

**Department of Botany**

**Garhbeta College**

**Garhbeta: :Paschim Medinipur::721127 West Bengal**

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**Programme Outcome(PO) For B.Sc.Hons.**

<b>PO</b>	<b>Description</b>
PO1	Knowledge and understanding of the range of plant diversity in terms of structure, function and environmental relationships.
PO2	Think logically and organize tasks into a structured form. Understand the evolving state of knowledge in a rapidly developing field.
PO3	Learn to carry out practical work, in the field and in the laboratory.
PO4	Apply the knowledge of basic science ,life science and fundamental process of plants to study and analyze any plant form.
PO5	Identify the taxonomic position of plants, formulate the research literature and analyze non reported plants with substantiated conclusion using first principles and methods of nomenclature and classification in botany
PO6	Design solutions from medicinal plants for health problems, disorders and disease of human beings and estimate the phytochemical content of plants which meet the specified needs to appropriate consideration for the public health.
PO7	Apply reasoning informed by the contextual knowledge to assess plant diversity, its importance for society, health, safety, legal and environmental issues and the consequent responsibilities relevant to the biodiversity conservation practice.
PO8	Understand the impact of the plant diversity in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
PO9	Create ,select and apply appropriate techniques, resources ,and modern instruments and equipments for biochemical estimation, Molecular Biology, Biotechnology, Plant Tissue culture experiments, cellular and physiological activities of plants with an understanding of the application and limitations.
PO10	Use research based knowledge and research methods including design of experiments, analysis and interpretation of data and development of the information to provide valid conclusion.

**Programme Specific Outcome(PSO)For B.Sc Hons. in Botany**

<b>PSO</b>	<b>Description</b>
PSO1	Students acquire fundamental Botanical knowledge through theory and practical's.
PSO2	To explain basis plant of life, reproduction and their survival in nature.
PSO3	Helped to understand role of living and fossil plants in our life.
PSO4	Use modern Botanical tools, Models, Charts and Equipments.
PSO5	To know advance techniques in plant sciences like tissue culture, phytoremediation, plant disease management, formulation of new herbal drugs etc.
PSO6	To create awareness about cultivation, conservation and sustainable utilization of biodiversity.
PSO7	Students able to start nursery, mushroom cultivation, biofertilizer production, fruit preservation and horticultural practices.
PSO8	Study and understand the recombinant DNA technology.
PSO9	Understand good laboratory practices and safety.
PSO10	Make aware and handle the sophisticated instruments/equipments

**COURSE OUTCOME(CO) FOR THE ACADEMIC YEATR 2018-2019****Name of the course: B.Sc. Honours. in Botany****Core Course: Botany****Semester -I**

<b>Paper Code &amp; Name</b>	<b>CO</b>	<b>Outcomes</b>
<b>CC1 (Phycology &amp; Microbiology)</b>	<b>CO1</b>	Know the concept and characteristics of Virus, Bacteria, Algae.
	<b>CO2</b>	Understand the structure and replication of DNA and RNA Virus.
	<b>CO3</b>	Learn about the microbial genetics and recombination of Bacteria.
<b>C1T</b>		

<b>C1P</b>	<b>CO1</b>	Understand the staining procedure of the bacteria.	
	<b>CO2</b>	Know about the types of bacteria through microscope.	
	<b>CO3</b>	Study the vegetative and reproductive structure of <i>Nostoc</i> , <i>Chlamydomonas</i> , <i>Volvox</i> , <i>Chara</i> , <i>Fucus</i> , <i>Polysiphonia</i> , <i>Vaucheria</i> .	
<b>CC2 (Bio-molecules and Cell Biology)</b>	<b>CO1</b>	Know about the structure, functions and biological roles of carbohydrates, proteins, lipids and nucleic acids.	
	<b>CO2</b>	Learn about the concept of thermodynamics, free energy and structure of ATP.	
	<b>CO3</b>	Get the detail knowledge about structure, classification, function and mechanism of enzymes in metabolic pathway.	
	<b>CO4</b>	Understand the detail structure, function, characteristics of prokaryotic and eukaryotic cells.	
	<b>C2T</b>	<b>CO5</b>	Know the structure, function, composition, transport mechanism of cell wall and cell membranes,
		<b>CO6</b>	Gain knowledge about structure, function of nucleus, cytoskeleton, chloroplast, mitochondria, peroxisomes and endomembrane system.
		<b>CO7</b>	Understand the eukaryotic cell cycle and mitotic and meiotic cell division.
<b>C2P</b>	<b>CO1</b>	Know the quantitative test for carbohydrates, reducing sugar, non-reducing sugar, lipids and proteins.	
	<b>CO2</b>	Learn about the measurement of cell size by the technique of micrometry.	
	<b>CO3</b>	Get detail knowledge about cell and its organelles	
	<b>CO4</b>	Understand the phenomenon of plasmolysis and deplasmolysis.	
	<b>CO5</b>	Know the different stages of mitosis and meiosis.	

