DEPARTMENT OF BOTANY
SARAT CENTENARY COLLEGE

AFFILIATED TO
THE UNIVERSITY OF BURDWAN

PROGRAMME OUTCOME PROGRAMME SPECIFIC OUTCOME & COURSE OUTCOME

B.SC. BOTANY HONOURS & B.SC. BOTANY GENERAL
UNDER CHOICE BASED CREDIT SYSTEM (CBCS)

NAME OF THE DEPARTMENT : DEPARTMENT OF BOTANY
INSTITUTION : SARAT CENTENARY COLLEGE
PROGRAMME : B.SC. HONOURS IN BOTANY (3 YEAR)
SYSTEM : CHOICE BASED CREDIT SYSTEM (CBCS) w.e.f. ACADEMIC YEAR 2017-2018
AFFILIATING UNIVERSITY : THE UNIVERSITY OF BURDWAN

PROGRAMME OUTCOMES

B.Sc. Botany Honours Course (CBCS)

PO No	Programme Outcomes
1.	Acquiring knowledge on Plant Diversity and evolution
2.	Students are able to learn about the characteristics and can compare various aspects of the different groups of plants like algae, fungi, bryophytes, pteridophytes, gymnosperms and angiosperms
3.	Students are gaining knowledge on functional aspects of life at genomic, molecular, cellular and tissue levels
4.	Students are able to understand the physical features of the environment together with structure of populations, communities, and ecosystems
5.	Students can acquire knowledge on Skill Enhancement courses like Agricultural Botany & Biofertilizer as well as Discipline Specific Elective Courses
6.	Collection of relevant ideas and information on plants for evaluation considering nomenclature, identification and their classification to recognize their position, origin & evolution
7.	Application of various modem techniques and instruments for Cytology, Microbiology, Biochemistry, Molecular Biology, Biotechnology, Tissue Culture etc. to carry out higher education & modern research
8.	Utilizing the ideas and knowledge gained from the programme for the enrichment of society considering various issues like environment, health, , food, shelter etc.
9.	Students will be confident enough on their area of study to develop their career and professional life and be well acquainted with scientific projects related to life sciences

PROGRAMME SPECIFIC OUTCOMES (PSO)

B.Sc. Botany Honours Course (CBCS)

PSO No	Programme Specific Outcomes
1.	The entire specific program helps to gain knowledge on different fields of plant biology starting from learning about the life forms and their metabolism of various life forms
2.	The specific programs can enhance the critical thinking ability by interpreting the conclusions obtained from different fields of biology
3.	The program helps the students to develop hands on training skills, efficiency, time management and accuracy while performing experiments related to anatomy, cytology, physiology, metabolism, ecology, plant systematics etc.
4.	The program offers opportunity to enjoy during excursion visits and also learn to collaborate and attain organizational and management skills as well as to develop interpersonal communication skills within peer groups
5.	The scope to learn advance application oriented subjects like cell biology, genetics, molecular biology, biochemistry, biostatistics, plant breeding, agricultural botany, economic botany, medicinal botany etc.
6.	The program offers prospects for understanding of nature and natural resources and the importance of natural conservation and its significance

COURSE OUTCOMES

B.Sc. Botany Honours Course (CBCS)

Semester	Course Code	Course Title	Course Outcome
I	**CC-1**	**Microbiology and Phycology**	1. The study of microorganisms is known as microbiology 2. The students knows about the structure and character of viruses and bacteria 3. Beside these, the also acquire knowledge about the taxonomy of virus and bacteria 4. Economic importance of bacteria in various fields like agriculture and industry. 5. The students also well acquainted various practical experiments like sterilization techniques, media preparation and culture technique etc. of microorganisms **6.** From phycology i.e. the study of algae, the students gained knowledge about the characters, structure, reproduction, life cycle etc. of algae 7. The students learns the vegetative and reproductive structures of different algae from the practical experiments
I	**CC-2**	**Archegoniate**	From the course curriculum of archegoniate the students learns : **1.** About the general characters, structure, reproduction, life cycle etc. of Bryophytes, Pteridophytes and Gymnosperms 2. Morphological diversities of Bryophytes and Pteridophytes **3.** about the economic importance of Bryophytes, Pteridophytes and Gymnosperms in varous fields **4.** the different genera of Bryophytes, Pteridophytes and Gymnosperms 5. to identify different Bryophytes, Pteridophytes, and Gymnosperms on the basis of their practical knowledge.
II	**CC-3**	**Mycology and Phytopathology**	The students gained knowledge about the general characters, structure, reproduction,

