

**THE UNIVERSITY OF BURDWAN**

Proposed Course Module  
For B. Sc. (Honours) Botany



**SEMESTER III & IV**

**Choice Based Credit System (CBCS)**  
(*w.e.f.* Academic Year 2018-2019)

# Semester III

CC5

Topics Name	Lectures	Teacher
<b>THEORY : Plant Ecology and Phytogeography</b>		
<b>Unit 1: Introduction</b> Basic concepts; Levels of organization. Inter-relationships between the living world and the environment, the components and dynamism, homeostasis.	06	SM1
<b>Unit 2: Soil</b> Importance; Origin; Formation; Composition; Physical; Chemical and Biological components.	06	SM1
<b>Unit 3: Water</b> Importance: States of water in the environment; Atmospheric moisture; Precipitation types (rain, fog, snow, hail, dew); Hydrological Cycle; Water in soil.	04	SM1
<b>Unit 4: Light, temperature, wind and fire</b> Climatic variables; adaptations of plants to their variation.	04	SM1
<b>Unit 5: Ecosystem</b> Structure; Process; Trophic organization, basic source of energy, autotrophy, heterotrophy; symbiosis, commensalism, parasitism; food chains and webs; ecological pyramids; biomass, standing crop.	08	SM1
<b>Unit 6: Population ecology</b> Characteristics and Dynamics .Ecological Speciation	04	CD
<b>Unit 7: Plant communities</b> Concept of ecological amplitude; Habitat and niche; Characters: analytical and synthetic; Ecotone and edge effect; Dynamics: succession – processes, types; climax concepts	08	CD
<b>Unit 8: Functional aspects of ecosystem</b> Principles and models of energy flow; Production and productivity; EcologicalBiogeochemical cycles; Cycling of Carbon, Nitrogen and Phosphorus.	08	CD
<b>Unit 9: Phytogeography</b> Principles; Continental drift; Theory of tolerance; Endemism; Characteristicfeatures of major terrestrial biomes (one each from tropical, temperate & tundra); Phytogeographical division ofIndia [Phytogeographical classification of India (D. Chatterjee- 1962)]; Vegetation Characteristics of Eastern Himalaya and Sunderbans.	12	CD
<b>PRACTICAL</b>		
Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter.		SM1
Determination of pH of various soil and water samples (pH meter, universal indicator and pH paper)		SM1
Analysis for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency		CD

from two soil samples by rapid field tests.		
Determination of organic matter of different soil samples by Walkley & Black rapid titration method.		<b>CD</b>
Determination of dissolved oxygen of water samples from polluted and unpolluted sources.		<b>CD</b>
Ecological adaptations of some species: <i>Ipomoea aquatica</i> stem, Phyllode of <i>Acaccia auriculiformis</i> , <i>Nerium</i> leaf and <i>Vanda</i> root		<b>CD</b>
Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus, by species area curve method (species to be listed).		<b>CD</b>
Field visit to familiarize students with ecology of different sites.		<b>CD</b>

Topics Name	Lectures	Teacher
<b>THEORY: Plant Systematics</b>		
<b>Unit 1: Significance of Plant systematics</b> Introduction to systematics; Plant identification, Classification, Nomenclature. Evidences from palynology, cytology, phytochemistry and molecular data. Field inventory; Functions of Herbarium; Important herbaria and botanical gardens of the world and India; Virtual herbarium; E-flora; Documentation: Flora, Revision, Monographs, Journals; Keys:Single access and Multi-access.	12	MB
<b>Unit 2: Taxonomic hierarchy</b> Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concept (taxonomic, biological, evolutionary).	06	MB
<b>Unit 3: Botanical nomenclature</b> Principles and rules (ICN); Ranks and names; Typification, author citation, valid publication, rejection of names, principle of priority and its limitations; Names of hybrids.	10	MB
<b>Unit 4: Systems of classification</b> Major contributions of Theophrastus, Bauhin, Tournefort, Linnaeus, Adanson, de Candolle, Bessey, Hutchinson, Takhtajan and Cronquist; Classification systems of Bentham and Hooker [1862-83 (upto series)] and Takhtajan (1997); Brief idea of APG System.	12	MB
<b>Unit 5: Biometrics, numerical taxonomy and cladistics</b> Characters; Variations; OTUs, character weighting and coding; Cluster analysis; Phenograms, cladograms (definitions and differences).	10	MB
<b>Unit 6: Phylogeny of Angiosperms</b> Terms and concepts (primitive and advanced, homology and analogy, parallelism and convergence, monophyly, Paraphyly, polyphyly and clades). Origin and evolution of angiosperms; Methods of illustrating evolutionary relationship (phylogenetic tree, cladogram).	12	MB
<b>PRACTICAL</b>		
Study of vegetative and floral characters from the locally available plants of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification): <b>Dicotyledons:</b> Malvaceae, Fabaceae, Euphorbiaceae, Apocynaceae, Asclepiadaceae, Solanaceae, Scrophulariaceae, Lamiaceae, Verbenaceae, Acanthaceae, Rubiaceae, Asteraceae. <b>Monocotyledons:</b> Liliaceae, Poaceae.		MB
Field visit -	02	All teachers
Demonstration of mounting of a properly dried and pressed specimens of any wild plant with herbarium label (to be submitted in the record book).		MB
Submission will include only herbarium sheets of 15 common angiosperms from local flora (EXCLUDING ENDANGERED AND THREATENED SPECIES). Emphasis should be given in preparation field record book with photographic documentation.		MB

