

BIJOY KRISHNA GIRLS' COLLEGE, HOWRAH

Estd : 1st August 1947. Affiliated to University of Calcutta
NCTE approved NAAC B accredited College with CPE status

POs PSO and COs

3. Program Outcome:

- Under the CBCS curriculum the 3 year Honours course in Botany is divided into six semesters where each semester emphasises on selected areas of plant science in detail to broaden the understanding of the students as well as to develop a gradual interest and attentiveness among the students.
- In addition to the core courses the curriculum also provides several skill enhancement courses and discipline specific elective courses to provide the students with an expanded comprehension of the subject.
- The course aims at developing a scientific, logical, curious and open minded attitude among the students. It also imparts skills in practical implementation of the knowledge of plant sciences and the use of different laboratory apparatus and instruments and the application of different laboratory techniques.
- Study of Botany makes the learner aware of the ongoing environmental issues. They become more concerned about the ongoing and probable hazards and threats to environment. And with a comprehensive knowledge of plant sciences and ecology they are able to tackle environmental issues and devise methods to reduce pollution. This also helps them to become a responsible citizen.
- After successful completion of the course, the students become eligible for applying for higher studies like masters in botany as well as other life sciences related subjects and also for applying for different government as well as public sector jobs.

4. Course Outcome:

Semester 1

CORE COURSE 1 : Phycology and Microbiology

The students get a meticulous idea of the basic features of algae , bacteria and virus with respect to their structural organisation , general characters and life cycle patterns. This curriculum builds the basic foundation of understanding

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microbiology and also opens prospects of higher studies in the intricate fields of virology.

Course Outcome : On completing the course successfully

CO1	The students get a meticulous idea of the basic features like thallus organisation in algae, their cellular and organellar ultra-structure, their classification and general features of the major classes of algae.
CO2	The students get a meticulous idea of the basic features like thallus organisation in algae, their cellular and organellar ultra-structure, their classification and general features of the major classes of algae.
CO3	This part of the curriculum introduces the students to amazing and diverse world of algae. They learn about the life cycle patterns in algae and also the life history of some common algae belonging to different families of algae.
CO4	They are also introduced to the basic techniques of microscopy in this semester and study the structural features of both the vegetative as well as reproductive parts of common algae like <i>Oedogonium</i> , <i>Chara</i> and <i>Ectocarpus</i> .
CO5	In this section they learn about bacteria and virus elaborately. They are acquainted with the types and characteristics of the microorganisms.
CO6	They understand the life cycle patterns in virus, their transmission and translocation technique and the physiochemical characters as well as multiplication procedure in TMV.
CO7	They understand the cell wall structures of both Gram positive and Gram negative bacteria, bacterial genome

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and the genetic recombination techniques in bacteria.

CORE COURSE 2: MYCOLOGY AND PHYTOPATHOLOGY

To understand basic classification, structure and functional details of Fungi and to understand the life cycle, evolutionary relationships among the major taxa.

To gain knowledge about Mycorrhiza, lichen and different plant pathogen and to comprehend their role to the environment.

Couse outcome:

On the successful completion of the course, students will be able to

CO1	Identify the general and specific characteristics of the different classes of fungi and the organization of the representative types.
CO2	Recognize and describe the major groups of fungi.
CO3	Understand the diversity of fungi and its outline systematics. Discuss their affinities and adaptations to different stages of their life.
CO4	Understand the unique features, taxonomy, and functional attributes of different classes of fungi, their roles for the goodness of nature and agriculture as well as forestry.
CO5	To infer the affinities, evolutionary relationships and adaptation of the association of fungi (Mycorrhiza & Lichen) and to explain their economic as well as ecological importance.
CO6	Acquired technical skills will help the students for collecting and identify the biological specimens for study.
CO7	Application of different techniques will help the students to distinguish different microscopic pathogens.
CO8	Students can acquire skill through analytical process in the detection of diseases.
CO9	Interpretation will help students to predict opinion about

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	procedures to cure or prevention of the disease.
CO10	Understand the diversity of pathogen and its outline systematics. Discuss their affinities and adaptations to different stages of their life. To gain knowledge about the harmful effects on the crops.