### Semester-II

Paper code & Name	CO	Outcomes	
<b>CC3 (Mycology &amp; Phytopathology)</b>	<b>CO1</b>	Understand the general account on occurrence, organisation, reproduction, classification of Fungi <i>Saccharomyces</i> , <i>Aspergillus</i> , <i>Penicillium</i> and <i>Rhizopus</i> .	
	<b>CO2</b>	Know about the brief account on pathogen etiology, mode of action and symptoms of fungal diseases of plant and a brief discussion of Biopesticides.	
	<b>CO3</b>	Understand nature and significance of Mycorrhiza.	
	<b>C3T</b>	<b>CO4</b>	Learn about the role of fungi in biotechnology, food industry, Agriculture.
		<b>CO5</b>	Acquire knowledge about medical mycology and its application.
		<b>CO6</b>	Know the symptoms of viral, bacterial and fungal disease of plants.

<b>C3P</b>	<b>CO1</b>	Know the introduction to the World fungi(Unicellular, coenocytic/septate mycellium, ascocarps and basidiocarps).
	<b>CO2</b>	Get an idea about asexual and sexual stage of <i>Rhizopus</i> , <i>Aspergillus</i> , <i>Penicillium</i> .
	<b>CO3</b>	Learn about the sectioning of gills of <i>Agaricus sp.</i>
	<b>CO4</b>	Understand the Herbarium specimens of bacterial ,viral and fungal diseases.
<b>CC-4 (Archegoniate)</b>	<b>CO1</b>	Understand the unifying features of Archegoniates.
	<b>CO2</b>	Know the evolution of algae, fungi, bryophytes, pteridophytes.
	<b>CO3</b>	Understand the classification of the bryophytes, pteridophytes, and gymnosperms.
	<b>CO4</b>	Know the systematics, morphology, anatomy and reproduction of bryophytes, pteridophytes, and gymnosperms.
	<b>CO5</b>	Learn about ecological and economic importance of bryophytes, pteridophytes, gymnosperms.
	<b>CO6</b>	Gain knowledge about Alternation of generation of cryptogams.
<b>C4P</b>	<b>CO1</b>	Learn about sectioning the thallus of <i>Marchantia</i> , <i>Anthoceros</i> , <i>Riccia</i> .
	<b>CO2</b>	Know about whole mount of leaf in <i>Funaria</i> , transverse section stem in <i>Selaginella</i> .
	<b>CO3</b>	Identify the male cone and female cone of <i>Pinus</i> and <i>Gnetum</i> .

**Semester -III**

<b>Paper Code &amp; Name</b>	<b>CO</b>	<b>Outcomes</b>
<p align="center"><b>CC-5 (Anatomy of Angiosperm)</b></p> <p align="center"><b>C5T</b></p>	<b>CO1</b>	Know the internal organisation and development of plant body.
	<b>CO2</b>	Learn about the classification of tissues.
	<b>CO3</b>	Understand the evolution concept of organisation of shoot apex and root apex.
	<b>CO4</b>	Get an idea about structure, function and seasonal activity of cambium and secondary growth in root and stem.
	<b>CO5</b>	Know about anatomical adaptations of xerophytes and hydrophytes.
<p align="center"><b>C5P</b></p>	<b>CO1</b>	Acquire knowledge about detail anatomical structure of leaf , stem, and root.
	<b>CO2</b>	Understand heart wood and sap wood
	<b>CO3</b>	Know about the adaptive anatomical features of xerophytes and hydrophytes.
<p align="center"><b>CC-6 (Economic Botany)</b></p> <p align="center"><b>C6T</b></p>	<b>CO1</b>	A detailed knowledge on origin, morphology, cultivation and importance of Wheat, Rice Legumes to man and ecosystem.
	<b>CO2</b>	Know about morphology, cultivation, processing and uses of sugarcane and potato.
	<b>CO3</b>	Gain knowledge about family and economic importance of saffron, clove, black pepper.
	<b>CO4</b>	Learn about morphology, processing, and uses of Tea and Coffee.
	<b>CO5</b>	Get detailed idea on uses of natural rubber, drug yielding plants, timber plants, and fiber yielding plants.
<p align="center"><b>C6P</b></p>	<b>CO1</b>	Acquire knowledge about micro-chemical test of starch grains, Soybean and Groundnut.
	<b>CO2</b>	Understand sources of oil and fats from oil yielding plants.
	<b>CO3</b>	Know the fibre and drug yielding plants.

