

<p>Programme outcome</p>	<p style="text-align: center;">Department of Botany</p> <p>Students of the Botany program get a thorough knowledge of plant diversity in terms of their habitat, morphology, structure, function and environmental relationship. They understand plants from their phylogenetic perspective which gives a complete insight as to how complex forms of plant life dominate the land on the planet earth. They can apply the knowledge of basic science, life sciences and fundamental process of plants to study and analyse any plant form. The program also helps students to identify the taxonomic position of plants based on methods of nomenclature and classification in Botany. They get a good practical knowledge about vegetative propagation and can identify pathological conditions in plants and differentiate them from mineral deficiencies. They understand plant physiology and this knowledge helps students in understanding the need for sustainable development.</p> <p>Students also develop intellectual skills to understand genetically dominant and recessive characters. They can write reports on various industrial processes, prepare permanent anatomical slides etc. They develop good practical skill to stain bacteria, calculate available oxygen and chloride contents of water samples, plant identification using taxonomic keys, a range of phytochemical analysis of plant materials in the context of plant physiology and biochemistry. They are able to prepare excellent slides of cell division in plants.</p> <p>Students of the Botany program develop a profound attitude about ethical awareness, reasoning and mould themselves as lifelong learners of plant sciences.</p>
<p>Program Specific Outcome</p>	<p>The undergraduate BSc CBZ course in Chemistry, Botany and Zoology emphasizes on the fundamentals to enhance the overall academic knowledge in the core domains. Graduates can take up administrative jobs, teaching jobs and work in plant seeds and nursery organisations.</p> <p>A graduate in the course can take up master's degree in any of these three subjects as well as in applied branches of life sciences like Microbiology, Bio-technology and Genetics etc. Later, one can pursue a doctorate programme as well as post- doctoral programme in several research institutes. With these qualifications one can take up lecturership which is an academic job or work as a scientist.</p> <p>CBZ graduates can do B.Ed. or D.Ed. programme and work as school teachers. They can take up bank jobs and they can also compete in KPSC, IAS, IFS, IPS selections for serving in administrative posts in the government of Karnataka and India. They can also take up JAM and TIFR entrance exams. They also have promising opportunities to work as medical representatives in herbal, pharmaceutical, beverage, food preservation and cosmetic industry. Horticulture and</p>