CORE COURSE 3: PLANT ANATOMY

To understand the internal structure of plants, to understand the organisation and function of different internal parts of the plants. To acquire knowledge about their life span and adaptations in the harsh environment.

Course outcome:

On the successful completion of the course, students will be able to

CO1	Understand different cells types, their functions and distributions.
CO2	Understand and identify the different internal plants parts and tissue association, their function, position and organisation.
CO3	Acquires knowledge about distribution of different mechanical tissue and their working techniques.
CO4	Understand and identify different normal and abnormal growths of plant tissue and their distribution and function.
CO5	Acquire knowledge about life span and adaptations of different plants in the extreme environment.
CO6	Acquire knowledge about different usage of plant parts in different aspects of society.

CORE COURSE 4: ARCHEGONIATE

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To understand basic classification, structure and functional details of Bryophytes, Pteridophytes and Gymnosperms, and to understand the life cycle, evolutionary relationships among the major plant groups. To gain knowledge about their adaptation and role in nature, ecology as well as economy.

Couse outcome:

On the successful completion of the course, students will be able to

CO1	Identify the general and specific characteristics of the different classes of Bryophytes, Pteridophytes and Gymnosperms, and the characteristic of the representative types.
CO2	Recognize and describe the major groups of Bryophytes, Pteridophytes and Gymnosperms.
CO3	Understand the diversity of bryophytes, pteridophytes and gymnosperms, and its outline systematics. Discuss their affinities and adaptations to different phases of their life.
CO4	To understand the affinities, evolutionary relationships and adaptation of the bryophytes, pteridophytes and gymnosperms, and to explain their economic as well as ecological importance.
CO5	Acquired technical skills will help the students for collecting and identify the bryophytes or parts of pteridophytes and gymnosperms specimens for study.
CO6	To study the diversity, variation, with ecological implication of different bryophytes, pteridophytes and gymnosperms.

CORE CORSE 5 : Palaeobotany and Palynology

This section of the course builds an bridge between the early plants and the modern vegetation and strengthens the understanding of evolutionary directions.

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CO1	Palaeobotany basically deals with the study of plant fossils and forming a link between the modern day plants.
CO2	This unravels many interesting features regarding the evolutionary trends. Here the students study the structural features of selected fossil plants.
CO3	Palynology helps to understand about spores and pollen. Here in this syllabus students are given a comprehensive idea of the pollen aperture types, NPC classification and the pollen wall and its ornamentation.
CO4	A brief concept of the different fields of applied palynology is also imparted here.

CORE COURSE 6: REPRODUCTIVE BIOLOGY OF ANGIOSPERMS

To understand basic morphology, structure and functional details of different reproductive organs. To study different types of inflorescences, flower, fruits and seed. To gain knowledge about fertilisation and changes occur before and after fertilisation, to understand different embryonic conditions.

Couse outcome:

On the successful completion of the course, students will be able to

CO1	Understand different types of inflorescences, flowers, fruits and seeds.
CO2	Understand basic morphology of inflorescences, flowers, fruits and seeds, their modifications, structural and functional details.
CO3	Acquire knowledge about fertilisation process, and changes that occur during, before, and after the fertilisation.
CO4	To gain knowledge about embyogenenis and different developmental process of endosperms.
CO5	Explain the basic aspects of structural and functional details of embryo & its stages. Understand different embryogenic conditions.

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CORE COURSE 7: PLANT SYSTEMATICS

To comprehend basic idea of classification, nomenclature and systematics of angiosperms, and to understand basic about nomenclatural type, rules of nomenclature, numericals and relationship with different aspects with taxonomy. Idea about different group of plants.

