

Bankim Sardar College
A College with Potential for Excellence

Department of Botany
Under Graduate Programme

Programme Outcome (PO) – Programme Specific Outcome (PSO) – Course Outcome (CO)

Programme Outcome (PO) –

Botany i.e. plant science originated in prehistory as herbalism with the efforts of early humans to identify – and later cultivate – edible, medicinal and poisonous plants, making it one of the oldest branches of science. Modern botany is a broad, multidisciplinary subject with inputs from most other areas of science and technology. The student graduating with the Degree B.Sc (Honours) Botany should be able to acquire

1. Core competency:

- The student will be able to identify major groups of plants and compare the characteristics of lower (e.g. algae and fungi) and higher (angiosperms and gymnosperms) plants.
- Students will be able to use the evidence based comparative botany approach to explain the evolution of organism and understand the genetic diversity on the earth.
- The students will be able to explain various plant processes and functions, metabolism, concepts of gene, genome and how organism's function is influenced at the cell, tissue and organ level.
- Students will be able to understand adaptation, development and behavior of different forms of life.
- The understanding of networked life on earth and tracing the energy pyramids through nutrient flow.
- Students will be able to demonstrate the experimental techniques and methods of their area of specialization in Botany.

2. Analytical ability: The students will be able to demonstrate the knowledge in understanding research and addressing practical problems.

3. Team Player: Students will learn team workmanship in order to serve industry and society.

4. Independent Learner: Apart from the subject specific skills, generic skills, especially in botany, the program outcome would lead to gain knowledge and skills for further higher studies, competitive examinations and employment. Learning outcomes based curriculum would ensure equal academic standards across the country and broader picture of their competencies.

Programme Specific Outcome (PSO) –

- To provide detailed knowledge about different groups of plant from primitive to newly evolved one.
- To make the students familiar with the plants and its utilization in the industrial sectors.
- To prepare the students with the knowledge related to field and laboratory based studies.
- To provide knowledge to the students about the potential of these studies to become an entrepreneur.
- To provide the knowledge about the sustainable uses and conservation of plant species.
- To shape the foundation for higher studies (M.Sc., M.Tech., M.Phil., Ph.D.) in Botany and its allied field.
- Help the students to build the successful career in Botany.
- To enable the graduate prepare for subject/ discipline specific national as well as international competitive examinations.

Sem	Core Courses	Content of CU Syllabus	Course Outcome (CO)
1	CCH1	Phycology <ul style="list-style-type: none"> • General account • Classification • Cyanobacteria • Bacillariophyta • Life history 	CO 1. Study about algae and its role in plant groups. CO 2. Types of algal habits are found and their morphological, anatomical, reproductive characters are depicted. CO 3. Blue-green algae and its role in nitrogen fixation is described here, significance of heterocyst is also mentioned here. CO 4. Diatoms and their role as diatomaceous earth and its economical uses in daily life are described. CO 5. Life history of different algal genera showing gametophytic variation and nature alternation of generation is analyzed.
		Microbiology <ul style="list-style-type: none"> • Virus • Bacteria 	CO 6. A cellular organism, its role as intermediate, its life cycle in the host cell and its beneficial and harmful effects. CO 7. Prokaryotic organism, its types, growth curve, beneficial and harmful role are depicted.
	CCH2	Mycology <ul style="list-style-type: none"> • General account 	CO 8. Study about fungus, concept of mycelium, hypha, dikaryotization etc. are described.