	<p>agriculture based organisations also employ them. Post graduates in MSc (Botany) can also get employed as research assistants in premier institutes like CFTRI, DFRI, CCMB, NEERI and others.</p> <p>Doctoral degree and post-doctoral degree holders in Botany also have an equal opportunity in CSIR/ICAR/DBT sponsored research institutes as well as in universities abroad.</p>												
<p>Course Outcome</p>	<table border="1"> <thead> <tr> <th data-bbox="400 510 568 629">Theory Paper Number</th> <th data-bbox="568 510 887 629">Course Name</th> <th data-bbox="887 510 1393 629">Course Outcome</th> </tr> </thead> <tbody> <tr> <td data-bbox="400 629 568 1025">1</td> <td data-bbox="568 629 887 1025"> <p>Diversity of Non-Vascular Plants Part 1 - Introduction to Microbiology, Viruses, Bacteria, Cyanobacteria and Phycology</p> </td> <td data-bbox="887 629 1393 1025"> <p>Students develop a foundation and understanding of microbiology, including its history, classification systems and a study of cyanobacteria and phycology. This paper introduces them to the field and helps them understand the basic characteristics of microorganisms.</p> </td> </tr> <tr> <td data-bbox="400 1025 568 1541">2</td> <td data-bbox="568 1025 887 1541"> <p>Diversity of Non-Vascular Plants Part - II Mycology, Plant Pathology, Bryophytes and Plant Anatomy</p> </td> <td data-bbox="887 1025 1393 1541"> <p>Students develop an in-depth understanding about detailed internal structure of the plants.</p> <p>They learn about the life cycles of forms of fungi and bryophytes, their benefits in industrial usage as well as the diseases caused from the microorganism.</p> <p>This paper allows for a practical understanding and application of their study.</p> </td> </tr> <tr> <td data-bbox="400 1541 568 2018">3</td> <td data-bbox="568 1541 887 2018"> <p>Pteridophytes, Palaeobotany, Environmental Biology and Phytogeography</p> </td> <td data-bbox="887 1541 1393 2018"> <p>Students will be taught the evolution of Pteridophytes from the lowest form to its final stage, along with fossil study.</p> <p>Students are able to critically examine the impact of ecological factors on ecosystems and the interaction processes. This understanding will help them develop targeted interventions to increase efficiency of these</p> </td> </tr> </tbody> </table>	Theory Paper Number	Course Name	Course Outcome	1	<p>Diversity of Non-Vascular Plants Part 1 - Introduction to Microbiology, Viruses, Bacteria, Cyanobacteria and Phycology</p>	<p>Students develop a foundation and understanding of microbiology, including its history, classification systems and a study of cyanobacteria and phycology. This paper introduces them to the field and helps them understand the basic characteristics of microorganisms.</p>	2	<p>Diversity of Non-Vascular Plants Part - II Mycology, Plant Pathology, Bryophytes and Plant Anatomy</p>	<p>Students develop an in-depth understanding about detailed internal structure of the plants.</p> <p>They learn about the life cycles of forms of fungi and bryophytes, their benefits in industrial usage as well as the diseases caused from the microorganism.</p> <p>This paper allows for a practical understanding and application of their study.</p>	3	<p>Pteridophytes, Palaeobotany, Environmental Biology and Phytogeography</p>	<p>Students will be taught the evolution of Pteridophytes from the lowest form to its final stage, along with fossil study.</p> <p>Students are able to critically examine the impact of ecological factors on ecosystems and the interaction processes. This understanding will help them develop targeted interventions to increase efficiency of these</p>
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			interaction processes for better ecosystem management.
4	Gymnosperms and Embryology of Angiosperms		Students understand the basic characteristics and development of beginning stages of a plant, with an in depth understanding of each stage.
5	Taxonomy and Economic Botany		Students are introduced to the field of taxonomy, its brief history and the classification systems prevalent in the field. During the course of this paper, they develop hands-on experience as they learn to make a herbarium. They develop proficiency in identifying different parts of a plant and classifying them based on pre-determined characters..
6	Molecular Biology, Genetic Engineering, Biotechnology and Plant Physiology		Students will be able to use their knowledge of the field so far and explain practical applications in the field of biotechnology and genetic engineering. The paper introduces them to the history of the field and current innovations as well, allowing for ideation of possible developments in the future.
7	Cytology, Genetics, Evolution and Plant Breeding		Students learn about cell and chromosomal biology, Mendelian principles, methods of gene mapping, the basics of evolution and plant breeding techniques.
8	Plant Physiology - III		Students will be proficient in their knowledge of enzymes - right from its nomenclature to actions and factors that both encourage and inhibit it. They also develop an in depth understanding of the process of photosynthesis, photorespiration and the requirement of mineral nutrition for plant growth

Practical Paper Number	Course Name	Course Outcome
1	Practical 1 - Diversity of Non vascular plants. Introduction to Microbiology, Viruses, Bacteria, Cyanobacteria and Phycology	Students learn about different microscopic instruments and sterilization. This lays the foundation and basics for lab research work. They also learn about the characteristics of bacteria, plant viral diseases, different types of algae
2	Practical:2 Diversity of Non-Vascular Plants Part - II Mycology, Plant Pathology, Bryophytes and Plant Anatomy	Students learn to identify and classify fungi, through practical exposure. They also study Bryophytes, Lichens and Mycorrhiza
3	Practical:3 Pteridophytes, Palaeobotany, Environmental Biology and Phytogeography of Angiosperms	Students undertake microscopic observation and identification of pteridophytes and gymnosperms. They also observe crop plants infected by the pathogens included in the syllabus and study of symptoms, causative agents and etiology. Students are also trained in micro preparation and preparing slides. They are also aware of soil types, structure and analysis.
4	Practical:4 Gymnosperms and Embryology of Angiosperms	Students study materials and slides of gymnosperms, microsporogenesis and male gametophyte, types of placentation, mounting of pollen grain, endosperm.
5	Practical:5 Taxonomy and Economic Botany	Students learn the morphology of angiosperms, types of classifications and learn about Botanical Survey of India (BSI). They also apply their knowledge of herbarium techniques to create one.

