

DUM DUM MOTIJHEEL COLLEGE
DEPARTMENT OF BOTANY
B.Sc. Botany (Hons) CBCS Syllabus
Issued by the West Bengal State University
With effect from 2018-19

Programme Specific Outcomes

- Demonstrate in-depth knowledge of plant taxonomy, plant anatomy, plant physiology, genetics, ecology, evolution, and plant biotechnology.
- Classify and identify plants of different taxonomic groups based on reproductive and vegetative morphology.
- Analyze internal and external structures of plants and relate them to specific functions.
- Explain various physiological processes in plants like photosynthesis, respiration, nitrogen metabolism, plant hormones, etc.
- Apply genetic principles to solve problems related to inheritance, variation, selection, and biotechnology in plant sciences.
- Evaluate relationships between plants and their environment at individual, population, and community levels.
- Describe mechanisms of organic evolution and forces that direct changes in plant populations over time.
- Demonstrate use of instruments, techniques and methods for laboratory and field investigations in diverse disciplines of botany.
- Analyze and interpret experimental data to draw meaningful conclusions applying statistical tools.
- Apply conceptual knowledge in one or more specialized areas like plant ecology, cell biology, molecular biology, economic botany, etc.
- Communicate concepts and research findings effectively using scientific report writing, seminars and presentations.

DUM DUM MOTIJHEEL COLLEGE
Course Outcome: or Learning Outcome
Three year B.A. /B.Sc. degree course
Under CBCS Semester System
HONOURS COURSE IN BOTANY
With effect from the session: 2018 – 2019

Course Name: Core Course-1

Course Code: BOTACOR01T and BOTACOR01P

Topic Name: Phycology and Microbiology

Course outcome: This course will help the students to get acquainted with the microbial world, prokaryotic and eukaryotic organisms along with understanding the general structure, ultrastructure and activities of different prokaryotic organisms like cyanobacteria, eubacteria, archaea and also viruses. Also, the field of phycology is vast, and it reveals about the crucial role that algae play in our world. The students get familiar with the taxonomic classification, identification, evolutionary significance and beneficial roles of algae, bacteria and viruses as well as the harmful and detrimental effect of these organisms on human beings, other animals, plants and our environment.

On completion of the course both theory and practical, the students will be able to

- Identify various genera of algae like *Nostoc*, *Volvox*, *Oedogonium*, *Fucus*, *Polysiphonia* etc.
- They will get hands on practice on preparation of media, sterilization of media for culturing and maintain of cultures.
- They will be able to identify bacteria by gram staining method and also perform differential staining for identification.

Course Name: Core Course-2

Course Code: BOTACOR02T and BOTACOR02P

Topic Name: Biomolecules and Cell biology

Course outcome: This is an application-based course which has a broad scope for the students. Here the students get familiarised with the chemical processes and principles which governs various life processes. The students understand the molecular structure of the various biomolecules, including the study of enzymes, their kinetics, structure, and function and also various other life sustaining chemical reactions in the biological world. The processes of cell cycle and cell division are very important to understand the development of the organism as a whole.

On completion of the course, both theory and practical, the students will be able to

- Understand the basics structure of cell and cellular organelles.

- Perform various chemical analysis to identify various biomolecules of the living system
- Identify various cellular organelles from electron micrographs
- Identify and analyse the various cell division phases both mitotic and meiotic.

Course Name: Core Course-3

Course Code: BOTACOR03T and BOTACOR03P

Topic Name: Mycology and Phytopathology

Course outcome: This course is concerned with the study of fungi, including their taxonomy, genetics, biochemical properties, and use by humans. By studying this course, the students will get familiarised with general characteristics and diversity among different fungal group. They also gain knowledge about plant diseases caused by pathogens (infectious organisms) and environmental conditions (physiological factors) It involves the study of pathogen identification, disease etiology, disease cycles, economic impact, plant disease epidemiology, plant disease resistance, and management of plant diseases.

