MAHISHADAL RAJ COLLEGE
(Govt. Sponsored)
Estd. : 1946
NAAC accredited 'A' Grade College
DST (FIST) Govt. of India Approved College
Mahishadal : Purba Medinipur

DEPARTMENT OF BOTANY

COURSE OUTCOME (CO)

B. Sc. (HONS.) in BOTANY

Semester	Paper code & Name	Outcomes
I	**CC1** **(Phycology & Microbiology)**	• Know the concept and characteristics of Virus, Bacteria, Algae. • Understand the structure and replication of DNA and RNA Virus. • Learn about the microbial genetics and recombination of Bacteria. • Understand the staining procedure of the bacteria. • Know about the types of bacteria through microscope. • Study the vegetative and reproductive structure of Nostoc, Chlamydomonas, Volvox, Chara, Fucus, Polysiphonia, Vaucheria.
	CC2 **(Biomolecules & Cell Biology)**	• Know about the structure, functions and biological roles of carbohydrates, proteins, lipids and nucleic acids. • Learn about the concept of thermodynamics, free energy and structure of ATP. • Get the detail knowledge about structure, classification, function and mechanism of enzymes in metabolic pathway. • Know the structure, function, composition, transport mechanism of cell wall and cell membranes, • Gain knowledge about structure, function of nucleus, cytoskeleton, chloroplast, mitochondria, peroxisomes and endomembrane system. • Understand the eukaryotic cell cycle and mitotic and meiotic cell division. • Know the quantitative test for carbohydrates, reducing sugar, non-reducing sugar, lipids and proteins. • Learn about the measurement of cell size by the technique of micrometry. • Get detail knowledge about cell and its organelles • Understand the phenomenon of plasmolysis and deplasmolysis.
II	**CC3** **(Mycology & Phytopathology**	• Understand the general account on occurrence, organization, reproduction, classification of Fungi Saccharomyces, Aspergillus, Penicillium and Rhizopus. • Know about the brief account on pathogen etiology, mode if action and symptoms of fungal diseases of plant and a brief discussion of Biopesticides. • Understand nature and significance of Mycorrhiza. • Learn about the role of fungi in biotechnology, food industry, Agriculture. • Acquire knowledge about medical mycology and its application. • Know the symptoms of viral, bacterial and fungal disease of plants. • Know the introduction to the World fungi (Unicellular, coenocytic/septate mycelium, ascocarps and basidiocarps). • Get an idea about asexual and sexual stage of Rhizopus, Aspergillus, Penicillum. • Learn about the sectioning of gills of Agaricus sp. • Understand the Herbarium specimens of plant.

Semester	Paper code & Name	Outcomes
II	**CC-4 (Archegoniate)**	• Understand the unifying features of Archegoniates. • Know the evolution of algae, fungi, bryophytes, pteridophytes. • Understand the classification, anatomy, morphology and reproduction of the bryophytes, pteridophytes, and gymnosperms. • Learn about ecological and economic importance of bryophytes, pteridophytes, gymnosperms. • Gain knowledge about Alternation of generation of cryptogams. • Learn about sectioning the thallus of Marchantia, Anthoceros, Riccia. • Know about whole mount of leaf in Funaria, transverse section stem in Selaginella. • Identify the male cone and female cone of Pinus and Gnetum.
III	**CC-5 (Anatomy of Angiosperm)**	• Know the internal organization and development of plant body. • Learn about the classification of tissues. • Understand the evolution concept of organization of shoot apex and root apex. • Get an idea about structure, function and seasonal activity of cambium and secondary growth in root and stem. • Know about anatomical adaptations of xerophytes and hydrophytes. • Acquire knowledge about detail anatomical structure of leaf, stem, and root. • Understand heart wood and sap wood
	CC-6 (Economic Botany)	• A detailed knowledge on origin, morphology, cultivation and importance of Wheat, Rice, Legumes to man and ecosystem. • Know about morphology, cultivation, processing and uses of sugarcane and potato. • Gain knowledge about family and economic importance of saffron, clove, black pepper. • Learn about morphology, processing, and uses of Tea and Coffee. • Get detailed idea on uses of natural rubber, drug yielding plants, timber plants and fiber yielding plants. • Acquire knowledge about micro-chemical test of starch grains, Soybean and Groundnut. • Understand sources of oil and fats from oil yielding plants. • Know the fibre and drug yielding plants.
	CC-7 (Genetics)	• Understand the Mendelian and neo-Mendelian genetics. • Know about interaction of genes, multiple alleles, linkage and crossing over. • Gain knowledge about sex linked inheritance, chromosomal aberrations. • Learn about variation in chromosome number and structure. • Know the population evolutionary genetics. • Learn about pretreatment, fixation, staining and squash procedure for mitosis study. • Enhances the knowledge on study of Mitosis and Meiosis by smear preparation. • Understand the Mendel's laws through seed ratios. • Get an idea about chromosome mapping using point cross data. • Know about Pedigree analysis for dominant and recessive autosomal and sex-linked traits.