			They also learn the taxonomic evidences from molecular, numerical and chemicals. They also briefly study the economic products with special reference to the botanical name, family, morphology of useful part and the uses
6	Practical:6 Molecular Biology, Genetic Engineering, Biotechnology and Plant Physiology		Students learn Qualitative Test for Starch, Protein, Reducing Sugars and Lipids. They also learn to determine Osmotic potential of the cell sap by Plasmolytic method and Stomatal Index. They study Osmosis & Transpiration Experiments and Phloem Transport by Ringing Experiment They also aware of structures of Stomata in Hydrophytes, Mesophytes and Xerophytes. They also gain skill on working principles of pH meter, colorimeter and centrifuge.
7	Practical:7 Cytology, Genetics, Evolution and Plant Breeding		Students learn to prepare cytological stains - Aceto carmine & Aceto orcein. They also well versed in the process of mitosis from <i>Allium</i> root tips and meiosis from <i>Allium</i> flower buds. They also learn about Karyotype and Idiogram: Camera Lucida drawing, emasculation and bagging of the flower buds of available species.
8	Practical:8 Plant Physiology - III		Students learn to separate photosynthetic material pigments by paper chromatography and measurement of Rf Values. They also able to determine the rate of photosynthesis at different wavelengths of light and at at different

			<p>concentrations of CO₂. They also able to estimate Ascorbic acid content in a plant sample and determine the rate of RQ of carbohydrates, fats and proteins. They also study of geotropism, phototropism and hydrotropism and respiratory processes during photosynthesis.</p>
<p>Learning Outcome</p>	<p>The course is aimed at providing basics of Botany. Students are imparted with knowledge about classical botany to enable students to get exposed to various branches of botany and Application oriented learning is also encouraged.</p> <p>Paper 1 / Course 1 DIVERSITY OF NON-VASCULAR PLANTS - PART-I INTRODUCTION TO MICROBIOLOGY, VIRUSES, BACTERIA, CYANOBACTERIA AND PHYCOLOGY 52 hrs</p> <ol style="list-style-type: none"> 1. Learn to understand the concept of microbial nutrition, particularly of bacteria and relate that to the commercially viable processes like fermentation, compost formation etc. 2. Learn to understand human friendly viruses, bacteria and viral & bacterial plant diseases and their management. 3. Learn appreciating the diversity of algae in the surroundings and their economic importance <p>*This leads to learning of basics to work as phycologist /microbiologist in Industries related to diary brewery Agro - based industries, biofuels etc apart from research laboratories.</p> <p>Paper2. /Course 2: DIVERSITY OF NON-VASCULAR PLANTS - PART - II MYCOLOGY, PLANT PATHOLOGY, BRYOPHYTES AND PLANT ANATOMY 52 hrs</p> <ol style="list-style-type: none"> 1. Learn to Identify true fungi and understand the concept of plant pathology and its application in managing fungal diseases in plants. 2. Learn to identify bryophytes understand plant evolution and their transition to land habitat. 3. Learn fundamentals of plant anatomy. 4. examine the internal anatomy of plant organs and analyse the composition of different parts of plants and their relationships to functions performed. 		