			life cycle etc. of different fungi 1. About the economic importance of fungi 2. Studies of Mycorrhiza will help to gain knowledge about green farming. 3. Identifying different genera of fungi from practical classes 4. Students also learn to identify diseases in plants and gained knowledge about plant pathology 5. Application of fungi in biotechnology is also studied
II	**CC-4**	**Morphology and Plant Anatomy of Angiosperm**	On completion of this course, the students are able to: 1. Know the concept on the structure, function and morphological diversity of different vegetative and reproductive plant parts like leaves, inflorescence, flower, fruit and seeds. 2. Learn the scope and importance of these fields 3. Be acquainted with the structural development of plant body. 4. Take knowledge on the theories of apical meristem. 5. Understand the sporogenesis and gametogenesis 6. To gain practical knowledge on different morphological and anatomical parts of the plants
III	**CC-5**	**Plant Ecology and Phytogeography**	From this course, the students are able to understand - 1. The concept of living world and the environment 2. The origin, composition and structure of the soil 3. The dynamics and characteristics of population. 4. The trophic organization, food chain, food web
III	**CC-6**	**Plant Systematics**	The course provides information about : 1. The scope and importance of the field 2. The contributions of taxonomists in this field. 3. Nomenclature, identification and classification 4. Know about the computer-based Literature.

			5. Knowledge about Numerical Taxonomy, Cytotaxonomy etc. 6. Nomenclatural codes 7. Idea about the phylogeny of angiosperms. 8. To identify unknown plant specimens based on their practical knowledge
III	**CC-7**	**Economic Botany**	1. The origin and distribution of plants are known from this course 2. Ideas about the economically important plants are also established 3. Student are able to identify the active ingredients of cereals, legumes, sugars yielding plants, spices etc. by various microchemical tests.
III	**SEC-1**	**Agricultural Botany**	1. Agricultural Botany is a two-credit skill enhancement course designed to receive a detail insight of important physiological mechanism, biochemical pathways and various breeding methods of plants. 2. The students know the green manures involving Cyanobacteria and Mycorrhiza 3. They will gain the concept of genetically modified plants along with its applications
IV	**CC-8**	**Palaeobotany & Palynology**	From this curriculum, the students are able to: 1. Know the scope and importance of palaeobotany, types of fossils, its preservations, fossilization process and geological time scale. 2. Understand the different fossil genera representing different fossil groups 3. Practical knowledge on various fossilized genera and pollen morphology
IV	**CC-9**	**Biomolecules and Cell Biology**	On completion of this course on Biomolecules and Cell Biology, students are able to gain knowledge on: 1. The structures and properties of water 2. Structure of carbohydrates, proteins and lipids 3. The Structures of amino acids and its biological roles in plants. 4. The structures of DNA and RNA, Forms of DNA, Types of RNA and their roles