Couse outcome:

On the successful completion of the course, students will be able to

CO1	Describe the distinguishing characteristics of the major groups of angiosperms. Explain the basic aspects of classification details of angiosperms.
CO2	Learn certain morphological attributes that are distinct and significant to each group of angiosperms.
CO3	Understand the systemic and various classification concepts of angiosperms.
CO4	Interpret the affinities, evolutionary relationships and modifications of the major groups of angiosperms and to explain their economic importance with respect medicinal properties.
CO5	To relate taxonomy with different other subjects.
CO6	Knowledge to different evolutionary aspects. Compare and contrast the various theories on formation of new species and identify the factors that play a role in the process of evolution and understand the process of evolutionary changes.
CO7	Acquired technical skills will help the students for collecting and processing biological specimens for analysis. Knowledge of identification of different groups of plants and techniques of preserve plant specimens for long period of time.

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CORE COURSE 8 : Plant Geography, Ecology and Evolution

The study of plant geography acquaints the students with the different phytogeographical regions of India and the most dominant flora around the country. The understandings of ecological principles help them to become more aware of the surroundings and environment. They are also made to understand the different theories of evolution in order to understand the ancestry of different plants and their interrelations.

CO1	The curriculum aims at imparting a constructive and worthwhile understanding of the broad ecological concepts.
CO2	This part of the curriculum leads way to understanding the environmental issues as well. They learn about the different levels of biodiversity and the conservation techniques.
CO3	Students get a more coherent idea of the theories of evolution , different terms and concepts of evolution and the phylogenetic tree.
CO4	They are also taken to visit a different phytogeographical region of India to study the flora and are also taught to study the community structure by quadrat method.

CORE COURSE 9: ECONOMIC BOTANY

To study of the relationship between people and plants. Economic botany meets many fields including established disciplines such as agronomy, chemistry, economics, forestry, genetic resources, geography, geology, horticulture, medicine, microbiology, nutrition, pharmacognosy, and pharmacology. The study explores the ways humans use plants for food, medicines, and commerce.

Couse outcome:

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CO1	<p>Understand the evolution of cultivated plants include the processes of domestication and the relationship between natural and human selection of specific plant traits.</p> <p>Knowledge of botany is essential to understanding how domestication may have changed a plant species over time.</p> <p>Concern it with basic botanical, phytochemical and ethnological studies of plants known to be useful or those which may have potential uses so far underdeveloped. Economic botany is, then, a composite of those sciences working specifically with plants of importance to mankind.</p>
CO2	<p>Build concept about different types of cereals, grains, oil, fats, legumes and their origin, processing, importance to man and environment.</p> <p>Recognize different types of cereals, grains, and legumes. Knowledge about cultivation procedure of cereals, and crop yielding method, time of yielding, time of sowing.</p> <p>Gain knowledge about different extraction procedure of sugar, starch, oil, fat, essential oils, health implications and their uses.</p>
CO3	<p>Learn about different beverages and their processing</p> <p>Knowledge about propagation of plants, their different products as well as by-products, and uses.</p>
CO4	<p>Get to know about different Important spices and their uses</p> <p>Different drug yielding plants, parts used and uses for mankind as well as health hazards occurs through the plants.</p>
CO5	<p>Knowledge about timber and fibre yielding plants, their morphology, processing, extraction procedure, ad</p>

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	uses. In this paper we get to know about different economically important plants, their uses.
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CORE COURSE 10 : Genetics

This part of the curriculum acquaints the students with the concepts of genetics and heredity. The students are introduced to the remarkable world of genes.

CO1	The students are imparted the knowledge of the classical principles of Mendelian genetics and its extension.
CO2	They are taught the interesting concepts of Crossing over, Gene mapping, molecular mapping, Epistasis and the structural organisation of genes to name a few.
CO3	They are also up skilled about mutation and concepts of homoerotic genes and transposons.
CO4	Practical knowledge of chromosome structure, techniques of chromosome preparation, determination of mitotic index and identification of normal and abnormal stages of mitosis and meiosis is imparted.
CO5	This in a way prepares them to pursue higher studies in advanced fields of biology like biotechnology.