<p style="text-align: center;"><b>CC-7 (Genetics)</b></p> <p style="text-align: center;"><b>C7T</b></p>	<b>CO1</b>	Understand the Mendelian and neo-Mendelian genetics.
	<b>CO2</b>	Know about interaction of genes, multiple alleles, linkage and crossing over.
	<b>CO3</b>	Gain knowledge about sex linked inheritance, chromosomal aberrations.
	<b>CO4</b>	Learn about variation in chromosome number and structure.
	<b>CO5</b>	Get an idea about fine structure of gene.
	<b>CO6</b>	Know the population evolutionary genetics.
<p style="text-align: center;"><b>C7P</b></p>	<b>CO1</b>	Learn about pretreatment ,fixation, staining and squash procedure for mitosis study.
	<b>CO2</b>	Enhances the knowledge on study of Mitosis and Meiosis by smear preparation.
	<b>CO3</b>	Understand the Mendel's laws through seed ratios.
	<b>CO4</b>	Get an idea about chromosome mapping using point cross data.
	<b>CO5</b>	Know about Pedigree analysis for dominant and recessive autosomal and sex linked traits.
<p style="text-align: center;"><b>SEC-1 (Biofertilizers)</b></p> <p style="text-align: center;"><b>SEC1T</b></p>	<b>CO1</b>	Know about the microbes used as biofertilizer( <i>Rhizobium</i> , <i>Azospirillum</i> , <i>Cyanobacteria</i> )
	<b>CO2</b>	Understand the classification, characteristics of <i>Azotobacter</i> .
	<b>CO3</b>	Learn about role of blue green algae and <i>Azolla</i> in rice cultivation.
	<b>CO4</b>	Acquire knowledge on organic farming and types of mycorrhizal association, taxonomy, occurrence and distribution.
	<b>CO5</b>	Know various steps in protein synthesis.

**Semester-IV**

<b>CC-8 (Molecular biology)</b>  <b>C8T</b>	<b>CO1</b>	Understand the biochemical nature of nucleic acids their role in living system.
	<b>CO2</b>	Know the various models and mode of replication of DNA.
	<b>CO3</b>	Learn about transcription in prokaryotes and eukaryotes.
	<b>CO4</b>	Understand the processing and modification of RNA.
	<b>CO5</b>	Know various steps in protein synthesis.
<b>C8P</b>	<b>CO1</b>	Know the preparation of LB medium and raising <i>E.coli</i> .
	<b>CO2</b>	Acquire knowledge on DNA isolation and estimation by Spectrophotometry.
	<b>CO3</b>	Understand the isolation of genomic DNA from <i>E.coli</i> .
<b>CC-9 (Plant Ecology &amp; Phytogeography)</b>  <b>C9T</b>	<b>CO1</b>	Get an idea on ecology and ecosystem, level of organisation, components and inter-relationship between living world and environment.
	<b>CO2</b>	Know the origin, formation, composition of soil, and soil profile and role of climate in soil development.
	<b>CO3</b>	Acquire the knowledge on importance of water, precipitation types, water in soil, water table.
	<b>CO4</b>	Gain the knowledge on food chain, food web and ecological pyramids
	<b>CO5</b>	Understand the characteristics of population and ecological speciation.
	<b>CO6</b>	Learn about the major terrestrial biomes, phytogeographical division of India and local vegetation.
	<b>CO2</b>	Gain knowledge on the pH of various soil and water samples.
	<b>CO3</b>	Understand the morphological adaptations of hydrophytes and xerophytes.