			5. Laws of thermodynamics and structure of ATP and its role as a energy currency molecule 6. The cell wall and plasma membrane along with transport system 7. Ultra structures and functions of various cell organelles like Nucleus, cytoplasm, chloroplast, peroxisomes, endomembrane systems 8. Cell cycle and mitotic and meiotic cell divisions along with regulations 9. Practical knowledge on biochemical tests, membrane permeability, stomatal index, plasmolysis, cell divisions etc.
IV	**CC-10**	**Molecular Biology**	From Molecular Biology course, students are able to understand 1. The genomic organization 2. Study of genes, genome, chromosome etc. 3. The mechanism of DNA replication, transcription, post transcriptional modifications, genetic code and translation, the concept of operon and its structure and regulations 4. The fundamentals of Recombinant DNA Technology 5. The principles and basic protocols for Plant Tissue Culture and its applications
IV	**SEC-2**	**Biofertilizer**	1. Students are able to understand and differentiate between chemical and biofertilizer along with the advantage and disadvantage, 2. Biofertilizer and its importance for soil health and nourishment 3. They are able to know the harmful effects of chemical fertilizers and how to reduce production costs and environmental impact associated with chemical fertilizers by increasing awareness of using biofertilizer in agriculture.
V	**CC-11**	**Plant physiology**	The course on plant physiology contains basic informations on physiological processes and related biochemical pathways in plants. The knowledge acquired by the students are as follows ; 1. Water uptake and water balance in

			plants 2. Nutrients and minerals absorption along with their importance. 3. Basics of phloem transport 4. Hormones and their significance in plant growth 5. Impact of light and its periodicity in flowering 6. Practical experiments on various physiological processes
V	**CC-12**	**Plant Metabolism**	The course on plant metabolism gives ideas about : 1. The anabolic and catabolic pathways; regulation of metabolism, isoenzymes, allosteric inhibitions covalent modulation etc 2. The synthesis and catabolism of sucrose and starch 3. Photosynthetic pigments, antenna molecules and reaction centres, photosynthetic electron transport; PSI, PSII, Q cycle, CO_2 reduction, photorespiration, crassulacean acid metabolism and factors affecting CO2 reduction. 4. Glycolysis and fate of pyruvate, regulation of glycolysis, oxidative pentose phosphate pathway, oxidative decarboxylation of pyruvate, TCA cycle, amphibolic role, anaplerotic reactions, regulation of the cycle, mitochondrial electron transport, oxidative phosphorylation, cyanide-resistant respiration, factors affecting respiration 5. Mechanism of ATP synthesis, substrate level phosphorylation, chemiosmotic, ATP synthase, Boyers conformational model, Racker's experiment, Jagendorf s experiment, role of uncouplers. 6. Lipid metabolis, beta oxidation, gluconeogenesis and its role, significance of lipids 7. Nitrate assimilation, biological nitrogen fixation, physiology and biochemistry of nitrogen fixation, ammonia assimilation and transamination 8. Cell signalling, receptor-ligand

			interactions, second messenger concept, calcium calmodulin, MAP kinase cascade 9. Practical knowledge in metaboloism
V	**DSE-1**	**Reproductive Biology of Angiosperms**	1. The reproductive biology is designed to understand the biological principles to govern the reproduction in plants 2. The flower and it's structure related functions, pollen biology, pollination, fertilization, seed formation, and separation process of viable and nonviable pollen by Tetrazolium test
V	**DSE-2**	**Biostatistics**	1. Biostatistics basically statistical methods used in biology 2. In Biostatistics, students learn about data, collection of data, types of data, sampling 3. The students also learn about measures of central tendency - mean, median and mode 4. The students gather knowledge on correlation and regression, chi squire test 5. Practical knowledge on mean, median, mode, standard deviation, standard error, correlation etc.
VI	**CC-13**	**Genetics & Plant Breeding**	On completion of the course, the students are able to understand: 1. Mendelian and Neo- mendelian genetics 2. The law of segregation, independent assortment 3. The phenomenon of linkage and crossing over 4. Mutation, types and it's detection, mutagens and its types, molecular basis of mutation 5. The classical as well as molecular concepts of gene. 6. Plant Breeding and its role 7. Various methods of crop improvement associated with plant breeding along with its merits and demerits 8. Knowledge of heterosis and inbreeding
VI	**CC-14**	**Plant Biotechnology**	This course introduces the current advancement in the applied fields of life sciences including plant biotechnology,