CORE COURSE 11 : Cell and Molecular Biology

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In this segment of the syllabus we teach the students about the origin and evolution of cells with special reference to the structural composition and functions of nucleus and chromosomes.

CO1	The curriculum provides a comprehensive understanding of the structural features of the nucleus and chromosomes and also the entire process of cell cycle and its regulation.
CO2	In the molecular biology section a detailed and lucid understanding of the three important phenomenons of DNA replication, transcription and translation is conveyed.
CO3	The students are familiarised with the concept of gene, its various properties and gene regulation.
CO4	The emerging field of recombinant DNA technology is also introduced to them and special emphasis is given on the understanding of Cancer biology.
CO5	Both theoretical and practical understanding of the subject is focused at in this chapter in order to convey a more systematized and lucid conceptualised understanding.

CORE COURSE 12 : Biochemistry

Biochemistry unites biology with chemistry and makes the understanding of different physiological processes of a plant more comprehensive as the chemical backgrounds are explained in detail.

CO1	Here students are taught about the basic biochemical foundations and also about the different bio-molecules.
CO2	The different bioenergetics principles are discussed here in thorough detail emphasising on chemical

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	reactions and mechanisms.
CO3	Practical application of biochemistry including the detection and estimation of different biochemical compounds is also a major aspect of the course

CORE COURSE 13 : Plant Physiology

This portion of the curriculum helps the students to understand the fundamentals of the different physiological processes of plants.

CO1	The detailed procedure of uptake translocation of mineral nutrients and water in plants is studied here.
CO2	The chemical composition and role of the different plant growth regulators.
CO3	The physiological concept of biological clock and photomorphogenesis is also taught here.

CORE COURSE 14 : Plant Metabolism

This section enlightens the student on the fundamental metabolic processes of plants.

CO1	This gives a comprehensive and extensive knowledge on photosynthesis, respiration, nitrogen metabolism and lipid metabolism.
CO2	The understanding of the metabolic processes helps in understanding the intricate details of plant physiology.
CO3	Practical application based knowledge is also imparted by the demonstration of different physiological phenomenon and also utilising different techniques to estimate and measure different physiological attributes of plants.

SKILL ENHANCEMENT COURSE

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1. SEC A

i. **Applied phycology, mycology and microbiology**

- This section informs the student upon the in general and industrial applications of algae, fungi and other microbes in our day to day life. This also helps them to prepare themselves for a prospective career in industrial microbiology.

ii. **Biofertilizers**

- Students learn the use of microbes in preparing fertilizers in detail. They are also introduced to the concept of organic farming. This learning can help them building an independent career by application of these techniques.

2. SEC B

i. **Plant Breeding**

- Students learn about the different plant breeding techniques and the methods of crop improvement. It broadens their understanding of the subject and its practical implementation to help them in developing nutritionally enriched and disease resistant plants.

ii. **Mushroom Culture Technology**

This section introduces them to the nutritional and medicinal values of edible mushrooms. They are also taught the procedures of mushroom cultivation, their storage and nutritional benefits.

DISCIPLINE SPECIFIC ELECTIVE COURSE

DSE-A: **BIOSTATISTICS (5-1)**

To develop knowledge of statistical fundamentals, analysis and broad uses of different aspects of plant sciences.