	<b>CO4</b>	Learn about minimum quadrat size for the study of herbaceous vegetation in college campus by species area curve method.
	<b>CO5</b>	Understand the quantitative analysis of herbaceous vegetation for density and abundance.
<p style="text-align: center;"><b>CC-10 (Plant Systematics)</b></p> <p style="text-align: center;"><b>C10T</b></p>	<b>CO1</b>	Understand the concept of systematics and Identification, Classification, Nomenclature of plants.
	<b>CO2</b>	Know about Herbarium and its role in plant systematics.
	<b>CO3</b>	Gain knowledge about concept of taxa ,categories and taxonomic hierarchy.
	<b>CO4</b>	Acquire knowledge on principles and rules of ICBN, Typification, author citation and principles of priority.
	<b>CO5</b>	Understand the classification system of plants by different taxonomists.
	<b>CO6</b>	Know the origin and evolution of angiosperms.
<p style="text-align: center;"><b>C10P</b></p>	<b>CO1</b>	Understand the vegetative and floral parts of different families of plants.
	<b>CO2</b>	Know the floral diagram, floral formula and systematic position of plants of different families according to Bentham and Hooker's systems of classification.
	<b>CO3</b>	Learn about mounting of properly dried and pressed specimens of any wild plant with herbarium label.

<b>SEC-2 (Mushroom Culture Technology)</b>	<b>CO1</b>	Know the concept of edible and poisonous mushroom and nutritional and medicinal value of edible mushrooms.
	<b>CO2</b>	Acquire the knowledge about mushroom cultivation process.
	<b>CO3</b>	Understand the composting technology in mushroom production.
	<b>CO4</b>	Learn about short term and long term storage of mushroom.
	<b>CO5</b>	Get an idea about types of food prepared from mushroom and know the national and regional level research centre's, marketing in India and abroad.

#### Semester-V

Paper Code & Name	CO	Outcomes
<b>CC-11 (Reproductive biology of Angiosperm)  C11T</b>	<b>CO1</b>	Know about flower as a modified determinate shoot.
	<b>CO2</b>	Understand the structure and function of anther wall, microsporogenesis, megagametogenesis.
	<b>CO3</b>	Gain knowledge about pollen wall protein, pollen viability, storage and germination of pollen.
	<b>CO4</b>	Get detail on organisation and ultrastructure of mature embryo sac.
	<b>CO5</b>	Know about types, significance and adaptation of pollination.
	<b>CO6</b>	Understand methods to overcome self-incompatibility, <i>in vitro</i> pollination and <i>in vitro</i> fertilization
<b>C11P</b>	<b>CO1</b>	Know about pollen viability test.
	<b>CO2</b>	Learn on types of ovule.
	<b>CO3</b>	Know the intra-ovarian pollination.

<p style="text-align: center;"><b>CC-12 (Plant Physiology)</b></p> <p style="text-align: center;"><b>C12T</b></p>	<b>CO1</b>	Know scope and importance of plant physiology.
	<b>CO2</b>	Understand plant and water relation.
	<b>CO3</b>	Learn about role of macro and micronutrients for growth and development of plants.
	<b>CO4</b>	Understand transport of ions across cell membrane and function of carrier proteins.
	<b>CO5</b>	Gain knowledge about translocation in phloem.
	<b>CO6</b>	Enhances the knowledge about physiological role of plant growth regulators.
	<b>CO7</b>	Know the role of phytochrome, cryptochromes and phototropins in photomorphogenesis.
<p style="text-align: center;"><b>C12P</b></p>	<b>CO1</b>	Understand osmotic potential of plant cell sap by plasmolytic method.
	<b>CO2</b>	Know about stomatal index and stomatal frequency.
	<b>CO3</b>	Learn about germination of seed.
	<b>CO4</b>	Gain knowledge about rooting from cutting portion of plants.
<p style="text-align: center;"><b>DSE-1 (Natural resource management)</b></p> <p style="text-align: center;"><b>DSE-1T</b></p>	<b>CO1</b>	Gain knowledge about natural resources and its sustainable utilization.
	<b>CO2</b>	Know the scope ,importance ,significance and management of biodiversity.
	<b>CO3</b>	Get idea about forest products and management of forests.
	<b>CO4</b>	Understand renewable and non-renewable sources of energy.
	<b>CO5</b>	Know the national and international efforts in resource management and conservation.