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III	**SEC-1 (Biofertilizers)**	• Know about the microbes used as biofertilizer (Rhizobium, Azospirillum, Cyanobacteria) • Understand the classification, characteristics and production of Azotobacter. • Learn about role of blue green algae and Azolla in rice cultivation. • Acquire knowledge on organic farming and types of mycorrhizal association, taxonomy, occurrence and distribution. • Know various steps in industrial process of biofertilizers.
IV	**CC-8 (Molecular biology)**	• Understand the biochemical nature of nucleic acids & their role in living system. • Know the various models and mode of replication of DNA. • Learn about transcription in prokaryotes and eukaryotes. • Understand the processing and modification of RNA. • Know various steps in protein synthesis. • Know the preparation of LB medium and raising E.coli. • Acquire knowledge on DNA isolation and estimation by Spectrophotometry. • Understand the isolation of genomic DNA from E.coli & gel electrophoresis.
	CC-9 (Plant Ecology & Phytogeography)	• Get an idea on ecology and ecosystem, level of organization, components and inter-relationship between living world and environment. • Know the origin, formation, composition of soil, and soil profile and role of climate in soil development. • Acquire the knowledge on importance of water, precipitation types, water in soil, water table. • Gain the knowledge on food chain, food web and ecological pyramids • Understand the characteristics of population and ecological speciation. • Learn about the major terrestrial biomes, phytogeographical division of India and local vegetation. • Gain knowledge on the pH of various soil and water samples. • Understand the morphological adaptations of hydrophytes and xerophytes. • Learn about minimum quadrat size for the study of herbacious vegetation in college campus by species area curve method. • Understand the quantitative analysis of herbacious vegetation for density and abundance.
	CC-10 (Plant Systematics)	• Understand the concept of systematics and Identification, Classification, Nomenclature of plants. • Know about Herbarium and its role in plant systematics. • Gain knowledge about concept of taxa, categories and taxonomic hierarchy.

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IV	**CC-10** **(Plant Systematics)**	• Acquire knowledge on principles and rules of ICBN, classification, author citation and principles of priority. • Understand the classification system of plants by different taxonomist • Know the origin and evolution of angiosperms. • Understand the vegetative and floral parts of different families of plants. • Know the floral diagram, floral formula and systematic position of plants of different families according to Bentham and Hooker's systems of classification. • Learn about mounting of properly dried and pressed specimens of any wild plant with herbarium label.
	SEC-2 **(Mushroom Culture Technology)**	• Know the concept of edible and poisonous mushroom and nutritional and medicinal value of edible mushrooms. • Acquire the knowledge about mushroom cultivation process. • Understand the composting technology in mushroom production. • Learn about short term and long-term storage of mushroom. • Get an idea about types of food prepared from mushroom and know the national and regional level research centers, marketing in India and abroad.
V	**CC-11** **(Reproductive biology of Angiosperm)**	• Understand the structure and function of anther wall, microsporogenesis, mega gametogenesis. • Gain knowledge about pollen wall protein, pollen viability, storage and germination of pollen. • Get detail on organization and ultrastructure of mature embryo sac. • Know about types, significance and adaptation of pollination. • Understand methods to overcome self-incompatibility, in vitro pollination and in vitro fertilization • Know about pollen viability test. • Learn on types of ovules. • Know the intra -ovarian pollination.
	CC-12 **(Plant Physiology)**	• Know the scope and importance of plant physiology. • Understand plant and water relation. • Learn about role of macro and micronutrients for growth and development of plants. • Understand transport of ions across cell membrane and function of carrier proteins. • Gain knowledge about translocation in phloem. • Enhances the knowledge about physiological role of plant growth regulators. • Know the role of phytochrome, cryptochromes and phytotropins in photomorphogenesis. • Understand osmotic potential of plant cell sap by plasmolytic method. • Know about stomatal index and stomatal frequency. • Learn about germination of seed. • Gain knowledge about rooting from cutting portion of plants.