Couse outcome:

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CO1	Fundamental statistical concepts and some of their basic applications in plant science and society Develop a fundamental understanding of basic concepts of statistic and bioinformatics.
CO2	Develop a thorough grounding in fundamental analytical approaches for quantitative study of living systems and life processes. Shall know how to organize, manage, and present data. Describe the contents and properties of the most important biometry databases, perform text- and sequence-based searches
CO3	Application of statistic to the study of living systems and life processes Carrying out exercises or small projects that incorporate data presentation.
CO4	Obtain and analyse information and data relating to specific yielding using a number of specific databases, statistic principles and tools
CO5	To educate the interdisciplinary nature of advances in statistic, and computational biology

DSE-A: (5-2): INDUSTRIAL AND ENVIRONMENTAL MICROBIOLOGY

To study of micro-organisms and the physical and chemical conditions that has an influence upon the industry as well as environment. Environments are components of ecosystems. An ecosystem is a community of micro-organisms and their physical and chemical environment that functions as an ecological unit. Micro-organism, those are used in Industrial purpose are directly connected to the production and commercial purposes.

On the successful completion of the course, students will be able to

CO1	Understand the roots of environmental microbiology are most closely linked to the microbial ecology,
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	<p>which comprises the study of the contact of micro-organisms with the environment, i.e. air, water or soil. It is the relationship of micro-organisms with one another and with their environment. It has concerns upon the three major spheres of life,</p>
CO2	<p>Understand Industrial microbiology may be defined as the study of the large-scale and profit motivated production of microorganisms or their products for direct use, or as inputs in the manufacture of other goods.</p>
CO3	<p>Recognize and identify certain micro-organism that may be for direct consumption as food for humans or as animal feed, or for use in bread-making; their product, ethanol, may also be consumed in the form of alcoholic beverages, or used in the manufacture of perfumes, pharmaceuticals, etc. Industrial microbiology is clearly a branch of biotechnology and includes the traditional and nucleic acid aspects.</p>
CO4	<p>Understand the methods of microbiology are often used in industrial microbiology for production of large scale of products and by-products. Knowledge about microbial treatment for contaminated water, soil and bioremediation, helpful effects an environment.</p>
CO5	<p>Knowledge of environmental microbiology can be traced to the studies of municipal waste treatment and disposal.</p> <p>Recognized that this field had expanded to the study of earth, water, and air systems, including the contact of indigenous microbes with organic and inorganic pollutants, behaviour of pathogens that has been introduced into these systems, and the discovery and application of new microbes and their products to benefit human health and promote welfare.</p>

DSE-A: (6-3): MEDICINAL AND ETHNOBOTANY

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The study of a region's plants and their practical uses through the traditional knowledge of a local culture and people. Thus attempts to document the local customs involving the practical uses of local flora for many aspects of life, such as plants as medicines, foods, intoxicants and clothing.

On the successful completion of the course, students will be able to

CO1	Considered a branch of ethnobiology, the study of past and present interrelationships between human cultures and the plants, animals, and other organisms in their environment. Like its parent field, the study makes apparent the connection between human cultural practices and the sub-disciplines of biology.
CO2	Understand the systematic study of the relationships between plants and people. The study is not only of the human "use" of plants; rather, it locates plants within their cultural context in particular societies, and situates peoples within their ecological contexts.
CO3	Recognize the culturally specific ways that humans perceive and classify different kinds of plants The things humans do to plant species, such as destroying "weeds" or "domesticating" and planting specific kinds of food and medicinal plants The ways in which various members of the plant world influence human cultures.
CO4	Understand the biochemical diversity of plants, which contributes to their innumerable medicinal and dietary uses, might also be traced in part to their immobility. Modern societies depend on chemical agents in plants for 25 percent of prescription drugs and nearly all recreational chemicals.
CO5	Focus of ethnomedical studies is often the indigenous perception and use of traditional medicines, another stimulus for this type of research is drug discovery and development. Ethnomedical investigations in this century have led to the development of important drugs for hypertension,

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anti-cancer drug, and treatment of certain cancers also.

DSE-A: (6-4) : Stress Biology

This section emphasizes vastly on the different types of stress factors that influence plant growth and metabolism.

CO1	It focuses on mechanisms of stress detection in plant and ways in which plant response to the stress factors.
CO2	The different physiological processes that help the plants to protect themselves from environmental stress and the different adjustment and adaptations are analysed here.
CO3	Practical implications are also demonstrated in order to familiarise students more with effects of the different stress factors on plants.