		<ul style="list-style-type: none"> • Classification • Life history • Mycorrhiza • Lichen 	<p>CO 9. Different types of fungi with their peculiarities are described according to different mycologists.</p> <p>CO 10. Life history of all the fungal species, homo and heterothallism, parasexuality and its mode of alternation of generation is mentioned.</p> <p>CO 11. Association of fungi with root and the symbiotic relationship is established. Types and its role in agriculture and forestry are described.</p> <p>CO 12. Algal and fungal associative relationship, types and ecological role are mentioned.</p>
		<p>Phyto-Pathology</p> <ul style="list-style-type: none"> • Terms and definitions • Host-Parasite interaction • Plant disease management • Symptoms, causal organism, disease cycle and control measures of plant diseases 	<p>CO 13. It deals with different types of plant diseases and related terminologies and disease triangle.</p> <p>CO 14. Interrelationship and interactive role of plant and its pathogen causing disease.</p> <p>CO 15. How to deal with the plant disease, is discussed.</p> <p>CO 16. The overall peculiarities of different types of plant diseases, responsible organism, cycle of disease development and remedy for the plants are discussed.</p>
2	CCH3	<p>Anatomy</p> <ul style="list-style-type: none"> • Cell wall, Stomata, Stele, Primary structure of stem and root • Secondary growth, Developmental anatomy • Ecological anatomy • Scopes of plant anatomy 	<p>CO 17. Structural components of cell wall, stomatal apparatus and its types and primary xylem, primary phloem and its arrangement are discussed.</p> <p>CO 18. Secondary cell wall materials like hemicellulose, lignin, pectin, suberin etc. are responsible for secondary growth and it also elaborates developmental pattern by periclinal and anticlinal division from new structures in gametophytes and sporeophytes.</p> <p>CO 19. To cope with its concerned environment, plants possess typical adaptive characters making a balance with its ecology.</p> <p>CO 20. To cope with its concerned environment, plants possess typical adaptive characters making a balance with its ecology.</p> <p>CO 21. After knowing the internal structural details, it can be correlated to any physiological or biochemical properties of the plants.</p>
	CCH4	<p>Bryophytes</p> <ul style="list-style-type: none"> • General account, Life history, Phylogeny, Importance <p>Pteridophytes</p> <ul style="list-style-type: none"> • General account, Life history <p>Gymnosperms</p> <ul style="list-style-type: none"> • Classification, Progymnosperms, Life history 	<p>CO 22. Different bryophyte members which are amphibian in nature have crucial role in terms of ecological and economical significance.</p> <p>CO 23. These are the first land vascular plants and it enunciates heterospory forwarding to seed habit.</p> <p>CO 24. Starting with progymnosperms having affinities on both side i.e. pteridophytes and gymnosperms, this chapter says about seed plants where seed is uncovered and presence of cone is significant.</p>
	CCH5	<p>Palaeobotany and Palynology</p> <ul style="list-style-type: none"> • Geological time scale with dominant plant groups through ages • Plant Fossils • Fossil Pteridophytes • Fossil Gymnosperms • Indian Gondwana System • Palynology 	<p>CO 25. This topic helps the learner to understand the evolution of different plant groups from ancient era to the present.</p> <p>CO 26. The students would get a brief idea about the different types of fossils, their mode of preservations, naming, conditions for fossilization and their importance.</p> <p>CO 27. The study would impart an elaborative idea of the different important fossil pteridophytes.</p> <p>CO 28. The study would help the students to know about the different important fossilized reconstructed genus of gymnosperms.</p> <p>CO 29. The study would impart knowledge of the different major mega fossils present in the Indian Gondwana System.</p> <p>CO 30. The following study would help the students understand the different spores and pollen, their structures, types,</p>

3		<ul style="list-style-type: none"> • Applied Palynology 	<p>and their mode of classification.</p> <p>CO 31. From the following study the students would get a brief idea of the different applied fields of palynology.</p>
	CCH6	<p>Reproductive Biology of Angiosperms</p> <ul style="list-style-type: none"> • Morphology of Angiosperms • Pre- fertilization changes • Fertilization • Post- fertilization changes • Apomixis and Polyembryony 	<p>CO 32. This topic helps the learner to get a brief idea about the different types of inflorescence and flowering present in angiosperms and the genetic mode of flower development.</p> <p>CO 33. The students would get a brief idea about the pre-fertilization changes that are observed.</p> <p>CO 34. The study would impart an elaborative idea of the different fertilization stages.</p> <p>CO 35. The study would help the students to know about the different post- fertilization stages.</p> <p>CO 36. This study would help the students to understand a mode of reproduction which does not involve formation of zygote through gametic fusion and a process in which the fertilization of single egg leads to the formation of two or more embryos.</p>
	CCH7	<p>Taxonomy of Angiosperms</p> <ul style="list-style-type: none"> • Introduction • Nomenclature • Systems of Classification • Phenetics & Cladistics • Data sources in Taxonomy • Diagnostic features, systematic position and Economic importance of Monocotyledonous and Dicotyledonous plants 	<p>CO 37. Introduction of plant habits, especially angiospermic plants.</p> <p>CO 38. Naming process of plants.</p> <p>CO 39. Criteria of classification and its description according to different taxonomists.</p> <p>CO 40. Evolutionary outline and interrelationship by forming phylogenetic tree.</p> <p>CO 41. How the taxonomic data are collected, maintained and preserved for future references.</p> <p>CO 42. Characters of different plants on the basis of branching pattern, phylotaxy, floral morphology. Economic importance in terms of industrial, medicinal or daily use.</p>
	SEC A	<ul style="list-style-type: none"> • Applied Phycology, Mycology and Microbiology • Applied Phycology • Applied Mycology • Applied Microbiology 	<p>CO 43. Economical as well as industrial processes, its utilization and marketing i.e. commercialization of different algal members.</p>
4	CCH8	<p>Plant Geography</p> <ul style="list-style-type: none"> • Phytogeographical regions • Endemism 	<p>CO 44. Geographical isolation according to vegetation cover throughout the globe.</p> <p>CO 45. Restricted species in restricted area and its ecological significance.</p>
		<p>Ecology</p> <ul style="list-style-type: none"> • Preliminary idea • Community Ecology • Conservation of Biodiversity • Evolution • Plant Geography and Ecology 	<p>CO 46. Interrelationship and interaction between biotic and abiotic organisms and their impact on the environment.</p> <p>CO 47. How the living organisms form population terminating into a community is described here.</p> <p>CO 48. Diversity of living organisms irrespective of flora and fauna and its in-situ and ex-situ conservation policies.</p> <p>CO 49. Origin and deviation of living organisms in different branches through the evolution are narrated.</p> <p>CO 50. Different zones in terms of vegetation and floral and faunal implications on these zones are analyzed.</p>
	CCH9	<p>Economic Botany</p> <ul style="list-style-type: none"> • Origin of cultivated crops, Cereals, Legumes • Sugar and starches, Spices, Beverages, Oil and fats • Drug yielding plants, Timber, Fibers 	<p>CO 51. Economical uses of different angiospermic plants including shrubs, herbs and trees.</p>
	CC10	<p>Genetics</p> <ul style="list-style-type: none"> • Introduction • Linkage, Crossing over and Gene mapping • Epistasis and Polygenic 	<p>CO 52. Concept of gene as an unit of heredity.</p> <p>CO 53. Crossing over between sister Chromatids, linked gene concept, genetic distance and its mapping in terms of linkage.</p> <p>CO 54. Influencing or dominating gene over the recessive one</p>