			genetic engineering and other research oriented pprocesses. The course used to highlight the students to flourish their career in research and development. They will excel their knowledge in the following areas : 1. Plant tissue culture techniques 2. Recombinant DNA technology 3. Construction of vector for gene cloning 4. Gene cloning and development of genetically modified plants by direct or indirect methods 5. Polymerase chain reaction 6. Application of biotechnology for human welfare 7. Practical knowledge on tissue culture and other processes
VI	**DSE-3**	**Plant Evolution and Biodiversity**	The students gained knowledge about : 1. Earliest forms of plant life, evolution of eukaryotes. 2. Evolutionary trends- green algae to land plants, non-vascular to vascular plants 3. Phylogeny of plants 4. Evolutionary theories - Natural Selection, Group Selection, Neutral theory of molecular evolution. **5.** Plant diversity around the world **6.** Practical knowledge on vegetative and reproductive structures of various plants
VI	**DSE-4**	**Horticulture and Post Harvest Technology**	1. Scope and importance, Branches of horticulture and its role 2. Ornamental plants **3.** Fruit and vegetable crops 4. Horticultural techniques 5. Landscaping and garden design 6. Floriculture 7. Disease control and management 8. Post-harvest technology 9. Horticultural crops 10. Field visits to gardens, standing crop sites, nurseries, vegetable gardens and horticultural fields along with reports

SARAT CENTENARY COLLEGE

DEPARTMENT OF BOTANY

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAMME OUTCOMES

Course Code & Course Title	PO-1 Acquiring knowledge on Plant Diversity and evolution	PO-2 Students are able to learn about the characteristics and can compare various aspects of the different groups of plants like algae, fungi, bryophytes, pteridophytes, gymnosperms and angiosperms	PO-3 Students are gaining knowledge on functional aspects of life at genomic, molecular, cellular and tissue levels	PO-4 Students are able to understand the physical features of the environment together with structure of populations, communities, and ecosystems.	PO-5 Students can acquire knowledge on Skill Enhancement courses like Agricultural Botany & Biofertilizer as well as Discipline Specific Elective Courses	PO-6 Collection of relevant ideas and information on plants for evaluation considering nomenclature, identification and their classification to recognize their position, origin & evolution	PO-7 Application of various modem techniques and instruments for Cytology, Microbiology, Biochemistry, Molecular Biology, Biotechnology, Tissue Culture etc. to carry out higher education & modern research	PO-8 Utilizing the ideas and knowledge gained from the programme for the enrichment of society considering various issues like environment, health, , food, shelter etc.	PO-9 Students will be confident enough on their area of study to develop their career and professional life and be well acquainted with scientific projects related to life sciences
CC-1 Microbiology & Phycology	Yes	Yes				Yes	Yes	Yes	Yes
CC-2 Archegoniatae	Yes	Yes				Yes		Yes	Yes
CC-3 Mycology and Phytopathology	Yes	Yes						Yes	Yes
CC-4 Morphology & Plant Anatomy			Yes				Yes	Yes	Yes

CC-5 Plant Ecology & Phytogeography	Yes			Yes		Yes	Yes	Yes	Yes
CC-6 Plant Systematics		Yes	Yes	Yes		Yes		Yes	Yes
CC-7 Economic Botany			Yes	Yes		Yes	Yes	Yes	Yes
SEC-1 Agricultural Botany	Yes		Yes		Yes		Yes	Yes	Yes
CC-8 Palaeobotany & Palynology			Yes					Yes	Yes
CC-9 Biomolecules & Cell Biology			Yes				Yes	Yes	Yes
CC-10 Molecular Biology			Yes			Yes	Yes	Yes	Yes
SEC-2 Biofertilizer				Yes	Yes		Yes	Yes	Yes
CC-11 Plant Physiology			Yes	Yes			Yes	Yes	Yes
CC-12 **Plant Metabolism**			Yes				Yes	Yes	Yes
DSE-1 **Reproductive Biology of Angiosperms**		Yes			Yes	Yes	Yes	Yes	Yes