DSE-B: (5-5): PLANT BIOTECHNOLOGY

On the successful completion of the course, students will be able to

CO1	To impart comprehensive understanding of the principles and practices of biotechnology.
CO2	Understanding the principles and practices of biotechnology give insights into the Technology of Tissue Culture, Technique of genetic engineering, and DNA Finger printing.
CO3	Application of genetic engineering in advancement of crop and discuss the different applications of biotechnology.
CO4	Understanding the application of genetic engineering, DNA Finger printing, DNA profiling in plant tissue culture in Life Sciences Research trains the students to think logically.
CO5	Interpretation will empower students to think and solve problems in the field of biotechnology.

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DSE-B: (5-6): HORTICULTURAL PRACTICES AND POST- HARVEST TECHNOLOGY

The horticulture has gained importance in recent years as a significant component of agriculture in India. The new impetus is given for the development of the horticulture, particularly for growing fruits and vegetables, which constitute important segment of India Dietaiy System (IDS).

CO1	<p>Understand the interaction between people and plants will have a direct influence on the development of environmentally and humanly healthful urban landscapes;</p> <p>Knowledge of the role of greenspace in interior as well as exterior settings; the involvement people in gardening; and the use of cut flowers, pot plants, and food crops to improve human life quality.</p> <p>Recognize what people expect from plants and the garden can directly influence horticultural products and techniques.</p>
CO2	<p>Identify the crops, their production, origin, distribution and quality control of crop and different marketing strategies.</p>
CO3	<p>Understand different techniques of farming, uses of manures, bio fertiliser, bio-pesticides, weed control methods, rotation of different crops and commercial purposes.</p>
CO4	<p>Understand the post-harvest technology, evaluation of quality and products, preservation and processing and handling of crops.</p>
CO5	<p>Identify the symptoms of the diseases of plants, their cure and prevention methods.</p> <p>Conservation strategies are also very important for crops. Different germplasm collections, tissue culture and production of cultivars and varieties are also very important for horticultural practice.</p>

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DSE-B: (6-7): RESEARCH METHODOLOGY

- Collection and preparation of samples for analysis.
- Operate and calibrate the laboratory instruments, recognize and correct basic instrument malfunctions
- Understand the technical and procedural aspects of laboratory testing for different biochemical and perform various staining techniques for bacterial pathogens.
- Operate different instruments for DNA analysis and DNA finger printing.

On the successful completion of the course, students will be able to

CO1	Operate and calibrate the laboratory instruments, recognize and correct basic instrument malfunctions. Learn about techniques, fundamentals, concept, qualitative as well as quantitative research methods.
CO2	Understand different micro-technical and procedural aspects of laboratory; testing for different biochemical and perform various staining techniques for bacterial pathogens.
CO3	Understand the methods of plant collection, field data collection, data analysis, preservation and identification of plant sample.
CO4	Learn to perform different analyses such as biochemical tests, crude drug extraction, aseptic tissue cultural method, pathogen isolation, genetical analysis, DNA isolation, DNA finger printing from the plant sample.
CO5	Learn to write and present the data collected from different research procedure. Learn to research ethics and copy right and plagiarism rules.

DSE-B: (6-8): NATURAL RESOURCE MANAGEMENT

On the successful completion of the course, students will be able to

CO1	Identify different natural resources and understand sustainable uses of nature and natural resources.
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CO2	Learn utilisation of different lands and measures of soil degradation and their managements.
CO3	Recognises different water resources, types and quality, threats and management of water resouces.
CO4	Identify different levels of biodiversity, threats, significant. Learn about different types of forest, their structures, compositions, forest products, uses and management.
CO5	Understand different renewable and non-renewable sources of energy. Different biotic and abiotic interactions of environment. Knowledge of GIS mapping as well as the names of various conservation sites and the rules of conservation as well as the names of animals or plants these sites preserve.