*This leads to learning basics to work as plant pathologist, field related to bioremediation, biopesticides biological manures etc. Wood science,

Paper 3/Course 3:

PTERIDOPHYTES, ENVIRONMENTAL BIOLOGY AND PHYTOGEOGRAPHY 52 hrs **PALEOBOTANY, AND**

1. learn the core concepts of ecosystem and, formation, composition and types of soils
2. learn the types and importance of phytogeographical division of India
3. Understand the energy flow in the ecosystem and the adaptation of plants in relation to light, temperature, water, wind and fire
4. Learn the concept and importance of natural resources and sustainable utilization of land, water, forest and energy resources.
5. Learn to identify Pteridophytes and their importance.

*This leads to learning basics of fossil study and evolution of earth and, to work in the field of conventional energy sources, environment, ecology, forest produce and related industry.

Paper 4/course 4

GYMNOSPERMS AND EMBRYOLOGY OF ANGIOSPERMS 52 hrs

1. Learn the concept of reproductive biology of plants.
2. Learn the concept behind fruit formation and seed setting which is the basis of plant breeding.
3. Learn the method and importance of tissue culture technique which has wide application in the improvement and conservation of plants.
4. Learn to identify Gymnosperms and their importance
5. Learn the ability of collective work in group and research methodology through compulsory miniprojector work.

*This leads to learning basics of Plant reproduction to work in the field of tissue culture, pomology, plant breeding.

Paper 5/Course 5

TAXONOMY AND ECONOMIC BOTANY 39 hrs

1. Learn the Plant systematics and understand morphological diversity of higher plants.
2. Learn to identify Angiosperm families and tools for identification.
3. Learn the concept and importance of herbarium and botanical gardens

4. Get an exposure to Latin words and names of plants and the rules of ICBN for botanical nomenclature
5. Learn to appreciate the vast and tough work involved in the documentation of flora of different regions of the world and classification through the study of types of plant classification.
6. Learn the plant treasure as source of food, medicine, oil, fibres etc.

*This leads to acquiring knowledge of plant morphology which is the basic need for on field plant identification. It helps to be a taxonomist who is in demand in all plant related industries and worldwide herbaria, botanical gardens etc.

Paper 6/Course 6 I:

**MOLECULAR BIOLOGY, GENETIC ENGINEERING,
BIOTECHNOLOGY AND PLANT PHYSIOLOGY**

39 hrs

1. Learn importance of water in various physiological processes of plants.
2. Understand the concept of ascent of sap, transpiration and learn to appreciate the engineering in these processes and the strategy exhibited with respect to facing drought condition.

*This provides basic knowledge to work in biotechnology related industries and agriculture research laboratories.

Paper7/Course 7 **CYTOLOGY, GENETICS, EVOLUTION AND PLANT BREEDING**

1. Learn the genetic basis of life and laws of inheritance, effect of chromosomal abnormalities to genetic disorders
2. Learns genetic interactions at population and evolutionary levels., effect of mutations on gene functions leading to understanding of evolution process.
3. Learn the concept of central dogma of life and steps in transcription, protein synthesis and protein modification.

*This leads to provide basics to work in the field of plant breeding and other agriculture and horticulture related field.

Paper 8/ Course 8 **PLANT PHYSIOLOGY - III**

1. Learn to understand the importance of plants for the existence of life on earth through the study of Photosynthesis and respiration
2. Assess dormancy and germination and flowering in plants
3. Analyse the structure and properties of various enzymes

	<p>*This leads to understanding of how energy is fixed by the plants to be available for all living system. It helps in the field of environment, agriculture and horticulture related industries.</p>
<p>Course Objectives</p>	<p>Graduates of Botany are expected to know basics of Botany, the traditional or classical botany, with an exposure to modern and applied aspects being introduced from time to time. The course is aimed at training them in the subject to prepare them take up higher studies and research as well as develop communicative skills, language, develop clarity in understanding and thought process, leadership, independent and group working, community and social responsibility. To develop these skills during the course the students are encouraged to take up self-study, utilise library, peer study, seminars and assignments, group discussions, individual and group projects and so on. Both traditional chalk & talk method and ICT enabled methods are used in class room teaching. Botany is practical oriented subject and to meet this regular laboratory practical study is adopted along with field trips and visits to research institutes and industries</p>