<b>DSE-1P</b>	<b>CO1</b>	Know about solid waste generated by domestic system.
	<b>CO2</b>	Understand the data on forest cover of specific area.
	<b>CO3</b>	Learn about the measurement of the dominant woody species by DBH method.
<b>DSE-2 (Plant breeding)</b>	<b>CO1</b>	Gain scientific knowledge about breeding systems of plants.
	<b>CO2</b>	Know about the selection methods and hybridization of plants for crop improvement.
	<b>CO3</b>	Understand the monogenic and polygenic inheritance.
	<b>CO4</b>	Get idea about genetic basis of inbreeding depression and heterosis and its application.
	<b>CO5</b>	Know the role of biotechnology in crop improvement.
<b>DSE-2T</b>	<b>CO1</b>	Understand the process of hybrid variety ,development and their release
	<b>CO2</b>	Know the technique of production of new superior crop varieties.
<b>DSE-2P</b>	<b>CO1</b>	Understand the process of hybrid variety ,development and their release
	<b>CO2</b>	Know the technique of production of new superior crop varieties.

#### Semester-VI

<b>Paper Code &amp; Name</b>	<b>CO</b>	<b>Outcomes</b>
<b>CC-13 (Plant Metabolism)</b>	<b>CO1</b>	Understand the concept of anabolic and catabolic pathways ,regulation of metabolism.
	<b>CO2</b>	Know the process of photosynthesis,C3,C4,CAM pathways.
	<b>CO3</b>	Get an idea about synthesis and catabolism of sucrose and starch.
	<b>CO4</b>	Know about carbon oxidation mechanism in plants.
<b>C13T</b>		

<b>C13P</b>	<b>CO1</b>	Understand the chemical separation of photosynthetic pigments.
	<b>CO2</b>	Learn about experiment of Hill's reaction.
	<b>CO3</b>	Understand the rate of respiration in different parts of a plant.
<b>CC-14 (Plant Biotechnology)</b>  <b>C14T</b>	<b>CO1</b>	Understand the fundamental of recombinant DNA technology.
	<b>CO2</b>	Gain knowledge about tissue culture techniques.
	<b>CO3</b>	Get an idea about gene cloning.
	<b>CO4</b>	Know the methods of gene transfer.
	<b>CO5</b>	Acquire knowledge about application of biotechnology in agriculture, horticulture and industry.
<b>C14P</b>	<b>CO1</b>	Know the preparation of MS medium.
	<b>CO2</b>	Understand the <i>in vitro</i> sterilization and inoculation methods.
	<b>CO3</b>	Acquire knowledge about the steps of genetic engineering for production of Bt cotton, Golden rice and Flavr Savr tomato.
<b>DSE-3 (Industrial and Environmental Microbiology)</b>  <b>DSE-3T</b>	<b>CO1</b>	Acquire knowledge of fermentation technology and production of fermented products.
	<b>CO2</b>	Know the application of microbial enzymes in industry.
	<b>CO3</b>	Understand the BOD, COD, TDS and TOC of water samples.
	<b>CO4</b>	Get an idea about uses of microbes in agriculture and bioremediation of contaminated soil.

<b>DSE-3P</b>	<b>CO1</b>	Know the principles and functions of instruments in microbiology laboratory.
	<b>CO2</b>	Understand the sterilization techniques and preparation of medium.
<b>DSE-4 (Analytical Techniques in Plant Sciences)  DSE-4T</b>	<b>CO1</b>	Understand the principles of microscopy and application of different microscope in plant sciences.
	<b>CO2</b>	Know the process of various centrifugation technique.
	<b>CO3</b>	Gain knowledge about uses of radioisotopes in biological research.
	<b>CO4</b>	Get ideas on principles of different chromatography.
	<b>CO5</b>	Learn about application of spectrophotometry in research.
	<b>CO6</b>	Understand the principles of Gel-electrophoresis.
<b>DSE-4P</b>	<b>CO1</b>	Learn about the Southern, Northern and Western blotting techniques.
	<b>CO2</b>	Learn about the analysis of nitrogenous bases by paper chromatography.
	<b>CO3</b>	Understand the separation of chloroplasts by differential centrifugation.
	<b>CO4</b>	Know the estimation of protein concentration by Lowry's methods
	<b>CO5</b>	Gain knowledge about the separation of protein and DNA by Gel-electrophoresis.