li> <li>2. Understand the idea of phytogeography, characterise the Indian botanical regions, and explain endemism.</li> <li>3. Explain the value of biodiversity and the necessity of conservation; use morphological characteristics to describe plants.</li> <li>4. Outline the fundamentals of plant taxonomy, describe the taxonomic hierarchy and the Bentham and Hooker classification scheme, and describe the ideas of numerical taxonomy and cladistics.</li> </ol>

<p>BOTANY GE <b>Sem II</b> <b>Core Course II</b></p>	<p>UG-BOT-G-CC-P-02</p>	<p>Plant Ecology, Morphology and Taxonomy</p>	<ol style="list-style-type: none"> <li>1. Study of the following measuring devices: lux metre, anemometer, psychrometer/hygrometer, soil thermometer, maximum and minimum thermometer, and anemometer.</li> <li>2. to become knowledgeable about field study procedures and plant preservation.</li> <li>3. to research the morphological modifications made by xerophytes, halophytes, and hydrophytes.</li> <li>4. Learn about the following biotic interactions: Stem parasites (<i>Cuscuta</i>), root parasites (<i>Orobanche</i>)—for illustration purposes only, epiphytes, and plant predators.</li> <li>5. Study of the vegetative and floral characteristics of the following families of the local genera that are dispersed according to the classification system developed by Bentham and Hooker: a. Poaceae, a monocotyledon. Asteraceae, Brassicaceae, Leguminosae (<i>Papilionoidae</i> and <i>Caesalpinioideae</i>), Malvaceae, Solanaceae, Lamiaceae, Euphorbiaceae, and Solanaceae are among the dicotyledonous plant families.</li> </ol>
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<b>Class/ Semester</b>	<b>Paper/ Semester</b>	<b>Course code</b>	<b>Title</b>	<b>Course Outcome</b>
BOTANY Programme <b>Sem I</b> <b>Core Course I</b>		UG-BOT-G-CC-T-01	Biodiversity of Microbes, Algae, Fungi and Archegoniata	<ol style="list-style-type: none"><li>9. Recognise the variety of microbes, their methods of nutrition and reproduction, and their economic significance.</li><li>10. Understand the function that microbes play in maintaining the ecological imbalance.</li><li>11. Recognise the significance of bacteria in contemporary research and its use.</li><li>12. knowledge of the numerous metabolic processes carried out by bacteria, algae, and viruses.</li><li>13. Recognise the distinction between advantageous and hazardous microorganisms or viruses.</li><li>14. Role of good or bad viruses in study, treatment, and diagnosis as the cause of plant illnesses.</li><li>15. Research on the evolution of sporophytes (progressive and regressive conceptions); the origin of alternation of generations (homologous and antithetic hypotheses); and the origin of bryophytes.</li><li>16. to gain knowledge of general characteristics, habitat variety, and the fundamentals of homosporous and heterosporous pteridophyte life cycle patterns.</li></ol>

<p>BOTANY Programme <b>Sem I</b> <b>Core Course I</b></p>	<p>UG-BOT-G-CC-P-01</p>	<p>Biodiversity of Microbes, Algae, Fungi and Archegoniatae</p>	<ol style="list-style-type: none"> <li>4. To know about types of bacteria, Lytic cycle, lysogenic cycle, Study of vegetative and reproductive structures of <i>Nostoc</i>, <i>Oedogonium</i>, <i>Vaucheria</i>, and <i>Polysiphonia</i> through temporary preparations; <i>Chlamydomonas</i> and <i>Fucus</i> through permanent slides and preserved specimens.</li> <li>5. To study Rhizopus, Puccinia, Agaricus, Penicillium, lichen and mycorrhizae.</li> <li>6. To study vegetative and reproductive structures of <i>Marchantia</i>, <i>Funaria</i>, <i>Lycopodium</i>, <i>Selaginella</i>, <i>Equisetum</i>, <i>Pteris</i> etc.</li> </ol>
<p>BOTANY Programme <b>Sem II</b> <b>Core Course II</b></p>	<p>UG-BOT-G-CC-T-02</p>	<p>Plant Ecology, Morphology and Taxonomy</p>	<ol style="list-style-type: none"> <li>1. How do various environmental, climatic, physiographic, and edaphic elements affect plant life? Describe the idea of ecology.</li> <li>2. Understand the idea of phytogeography, characterise the Indian botanical regions, and explain endemism.</li> <li>3. Explain the value of biodiversity and the necessity of conservation; use morphological characteristics to describe plants.</li> <li>4. Outline the fundamentals of plant taxonomy, describe the taxonomic hierarchy and the Bentham and Hooker classification scheme, and describe the ideas of numerical taxonomy and cladistics.</li> </ol>