		<p>inheritance in plants</p> <ul style="list-style-type: none"> • Aneuploidy and Polyploidy • Chromosomal aberration • Mutation • Structural organization of Gene 	<p>and its being carry forwarded through the generations of plants.</p> <p>CO 55. Chromosomal number, character variation and its implication in the structural behavior. Also the effects of external factors in terms of physical mutagen and chemical mutagen are aptly described.</p>
	SEC B	<p>Plant Breeding</p> <ul style="list-style-type: none"> • Plant Breeding • Methods of Crop improvement • Germplasm • Mass and Pure line selection • Heterosis, Hybrid seed, Male sterility, Inbreeding, Molecular breeding • Role of mutation and role of biotechnology in crop improvements 	<p>CO 56. Crossing in between plants for the improvement of crop productivity and agricultural benefits.</p>
5	CCH11	<p>Cell Biology</p> <ul style="list-style-type: none"> • Origin and Evolution of cells • Nucleus and Chromosome • Cell cycle and its regulation 	<p>CO 57. Deals with origin of unicellular life and its evolution towards multicellular life and also the complexity of organism from prokaryotes to eukaryotes.</p> <p>CO 58. Nucleus is the sole responsible for all system regulation in the body and chromosome is its unit of heredity. Chromosome structure, its behaviour, functions are the key points concerned.</p> <p>CO 59. Cell cycle signifies cell division types and its regulation along with maturation promotion factors with checkpoints.</p>
		<p>Molecular Biology</p> <ul style="list-style-type: none"> • DNA Replication, Transcription and Translation • Gene regulation • Genetic code • Development and causes of Cancer • Recombinant DNA Technology 	<p>CO 60. Central dogma is dealt with it. It describes copy of DNA formation, formation of mRNA from DNA and from mRNA to protein.</p> <p>CO 61. Regulation process of structural genes and role of OPERON.</p> <p>CO 62. Triplet code of genes, concept of purine, pyrimidine bases and nature of genetic code like non-overlapping, unambiguous etc. are the matters concerned.</p> <p>CO 63. Role of oncogene protooncogene to cause cancer and its development forwarding apoptosis i.e. programmed cell death is narrated.</p> <p>CO 64. Genetic engineering method by the utilization of restriction enzymes.</p>
	CCH12	<p>Biochemistry</p> <ul style="list-style-type: none"> • Biochemical foundations • Molecules of life • Energy flow • Enzymology • Cell membrane • Phosphorylation 	<p>CO 65. Chemical bonding between the atoms and molecules, PH, Buffer and iso-electric point are relevant to it.</p> <p>CO 66. Responsible molecules i.e. carbohydrates, protein, lipid for life and its mutual arrangement towards the body make up deals with this module.</p> <p>CO 67. Energy currency i.e. ATP and its nature of flow following thermodynamics principles are discussed.</p> <p>CO 68. Knowledge of enzymes, its nomenclature, properties and implication of these on plant and animal body.</p> <p>CO 69. Relates to the plasmamembrane, its structure and properties.</p> <p>CO 70. Process of addition and emission of phosphorous i.e. phosphate ions and its role in biological organisms.</p>
	DSE A1	<p>Biostatistics</p> <ul style="list-style-type: none"> • Biostatistics, Biometry • Central tendency, Test of significance, Probability • Measurement of gene frequency 	<p>CO 71. It deals with the counting method of plant sample, different allied tests, probable equations and its description in terms of gene and genetic drift within any population.</p>
	DSE B1	<p>Plant Biotechnology</p> <ul style="list-style-type: none"> • Plant tissue culture, Callus culture 	<p>CO 72. Regeneration and degeneration of tissues to form new plant life in vivo i.e. within the laboratories.</p>