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V	**DSE-1** **(Natural resource management)**	• Gain knowledge about natural resources and its sustainable utilization. • Know the scope, importance, significance and management of biodiversity. • Get idea about forest products and management of forests. • Understand renewable and non-renewable sources of energy. • Know the national and international efforts in resource management and conservation. • Know about solid waste generated by domestic system. • Understand the data on forest cover of specific area. • Learn about the measurement of the dominant woody species by DBH method.
	DSE-2 **(Plant breeding)**	• Gain scientific knowledge about breeding systems of plants. • Know about the selection methods and hybridization of plants for crop improvement. • Understand the monogenic and polygenic inheritance. • Get idea about genetic basis of inbreeding depression and heterosis and its application. • Know the role of biotechnology in crop improvement. • Understand the process of hybrid variety, development and their release • Know the technique of production of new superior crop varieties.
VI	**CC-13** **(Plant Metabolism)**	• Understand the concept of anabolic and catabolic pathways, regulation of metabolism. • Know the process of photosynthesis, C3, C4, CAM pathways. • Get an idea about synthesis and catabolism of sucrose and starch. • Know about carbon oxidation mechanism in plants • Understand the chemical separation of photosynthetic pigments. • Learn about experiment of Hill's reaction. • Understand the rate of respiration in different parts of a plant.
	CC-14 **(Plant Biotechnology)**	• Understand the fundamental of recombinant DNA technology. • Gain knowledge about tissue culture techniques. • Get an idea about gene cloning. • Know the methods of gene transfer. • Acquire knowledge about application of biotechnology in agriculture, horticulture and industry. • Know the preparation of MS medium. • Understand the in vitro sterilization and inoculation methods. • Acquire knowledge about the steps of genetic engineering for production of Bt cotton, Golden rice and Flavr Savr tomato.
	DSE-3 **(Industrial and Environmental Microbiology)**	• Acquire knowledge of fermentation technology and production of fermented products. • Know the application of microbial enzymes in industry. • Understand the BOD, COD, TDS and TC of water samples. • Get an idea about uses of microbes in agriculture and bioremediation of contaminated soil. • Know the principles and functions of instruments in microbiology laboratory. • Understand the sterilization techniques and preparation of medium.

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VI	**DSE-4** **(Analytical Techniques in Plant Sciences)**	• . Understand the principles of microscopy and application of different microscope in plant sciences. • Know the process of various centrifugation technique. • Gain knowledge about uses of radioisotopes in biological research. • Get ideas on principles of different chromatography. • Learn about application of spectrophotometry in research. • Understand the principles of Gel-electrophoresis. • Learn about the Southern, Northern and Western blotting techniques. • Learn about the analysis of nitrogenous bases by paper chromatography. • Understand the separation of chloroplasts by differential centrifugation. • Know the estimation of protein concentration by Lowry's methods • Gain knowledge about the separation of protein and DNA by Gel-electrophoresis.

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I	**GE1** **Biodiversity (Microbes, Algae, Fungi and Archegoniate)**	• Know the concept and characteristics of Virus, Bacteria, Algae. • Understand the structure and replication of DNA and RNA Virus. • Learn about the microbial genetics and recombination of Bacteria. • Understand the staining procedure of the bacteria. • Know about the types of bacteria through microscope. • Study the vegetative and reproductive structure of Nostoc, Chlamydomonas, Volvox, Chara, Fucus, Polysiphonia, Vaucheria. • Understand the unifying features of Archegoniate. • Know the evolution of algae, fungi, bryophytes, pteridophytes. gymnosperms. • Know the systematics, morphology, anatomy and reproduction of bryophytes, pteridophytes, and gymnosperms. • Learn about ecological and economic importance of bryophytes, pteridophytes, gymnosperms. • Gain knowledge about Alternation of generation of cryptogams. • Learn about sectioning the thallus of Marchantia, Anthoceros, Riccia. • Know about whole mount of leaf in Funaria, transverse section stem in Selaginella. • Identify the male cone and female cone of Pinus and Gnetum.
II	**GE2** **(Plant Ecology and Taxonomy)**	• This course covers two very important topics of plant science, namely Ecology and taxonomy. • In ecology, students learn about ecological factors different plant communities' general idea about ecosystem and phytogeography. • Ecology seeks to understand the vital connections between plants and animals and the world around them. Taxonomy is the science of classifying • living organisms based on certain sets of characters for easy identification and study. The course includes introduction to plant taxonomy, identification, taxonomic hierarchy, botanical nomenclature, biometrics, numerical taxonomy and cladistics.

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III	**GE 3** **(Economic Botany and Plant Biotechnology)**	• Understanding and knowledge of the different medicinal and cultivated plants, staple cereals legumes. • Knowledge on the use and importance of spices beverages oils starches. Biotechnology is the booming topic in the entire area of biology. The knowledge of plant biotechnology in this course will provide the fundamental basis for them to study this topic in details.
IV	**GE 4** **(Plant Physiology and Metabolism)**	• Know scope and importance of plant physiology. • Understand plant and water relation. • Learn about role of macro and micronutrients for growth and development of plants. • Understand transport of ions across cell membrane and function of carrier proteins. • Gain knowledge about translocation in phloem. • Enhances the knowledge about physiological role of plant growth regulators. • Know the role of phytochrome, cryptochromes and phytotropins in photomorphogenesis. • Understand osmotic potential of plant cell sap by plasmolytic method. • Know about stomatal index and stomatal frequency. • Learn about germination of seed. • Gain knowledge about rooting from cutting portion of plants. • Understand the concept of anabolic and catabolic pathways, regulation of metabolism. • Know the process of photosynthesis, C3, C4, CAM pathways. • Get an idea about synthesis and catabolism of sucrose and starch. • Know about carbon oxidation mechanism in plants • Understand the chemical separations of photosynthetic pigments. • Learn about experiment of Hill's reaction. • Understand the rate of respiration in different parts of a plant.