DSE-2 **Biostatistics**					Yes	Yes	Yes	Yes	Yes
CC-13 **Genetics & Plant Breeding**			Yes	Yes		Yes	Yes	Yes	Yes
CC-14 **Plant Biotechnology**			Yes	Yes			Yes	Yes	Yes
DSE-3 **Plant Evolution and Biodiversity**	Yes	Yes		Yes	Yes	Yes		Yes	Yes
DSE-4 **Horticulture & Post Harvest Technology**	Yes			Yes	Yes	Yes		Yes	Yes

NAME OF THE DEPARTMENT : DEPARTMENT OF BOTANY
INSTITUTION : SARAT CENTENARY COLLEGE
PROGRAMME : B.SC. GENERAL WITH BOTANY (3 YEAR)
SYSTEM : CHOICE BASED CREDIT SYSTEM (CBCS) w.e.f. ACADEMIC YEAR 2017-2018
AFFILIATING UNIVERSITY : THE UNIVERSITY OF BURDWAN

PROGRAMME OUTCOMES

B.Sc. Botany General Course (CBCS)

PO No	Programme Outcomes
1.	Students are able to learn about the fundamental knowledge on the basic principles and applications of major fields of life sciences
2.	Acquiring knowledge to solve the practical issues related to applied fields of life sciences like cytology, genetics, plant breeding, economic botany, molecular biology, biochemistry, microbiology etc.
3.	Students are able to acquainted with Skill Enhancement courses and Discipline Specific Elective Courses
4.	Obtaining sustainable and eco-friendly technologies in Botany
5.	Gaining knowledge for conservation of endemic and endangered plant species

PROGRAMME SPECIFIC OUTCOME (PSO)

B.Sc. Botany General Course (CBCS)

PSO No	Programme Specific Outcomes
1.	The student learn about the nature and biodiversity and communications within the different components of ecosystem
2.	Students learn about the details of the life cycles of different plant groups ranging from lower to higher plants.
3.	Students are receiving hands on training skills, efficiency and accuracy through practical classes
4.	Students obtain communication and management skills through field visit or excursion
5.	Students learn application oriented subjects like biotechnology, microbiology, cell biology, genetics, plant breeding, physiology, biochemistry by which they can go through higher studies as well as entrepreneurship skills

COURSE OUTCOME

B.Sc. Botany General Course (CBCS)

Core Course (CC-1A) : Biodiversity

The students learns about :

- Discovery, general structure and replication of viruses
- Discovery, general characteristics and cell structure and Reproduction of bacteria along with economic importance
- General characteristics, distribution, reproduction and classification of algae, Morphology and life-cycles of few genera and economic importance of algae
- General characteristics, nutrition, reproduction and classification of fungi, Morphology and life-cycles of few genera and Economic importance of fungi
- General characteristics, Classification of bryophytes, morphology, anatomy and reproduction of few genera and economic importance of bryophytes
- General characteristics, classification, morphology of pteridophytes, Anatomy and reproduction of few genera, economic importance of Pteridophytes.
- General characteristics, classification of gymnosperm, morphology, anatomy and reproduction of few genera along with economic importance.
- Practical knowledge of respective topics

Core Course (CC- 1B) : Plant Ecology and Taxonomy

The students gained knowledge on :

- Introduction of Plant Ecology and Taxonomy
- Ecological factors - Origin, formation, composition and profile of soil, Water and States of water in the environment
- Plant communities
- Ecosystem - Structure; energy flow trophic organisation; Food chains and food webs, Ecological pyramids, Biogeochemical cycling
- Phytogeography - Principle biogeographical zones and Endemism
- Plant taxonomy - Identification, Classification, Nomenclature
- Practical knowledge of related topics

Core Course (CC- 1C): Plant Anatomy and Embryology

The students learns about :

- Meristematic and permanent tissues
- Structure of dicot and monocot root stem and leaf
- Vascular cambium – structure and function, seasonal activity, Secondary growth in root and stem, Wood
- Adaptive and protective systems - Epidermis, cuticle, stomata; General account of adaptations in xerophytes and hydrophytes
- Structural organization of flower - Structure of anther and pollen; Structure and types of ovules; Types and structure of embryo sacs
- Pollination and fertilization - Pollination mechanisms and adaptations, Double fertilization