		<ul style="list-style-type: none"> Plant regeneration, Haploid culture, Protoplast culture Plant genetic engineering 	<p>CO 73. Different process of explant insertion into another biological organism.</p>
6	CCH13	<p>Plant physiology</p> <ul style="list-style-type: none"> Plant-water relations Mineral nutrition Organic translocation Plant growth regulators Photomorphogenesis Seed dormancy Physiology of Senescence and ageing 	<p>CO 74. With the help of xylem and phloem tissue i.e. conducting tissue plant water continuum is established through the ascent of sap where cohesion-adhesion force has typical role.</p> <p>CO 75. Major and minor elements have the significant role in case of plant nutrition.</p> <p>CO 76. Organic substances are translocated throughout the body parts of the plants with the aid of phloem loading and unloading.</p> <p>CO 77. Plant hormones are specially growth regulators and also control flowering, fruit ripening, senescence, ageing etc.</p> <p>CO 78. Growth and movement of plant organs effected by photon, where phytochrome pigment plays vital part.</p> <p>CO 79. Factors responsible for seed dormancy i.e. its resting phase and how to overcome this phase are discussed.</p> <p>CO 80. One of the phytohormones i.e. Cytokinin is significantly responsible in relation with delaying senescence and it also correlates ageing process.</p>
	CCH14	<p>Plant Metabolism</p> <ul style="list-style-type: none"> Concept of metabolism Photosynthesis Respiration Nitrogen metabolism Lipid metabolism Mechanism of signal transduction 	<p>CO 81. It emphasizes both structural and functional growth, may be it constructive i.e. anabolic or destructive in terms of energy release i.e. catabolic process.</p> <p>CO 82. This includes anabolic metabolism by which plant can synthesize its own food with the help of green chlorophyll and in the presence of sunlight.</p> <p>CO 83. This encompasses catabolic metabolism by which energy is released to break down the prepared food by photosynthesis.</p> <p>CO 84. It refers to atmospheric nitrogen fixation in the soil and utilization of this nitrogen in different compatible forms by bio-geo-chemical cycle.</p> <p>CO 85. Lipid molecule are break down to be digested in the form of fatty acid and glycerol.</p> <p>CO 86. Each and every biological process needs to be introduced through any signal molecule. Here this process is discussed.</p>
	DSE A2	<p>Medicinal and Ethnobotany</p> <ul style="list-style-type: none"> Medicinal botany, Pharmacognosy Secondary metabolites, Pharmacologically active constituents Ethnobotany and folk medicine 	<p>CO 87. It deals with medicinal importance of the plants and its parts.</p> <p>CO 88. Secondary metabolites in the form of active constituent are significantly responsible for medicinal behavior of the plants.</p> <p>CO 89. It deals with day to day to use of plants by human beings following its local medicinal behavior.</p>
	DSE B2	<p>Research Methodology</p> <ul style="list-style-type: none"> Basic concepts of Research, General laboratory techniques Data collection and documentation, Overview of biological problems Methods to study plant cells/tissue culture, Plant micro-techniques The art of scientific writing and its presentation 	<p>CO 90. It elaborates aptitude or innovations to establish a new concept concerned with laboratory techniques, whether be dry or wet laboratory.</p> <p>CO 91. Tedious involvement to collect data, to preserve it for the establishment of a new fact includes also field study.</p> <p>CO 92. Within basic aseptic condition, explants taken into account, culture medium is prepared to formulate new life in several copies using hybrid, cybrid, somatic embryogenesis etc.</p> <p>CO 93. After formulating theories and collecting relevant data, it should be preserved in writings following specific design using bullets, paras, points and also to highlight the key points by presentation method, so that it can be accessed easily by any of the future researchers.</p>