On completion of the course, both theory and practical, the students will be able to

- Identify fungal genera from different classes like *Rhizopus*, *Aspergillus*, *Penicillium*, *Ascobolus*, *Alternaria*, *Puccinia*, *Agaricus*, *Albugo* etc.
- Identify Lichens - crustose, foliose and fruticose types and mycorrhiza.
- Get the knowledge of Plant pathogens, organisms that cause infectious plant diseases, include fungi, oomycetes, bacteria, viruses, viroids, virus-like organisms, phytoplasmas, protozoa, nematodes.

Course Name: Core Course-4

Course Code: BOTACOR04T and BOTACOR04P

Topic Name: Archegoniate

Course outcome: This course deals with the study of the plant group archegoniate which includes lower plants like Bryophytes, pteridophytes and gymnosperms and understand their evolution, diversity and significance. Since it includes a diverse group of plants, a thorough knowledge is attained after studying this course.

After completing this course, students will be able to:

- Understand the lower plants like Bryophytes, Pteridophytes and Gymnosperms, their vegetative and reproductive structures.
- Identify and characterise the plants in nature.

Course Name: Core Course 5

Course Code: BOTACOR05T & BOTACOR05P

Topic Name: Morphology and Anatomy

Course outcome: This course deals with the study of external and internal structures of the plants with special reference to flowering plants. Important morphological structures like types of roots, stem, inflorescence, flowers and fruits helps us to understand the incredible diversity among the angiosperms. The anatomical study helps students to grasp the knowledge of various tissue organizations and its importance. Also helps to understand the adaptation of the plants in different environmental conditions.

After completing this course, students will be able to:

- Identify the plants on the basis of their external and internal structures.
- Identify the cellular and tissue organization of the flowering plants.
- Prepare permanent slides by double staining method for the important anatomical features of monocots and dicots.

Course Name: Core Course 6

Course Code: BOTACOR06T & BOTACOR06P

Topic Name: Economic Botany

Course outcome: The course includes the study of plants and their products that are useful for humans. Students familiarise with the diversity, origin, cultivation, and domestication of various plant groups that provide food, oil, sugar, starch, beverages, spices, rubber, drugs, wood, fibers etc.

After completing this course, students will be able to:

- Understand the nutritional, medicinal, industrial, and cultural values of different plant products.
- Understand the importance of gene banks and germplasm diversity for the conservation and improvement of plant resources.
- Perform laboratory experiments to extract, test, and analyze different plant products.

Course Name: Core Course 7

Course Code: BOTACOR07T & BOTACOR07P

Topic Name: Genetics

Course outcome: This is also an important course which enables students to attain a solid foundation in both classical and modern molecular genetics. It focuses on understanding the principles and mechanisms for the organization, replication, expression, variation, and evolution of genetic material at a molecular level. The course also covers advanced concepts of genes and aspects of transmission genetics, quantitative genetics, and population genetics.

After completing this course, students will be able to:

- Prepare and identify the slides of the various stages of cell division- mitosis and meiosis
- Identify various genetic diseases.
- Calculate the Mendelian ratio, chi square analysis and probability tests.
- Mapping of chromosomes, anomalies in genetics through permanent slides.

Course Name: Core Course 8

Course Code: BOTACOR08T & BOTACOR08P

Topic Name: Molecular Biology

Course outcome: This is also an important application based course with tremendous scope in modern times. This course will teach students the basics of molecular biology. It will help students understand how genetic material is organized, copied, used, changed, and evolved at a tiny, molecular level. Students will also be aware of the famous experiments in genetics conducted by scientists like Griffith, Hershey & Chase, Conrat, Fraenkel, Stahl & Meselson, and Avery.

After finishing the course, students will know how to:

- Make a type of nutrient-rich liquid (called Lysogeny broth or LB medium) used for growing bacteria.
- Extract DNA from plant materials and measure the amount of DNA.
- Understand the role of RNA polymerases, which are proteins that make RNA from a DNA template.