<p>BOTANY Programme <b>Sem II</b> <b>Core Course II</b></p>	<p>UG-BOT-G-CC-P-02</p>	<p>Plant Ecology, Morphology and Taxonomy</p>	<ol style="list-style-type: none"> <li>6. Study of the following measuring devices: lux metre, anemometer, psychrometer/hygrometer, soil thermometer, maximum and minimum thermometer, and anemometer.</li> <li>7. to become knowledgeable about field study procedures and plant preservation.</li> <li>8. to research the morphological modifications made by xerophytes, halophytes, and hydrophytes.</li> <li>9. Learn about the following biotic interactions: Stem parasites (<i>Cuscuta</i>), root parasites (<i>Orobanche</i>)—for illustration purposes only, epiphytes, and plant predators.</li> <li>10. Study of the vegetative and floral characteristics of the following families of the local genera that are dispersed according to the classification system developed by Bentham and Hooker: a. Poaceae, a monocotyledon. Asteraceae, Brassicaceae, Leguminosae (<i>Papilionoidae</i> and <i>Caesalpinioideae</i>), Malvaceae, Solanaceae, Lamiaceae, Euphorbiaceae, and Solanaceae are among the dicotyledonous plant families.</li> </ol>
<p>BOTANY Programme <b>Sem III</b> <b>Core Course III</b></p>	<p>UG-BOT-G-CC-T-03</p>	<p>Plant Cell, Anatomy and Embryology</p>	<ol style="list-style-type: none"> <li>1. Explain the developmental patterns of both a plant's vegetative and reproductive organs, as well as how to recognise, characterise, and differentiate between plant cells, cell organelles, and their activities;</li> <li>2. apply the understanding of ontogeny, evolutionary biology, and taxonomy investigations;</li> <li>3. examine and comprehend the structure of wood.</li> <li>4. Use your understanding of embryological traits to describe plant reproductive biology.</li> </ol>
<p>BOTANY Programme <b>Sem III</b> <b>Core Course III</b></p>	<p>UG-BOT-G-CC-P-03</p>	<p>Plant Cell, Anatomy and Embryology</p>	<ol style="list-style-type: none"> <li>1. Cell organelle research and micrometric cell size estimation.</li> <li>2. Details of the anatomy of the plant root, stem, and leaves are covered.</li> <li>3. Study of reproductive structure and estimation of pollen grain germination rate are carried out.</li> </ol>

BOTANY Programme  <b>Sem III</b>  <b>Skill Enhancement Course I</b>	UG -BOT-G-SEC-T-01	A. Biofertilizers	<ol style="list-style-type: none"> <li>1. elucidate several forms of fertilizers employing biological organisms</li> <li>2. apply the information learned in exploitation of biofertilizers in organic farming.</li> </ol>
		B. Plant Diversity and Human Welfare	<ol style="list-style-type: none"> <li>1. define and discuss the importance of biodiversity, its risks, the necessity for conservation, and environmental stewardship.</li> <li>2. Apply and put into practise conservation tactics for managing biodiversity.</li> </ol>

Botany Programme  <b>Sem IV</b>  <b>Core Course IV</b>	UG-BOT-G-CC-T-04	Plant Physiology and Metabolism	<ol style="list-style-type: none"> <li>1. Describe the physiological processes of photosynthesis and respiration in plants.</li> <li>2. Describe the enzymes, hormones, environmental responses, and nitrogen metabolism necessary for plant growth and development.</li> <li>3. Describe the water relations between plants and clarify the mineral nutrients that plants need, how they are obtained, metabolized, and transported.</li> </ol>
Botany Programme  <b>Sem IV</b>  <b>Core Course IV</b>	UG-BOT-G-CC-P-04	Plant Physiology and Metabolism	<ol style="list-style-type: none"> <li>1. To measure the osmotic potential of cell sap using the plasmolytic method, calculate the stomatal index, compare the rates of respiration of various plant parts, and separate amino acids using paper chromatography.</li> <li>2. IAA's effects on seed germination and roots are demonstrated.</li> </ol>

Botany Programme <b>Sem IV</b> <b>Skill Enhancement Course II</b>	UG-BOT-G-SEC- T-04	A. Medicinal Botany	1. Discuss the development, use, and significance of plants as sources of medication. Describe sustainable techniques for using plant herbal resources. Apply what you've learned about using plants as traditional or folk remedies and conservation tactics.
		B. Mushroom culture	<ol style="list-style-type: none"> <li>1. Describe the nutritional and therapeutic benefits of edible mushrooms and their production techniques;</li> <li>2. Use the knowledge acquired in food preparation and preservation.</li> </ol>
BOTANY Programme <b>Sem V</b> <b>Discipline Specific Elective          Course I</b>	UG-BOT- G- DSE-T-01	A. Analytic al Techniq ues in Plant Sciences	<ol style="list-style-type: none"> <li>1. Give an overview of the principle of spectrophotometry and its use in biological research; outline several imaging-related approaches;</li> <li>2. describe nucleic acids and proteins; utilizing the chi-square test for goodness of fit, analyze statistical data.</li> </ol>