- Embryo and endosperm - Endosperm types, structure and functions; Dicot and monocot embryo
- Practical knowledge of related topics

SEC 1:Biofertilizers

The students are well acquainted with :

- General account about the microbes used as biofertilizer
- Rhizobium and Azospirillum – isolation and cultivation
- Cyanobacteria, Azolla - Anabaena association
- Mycorrhizal association, VAM – isolation and inoculum and its influence on growth and yield of crop plants.
- Organic farming

Core Course (CC- 1D) : Plant Physiology and Metabolism

The students gathered knowledge on :

- Plant-water relations - Importance of water, water potential and its components; Transpiration and its significance
- Mineral nutrition - Essential elements, macro and micronutrients, role of essential elements, Transport of ions across cell membrane, active and passive transport
- Translocation in phloem
- Photosynthesis – Pigments, Photosystem I and II, reaction center, antenna molecules, Electron transport chain and ATP synthesis, C3, C4 and CAM pathways of carbon fixation, Photorespiration
- Respiration – Glycolysis, TCA cycle, Oxidative phosphorylation
- Enzymes along with its structures, properties and functions
- Biological nitrogen fixation
- Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene
- Plant response to light and temperature
- Practical knowledge of related topics

SEC – 2 : Medicinal Botany

They received the ideas on :

- History, Scope and Importance of Medicinal Plants, Indigenous Medicinal Sciences, Ayurveda, Siddha, Unani
- Conservation of endangered and endemic medicinal plants, Propagation of Medicinal Plants
- Ethnobotany and Folk medicines

DSE 1A : Economic Botany and Biotechnology

The students learns about :

- Origin of Cultivated Plants (4 Lectures) Concept of centres of origin, their importance with reference to Vavilov’s work

- Origin, morphology, general description and uses of cereals, legumes, Spices, Beverages, oil and fibre yielding plants
- History, Definition, aim and scope of biotechnology, Contribution of Indian Scientist
- Plant tissue culture and its applications
- Recombinant DNA Technology
- Practical knowledge of related topics

DSE 1B : Cell Biology, Genetics and Molecular Biology

The learners are familiar with :

- Various techniques in Biology like Microscopy, Sample Preparation, X-ray diffraction analysis
- Cell Theory, Prokaryotic and eukaryotic cells, Cell size and shape, Eukaryotic Cell components
- Linkage- types and factors, Crossing over – types, mechanisms and factors
- Mutation – types, mutagen, effects of mutagens
- Structural and numerical changes of chromosomes and its effects
- Cell organelles – Structures and functions of mitochondria, ER, Golgi bodies, Lysosomes Nucleus etc.
- Cell Membrane and Cell Wall – Structures, model and functions
- Cell cycle and cell divisions
- DNA – structure, forms, functions, replication
- RNA – types, transcription
- Protein synthesis, genetic code
- Gene regulation – operon concept
- Practical knowledge of related topics

SEC -4 :Ethnobotany

The students learns about :

- Introduction, concept, scope and objectives
- Major and minor ethnic groups or Tribals of India, and their life styles, Plants used by the tribals
- Methodology of Ethnobotanical studies - Field work, Herbarium, Ancient Literature, Archaeological findings and Sacred groves
- Role of ethnobotany in modern Medicine
- Significance of the following plants in ethno botanical practices - Azadiractha indica, Ocimum sanctum, Vitex negundo and Gloriosa superba
- Role of ethnobotany in modern medicine with special example Rauvolfia serpentina, Trichopuszeylanicus, Artemisia and Withania
- Role of ethnic groups in conservation of plant genetic resources. Endangered taxa and forest management
- Ethnobotany as a tool to protect interests of ethnic groups, Biopiracy, Intellectual Property Rights and traditional knowledge.