Course Name: Core Course 9

Course Code: BOTACOR09T & BOTACOR09P

Topic Name: Plant ecology and Phytogeography

Course outcome: This course gives a vivid understanding of the ecosystem, the biotic and abiotic components and their interrelationship. It also helps to understand the rich biodiversity of our land and how to preserve and conserve it. This course helps to boost our awareness for environment protection. Phytogeography gives an insight to the geographical distribution of plants and their adaptations to different ecological conditions.

After finishing the course, students will know how to:

- Study the various abiotic factors of the environment using specific instruments.
- Study various chemical components of surrounding soil and water like concentration of oxygen, carbon dioxide, chloride, and many more.
- Study the vegetation of different localities using quadrat to analyse the diversity and frequency of plant population.

Course Name: Core Course 10

Course Code: BOTACOR010T & BOTACOR010P

Topic Name: Plant systematics

Course outcome: This study focuses on identification, nomenclature and classification of various plant species. Students are made aware of the classical and modern methods of classifying plants to their correct taxonomic ranks. The study is done with special stress to field visits which will enable the students to identify the plants in the wild and take suitable measures to protect and preserve the natural flora of a particular area.

After completing this course, students will be able to:

- Understand the various technical terms related to plant systematics.
- Identify plants in wild or their natural habitat.
- Identification up to genus level according to Bentham and Hooker's system of classification.

Course Name: Core Course-11

Course Code: BOTACOR11T & BOTACOR11P

Topic Name: Reproductive Biology of Angiosperm

Course outcome: The course contains detailed information on structure and function of reproductive organs and their significance in plant reproduction. Reproductive development, Pollination, Fertilization, self-incompatibility and its significance, Embryogenesis, polyembryony are the areas which are stressed upon.

On completion of the course both theory and practical

- Students will be able to differentiate reproductive organs at Morphological, Anatomical, Physiological and Biochemical level.
- Attain detailed knowledge of embryo, endosperm and seed.
- Learn laboratory techniques to study anther, pollen, pollen viability by using Tetrazolium.
- This knowledge will be helping to apply in agriculture for production of hybrids.
- The allergic reactions in Humans can be better understood on the basis of pollen study.

Course Name: Core Course-12

Course Code: BOTACOR12T & BOTACOR12P

Topic Name: Plant Physiology

Course outcome: This course aims to educate student about the mechanism and physiology of the life processes in plants. It focuses on the plant nutrient uptake and translocation, plant water relations, transpiration, mineral nutrition, plant growth regulators, physiology of flowering, photosynthesis, respiration and nitrogen metabolism.

On completion of the course both theory and practical

- Students will be able to understand the various physiological and metabolic life processes in plants.
- They will also gain about the various uptake and transport mechanisms in plants and are able to coordinate the various processes.
- They understand the role of various hormones, signalling compounds, thermodynamics and enzyme kinetics.
- During the course students will gain knowledge about various mechanisms such as channel or transport proteins involved in nutrient uptake in plants.

Course Name: Core Course-13

Course Code: BOTACOR13T & BOTACOR13P

Topic Name: Plant Metabolism

Course outcome: This course aims to educate student about concept of metabolism; Carbohydrates, lipid, nitrogen metabolism; carbon assimilation and oxidation; mechanism of signal transduction. On completion of the course both theory and practical

- Students will be able to understand the various physiological life processes in plants in relation to the biochemicals of their system.
- They will also gain about the various uptake and transport mechanisms in plants and are able to coordinate the various processes.
- They understand the role of various hormones, signalling compounds, thermodynamics and enzyme kinetics.