	UG-BOT-G-DSE-P-01		<p>1.Examination of blotting methods, including Southern, Northern, and Western blotting, DNA fingerprinting, DNA sequencing, and PCR using images.</p> <p>2. Amino acid separation using paper chromatography 3. A demonstration of column chromatography's ability to separate pigments.</p> <p>4. Using Lowry's technique, estimate the protein concentration.</p> <p>5. Research of various microscopic methods employing images/micrographs (frozen etching, freeze fracture, positive, negative, and fluorescent staining, and FISH).</p> <p>6. Making permanent slides using the double-staining technique (Helianthus stem, Nerium leaf, Maize root).</p>
<p>BOTANY Programme Sem V Discipline Specific Elective Course I</p>	UG-BOT-G-DSE-T-01	<p>B. Industrial and Environmental Microbiology</p>	<p>1. Apply the fundamentals of microbiology to lay the groundwork for investigations in the field and the industrial usage of microbes to produce vast quantities of food or other items;</p> <p>2. Introduce microbial processes that are important for the environment and geochemistry; use microbes as tools for cleaning up the environment.</p>
	UG-BOT-G-DSE-P-01		<p>1.Principles and how equipment in a microbiological lab works.</p> <p>2. Practical sterilization methods and culture media preparation (nutrient broth and nutrient agar).</p> <p>3. Setting up the Petri Plates for slanting, stabbing, and pouring.</p> <p>5. Rhizobium isolation from root nodules.</p> <p>6. Soil-based microorganism isolation.</p> <p>7. A visit to any educational facility or business to observe an industrial fermenter and other post-processing steps.</p>

BOTANY Programme <b>Sem V</b> <b>Skill Enhancement Course III</b>	UG-BOT-G- SEC-T-03	A. Herbal Technology	1. Plan, examine, and find solutions to issues relating to herbal science, technology, and allied subjects.  2. Create unit operations and plant-wise processes that will result in a professional qualification for the phytochemical or herbal sector.
		B. Floriculture	1. Use the learned information and abilities to produce, prepare, and distribute flowers, cut flowers, foliage, and other plant materials. 2. Specify optimum management practises for growing flowers and associated plant materials in fields and greenhouses, as well as for arranging plant materials for ornamental reasons.
BOTANY Programme <b>Sem VI</b> <b>Discipline Specific Elective II</b>	UG-BOT-G- DSE-T-02	A. Biodiversity and Conservation	1. Show that you have a thorough understanding of how to apply the basic concepts of ecological studies to the preservation of biodiversity. 2. Discuss and cite ideas and case studies as requirements for success in effective species conservation and sustainable utilization. 3. Convert theoretical facets of modern methods into suggestions for environmental management. 4. Effectively communicate through both verbal and written reports and presentations.

	UG-BOT-G-DSE-P-02	A. Biodiversity and Conservation	<ol style="list-style-type: none"> <li>1. Data gathering on forest cover, both qualitative and quantitative.</li> <li>2. Gathering quantitative and qualitative data on a particular region within the Protected Area Network.</li> <li>3. Gathering qualitative and quantitative data on a particular location that exhibits urban variety.</li> <li>4. Utilization of the diameter at breast height (DBH) approach to assess the dominance of woody species.</li> <li>5. Evaluation of ecological footprint calculations.</li> </ol>
<p>BOTANY Programme <b>Sem VI</b> <b>Discipline Specific Elective Course II</b></p>	UG-BOT-G-DSE-T-02	B. Genetics and Biotechnology	<ol style="list-style-type: none"> <li>1. Describe Mendel's hypothesis of inheritance.</li> <li>2. Recognise how genetic recombination works.</li> <li>3. Learn about the fundamentals, culture techniques, significance, and applications of plant tissue culture.</li> <li>4. Recognise the many gene transfer methods.</li> </ol>
	UG-BOT-G-DSE-P-02		<ol style="list-style-type: none"> <li>1. Study of various mitosis and meiosis stages (from long-term slides or photos).</li> <li>2. Calculating the mitotic index in <i>Allium cepa</i>.</li> <li>3. Familiarization with the fundamental tissue culture equipment</li> <li>4. Demonstration of in vitro sterilization, inoculation, and production of MS medium</li> <li>5. Examine through images: Micropropagation, endosperm and embryo cultivation, and somatic embryogenesis.</li> </ol>
	BOTANY	UG-BOT-G-SEC-T-04	A. Ethnobotany

<p>Programme</p> <p><b>Sem VI</b></p> <p><b>Skill Enhancement Course IV</b></p>		<p>B. Intellectual Property Rights</p>	<ol style="list-style-type: none"><li>1. Identify the many forms of intellectual properties (IPs), ownership rights, the extent of IP protection, and methods for creating and monetizing IP.</li><li>2. Recognise how IP plays a role in various industries in advancing the development of products and technologies.</li><li>3. Describe the procedures to be taken to prevent infringement of such rights in the creation of products and technologies, together with the activities that constitute IP infringements, the remedies available to the IP owner, and any relevant laws.</li><li>4. Talk about the procedures and various IPM (Intellectual Property Management) techniques.</li></ol>
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