Course Name: Core Course-14

Course Code: BOTACOR14T & BOTACOR14P

Topic Name: Plant Biotechnology

Course outcome: This course explores the use of biotechnology to both generate genetic variation in plants and to understand how factors at the cellular level contribute to the expression of genotypes and hence to phenotypic variation. There is an emphasis on the molecular mechanisms directing plant gene expression under diverse environmental and developmental stimuli. The course include plant tissue culture, recombinant DNA technology, methods of gene transfer and various applications of biotechnology including genetically engineered products for plants and humans both.

On completion of the course both theory and practical students can be able to prepare different plant tissue culture medium.

- Students can study and can construct restriction map.
- Students have an idea on micropropagation, somatic embryogenesis, different gene transfer methods, study of genetic engineering and genetically modified crops.
- Genomic DNA isolation and gel electrophoresis.

Course Name: Discipline Specific Elective- 1

Course Code: BOTADSE02T and BOTADSE02P

Topic Name: Horticultural Practices and Post - Harvest Technology

Course outcome: Horticultural practices and post-harvest technologies play an important role in the Indian economy by entrepreneurship development. It has also played a significant role by providing raw materials to various food processing industries and higher farm profitability due to the higher production and earning through foreign exchange. Hence this study is not only targeted to imparting theoretic knowledge but also is targeted towards its practical applications in generating employment.

On completion of the course both theory and practical Students will attain knowledge on identification, propagation and economic uses of different ornamental plants, fruits, vegetable crops.

- Students also become aware of the various Horticultural techniques, setting up of garden, maintain cut flowers, bonsai making etc.
- Students are familiarised with various methods of garden designing, landscaping, avenue plant, flower arrangement etc.
- They can grow an idea on disease control and management.

Course Name: Discipline Specific Elective-2

Course Code: BOTADSE03T and BOTADSE03P

Topic Name: Industrial and Environmental Microbiology

Course outcome: The content of this curriculum has been designed to acquire knowledge by the students in different field of applied microbiology.

- Learners will be able to understand how different technologies are being used to produce different industrially important microbial products in large scale.
- Students will be able to know the role of microbes in maintain quality of the environment. They will be able to identify the microbial flora of water.
- Students will be able to explain the role of microbes in agriculture and how microbes could be applied for remediation of contaminated soil.

Course Name: Discipline Specific Elective-3

Course Code: BOTADSE04T and BOTADSE04P

Topic Name: Analytical Techniques in Plant Sciences

Course outcome: This is a very interesting application-based study targeted towards understanding the various analytical tools used to study various aspects of plant sciences. These are the techniques which have mostly been developed in last few decades which have immensely helped in opening our eyes to the newer aspects of plant life systems. Few of the techniques are spectrophotometry, Molecular markers, FACS, FISH, PCR, Northern and southern hybridisation etc.

On completion of the course both theory and practical the students will be able to

- Have a theoretical knowledge of the working principle of various important tools and techniques in plant sciences.
- Perform experiments like extraction of DNA, separation of nitrogenous bases, separation of proteins, PCR reaction, gel electrophoresis.
- Understand the principle governing cellular visualisation techniques like freeze etching, freeze fracture, negative and positive staining, FISH.

Course Name: Discipline Specific Elective-4

Course Code: BOTADSE06T and BOTADSE06P

Topic Name: Biostatistics

Course outcome: This course will enable the students to understand and interpret the data generated in biological sciences using modern Statistical Methods. The students will be able to learn through real examples by applying the statistical research techniques to variety of plant related research problems.

On completion of the course both theory and practical the students will be able to

- Perform statistical analysis of provided data series like calculation of mean, median, mode standard deviation and error measurement.
- Finding correlations between provided sets of data.
- Perform simple hypothesis-based test like student t test and chi square test.

Course Name: Skill Enhancement Course-1

Course Code: BOTSSEC01M

Topic Name: Plant diversity and Human welfare

Course outcome: This course will help the students familiarise with the diversity of the plant group as a whole and its different uses in the welfare of the society. They will understand about the importance of biodiversity and its conservation management strategies. After the completion of course, the students will

- Understand the importance of Agrobiodiversity, sustainable development and important commercial aspects of agriculture like ornamental plants, silviculture, avenue trees etc
- Understand the importance of in situ and ex situ conservation, social approaches to conservation, and biodiversity awareness programmes.
- Important organizations related to biodiversity management like IUCN, UNESCO, WWF, NBPGR etc.

Course Name: Skill Enhancement Course-2

Course Code: BOTSSEC02M

Topic Name: Ethnobotany

Course outcomes: This course deals with the study of plants useful not only for preserving traditional cultures but also for community health care and drug development. It helps in understanding the study of ethnobotany as an interdisciplinary science. Understanding how the plants were used traditionally by the ethnic groups of India for many years would have a great implication in understanding the same in relation to modern medicine.

After the completion of course, the students will

- Learn about the major and minor ethnic groups or Tribals of India, their life styles and the plants used by them for generations.
- Get familiarised with Field work, Herbarium , Ancient Literature , Archaeological findings, temples and sacred place
- Understand the Medico-ethnobotanical sources in India and their applications

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Course Outcome: or Learning Outcome

Three-year B.A. /B.Sc. degree course

Under CBCS Semester System

GENERAL COURSE IN BOTANY

With effect from the session: 2018 – 2019

Course Name: Discipline Specific Core Course 1/ General Elective 1

Course Code: BOTGCOR01T/BOTGCOR01P OR BOTHGEC01T/BOTHGEC01P

Topic Name: Biodiversity (Microbes, Algae, Fungi and Archegoniate)

Course outcome: This course will help the students to get acquainted with the microbial world, prokaryotic and eukaryotic organisms along with fungal world and archegoniate which includes lower plants like Bryophytes, pteridophytes and gymnosperms.

After completing this course both theory and practical, students will be able to:

- Understand the general structure, ultrastructure and activities of different prokaryotic organisms and recognize them under microscope.
- Identify different fungal genera from different classes.
- Understand the lower plants like Bryophytes, Pteridophytes and Gymnosperms, their vegetative and reproductive structures.
- Have a basic understanding about lichens and mycorrhiza and their economic importance.
- Identify and the plants in nature.

Course Name: Discipline Specific Core Course 2/ General Elective 2

Course Code: BOTGCOR02T/BOTGCOR02P OR BOTHGEC02T/BOTHGEC02P

Topic Name: Plant ecology and Taxonomy

Course outcome: This course gives the students a vivid understanding of the ecosystem, the biotic and abiotic components, their interrelationship and gives them a basic idea of biodiversity and gain a general idea on the phytogeographical distribution of different plant genera. This course also deals with plant taxonomy which is study of identification, nomenclature and classification of various plant species. Students are made aware of the classical and modern methods of classifying plants to their correct taxonomic ranks.

After completing this course both theory and practical, students will be able to:

- Study the various abiotic factors of the environment using specific instruments.
- Study the vegetation of different localities using quadrat to analyse the diversity and frequency of plant population.

- Understand the various technical terms related to plant systematics, and able to classify them according to Bentham and Hooker's system of classification.
- Prepare an herbarium of plants mentioned in the course.

Course Name: Discipline Specific Core Course 3/ General Elective 3

Course Code: BOTGCOR03T/BOTGCOR03P OR BOTHGEC03T/BOTHGEC03P

Topic Name: Plant anatomy and Embryology Course outcome: The course contains detailed information on structure and function of reproductive organs and their significance in plant reproduction and the process of development of embryo in plants. The anatomical aspect of this course deals with familiarising the students with the knowledge of various tissue organization within the plants and its importance. Also helps to understand the adaptation of the plants in different environmental conditions.

On completion of the course both theory and practical, the students will be able to

- Identify the cellular and tissue organization of the flowering plants.
- Identifying the important anatomical features of monocots and dicots through permanent slides.
- Attain detailed knowledge of embryo, endosperm and seed.
- Learn laboratory techniques to study anther, pollen, pollen viability.
- Have a basis idea about alternate modes of reproduction like apomixis, polyembryony etc.

Course Name: Discipline Specific Core Course 4/ General Elective 4

Course Code: BOTGCOR04T /BOTGCOR04P OR BOTHGEC04T/BOTHGEC04P

Topic Name: Plant Physiology and Metabolism

Course outcome: This course aims to familiarize student about the various metabolic activities of the plant system plays a vital role in its survival. It focuses on the plant nutrient uptake and translocation, plant water relations, transpiration, mineral nutrition, plant growth regulators, physiology of flowering, photosynthesis, respiration and nitrogen metabolism, all of which are the vital physiological process of the plant system.

On completion of the course both theory and practical, the students will be able to

- To understand the various physiological and metabolic life processes in plants.
- Perform experiments related to osmotic potential, photosynthesis, respiration etc.
- Understand the relation of the stomatal frequency to the rate of transpiration.
- Perform basic experiments on enzymes important for metabolic processes.

Course Name: Discipline Specific Elective Course-1

Course Code: BOTGDES01T/BOTGDSE01P

Topic Name: Cell and Molecular Biology

Course outcome: This is an important course dealing with understanding the basis of life i.e. Cell as the cells are the units of the living system. The students get to know about the various organelles of the cell and their functions. Students are also familiarised with the important instruments associated with studying the cells and their components. Also, the processes of cell cycle and cell division are very important to understand the development of the organism as a whole.

On completion of the course, both theory and practical, the students will be able to

- Understand the basics structure of cell and cellular organelles.
- Identify various cellular organelles from electron micrographs.
- Identify and analyse the various cell division phases both mitotic and meiotic.

Course Name: Discipline Specific Elective Course-2

Course Code: BOTGDES04T/BOTGDSE04P

Topic Name: Analytical techniques in Plant sciences

Course outcome: This is a very interesting application-based study targeted towards understanding the various analytical tools used to study various aspects of plant sciences. These are the techniques which have immensely helped in understanding the newer aspects of plant life systems. Few of the techniques are spectrophotometry, Molecular markers, FACS, FISH, PCR, Northern and southern hybridisation etc.

On completion of the course both theory and practical the students will be able to

- Understand the working principle of various important tools and techniques in plant sciences.
- Perform experiments like extraction of DNA, separation of nitrogenous bases, separation of proteins, PCR reaction, gel electrophoresis.
- Understand the principle governing cellular visualisation techniques like freeze etching, freeze fracture, negative and positive staining, FISH.

Course Name: Skill Enhancement Course-1

Course Code: BOTSSEC01M

Topic Name: Plant diversity and Human welfare

Course outcome: This course will help the students familiarise with the diversity of the plant group as a whole and its different uses in the welfare of the society. They will understand about the importance of biodiversity and its conservation management strategies.

After the completion of course, the students will

- Understand the importance of Agrobiodiversity, sustainable development and important commercial aspects of agriculture like ornamental plants, silviculture, avenue trees etc.
- Understand the importance of in situ and ex situ conservation, social approaches to conservation, and biodiversity awareness programmes.
- Important organizations related to biodiversity management like IUCN, UNESCO, WWF, NBPGR etc.

Course Name: Skill Enhancement Course-2

Course Code: BOTSSEC02M

Topic Name: Ethnobotany

Course outcome: This course deals with the study of plants useful not only for preserving traditional cultures but also for community health care and drug development. It helps in understanding the study of ethnobotany as an interdisciplinary science. Understanding how the plants were used traditionally by the ethnic groups of India for many years would have a great implication in understanding the same in relation to modern medicine.

After the completion of course, the students will

- Learn about the major and minor ethnic groups or Tribals of India, their lifestyles and the plants used by them for generations.
- Get familiarised with Field work, Herbarium, Ancient Literature, Archaeological findings, temples and sacred place.
- Understand the Medico-ethnobotanical sources in India and their applications.