# CC7

Topics Name	Lectures	Teacher
<b>THEORY : ECONOMIC BOTANY</b>		
<b>Unit 1:</b> Origin of Cultivated Plants Concept of Centres of Origin, their importance with reference to Vavilov’s work. Examples of major plant introductions; Crop domestication and loss of genetic diversity; evolution of new crops/varieties, importance of germplasm diversity.	<b>06</b>	<b>IB/SM2</b>
<b>Unit 2:</b> Cereals Wheat and Rice (origin, morphology, processing & uses); Brief account of millets.	<b>06</b>	<b>SM2</b>
<b>Unit 3:</b> Legumes Origin, morphology and uses of Chick pea, Pigeon pea and fodder legumes. Importance to man and ecosystem.	<b>06</b>	<b>IB</b>
<b>Unit 4:</b> Sources of sugars and starches Morphology and processing of sugarcane, products and by-products of sugarcane industry. Potato – morphology, propagation & uses.	<b>04</b>	<b>SM2</b>
<b>Unit 5:</b> Spices Listing of important spices, their family and part used. Economic importance with special reference to fennel, saffron, clove and black pepper	<b>06</b>	<b>IB</b>
<b>Unit 6:</b> Beverages Tea, Coffee (morphology, processing & uses)		<b>SM2</b>
<b>Unit 7:</b> Sources of oils and fats General description, classification, extraction, their uses and health implications groundnut, coconut, linseed, soybean, mustard and coconut (Botanical name, family & uses). Essential Oils: General account, extraction methods, comparison with fatty oils & their uses.	<b>10</b>	<b>IB/SM2</b>
<b>Unit 8:</b> Natural Rubber Para-rubber: tapping, processing and uses.	<b>03</b>	<b>IB</b>
<b>Unit 9:</b> Drug-yielding plants Therapeutic and habit-forming drugs with special reference to Cinchona, Digitalis, Papaver and Cannabis; Tobacco (Morphology, processing, uses and health hazards).	<b>08</b>	<b>IB/SM2</b>
<b>Unit 10:</b> Timber plants General account with special reference to teak and pine.	<b>03</b>	<b>IB</b>
<b>Unit 11:</b> Fibers Classification based on the origin of fibers; Cotton, Coir and Jute (morphology, extraction and uses).	<b>04</b>	<b>SM2</b>
<b>PRACTICAL</b>		
<b>Cereals:</b> Rice(habit sketch, study of paddy and grain, starch grains, micro-chemical tests).		<b>SM2</b>
<b>Legumes:</b> Soybean, Groundnut, (habit, fruit, seed structure, micro-chemical tests).		<b>IB</b>
<b>Sources of sugars and starches:</b> Sugarcane (habit sketch; cane juice- micro-chemical tests),Potato(habit sketch, tuber morphology, T.S. tuber to show localization of starch grains, w.m. starch grains, micro-chemical tests).		<b>IB, SM2</b>

<b>Spices:</b> Black pepper, Fennel and Clove (Macromorphology)		<b>IB</b>
<b>Beverages:</b> Tea (plant specimen, tea leaves), Coffee (plant specimen, beans).		<b>SM2</b>
<b>Sources of oils and fats:</b> Coconut- T.S. nut (photograph), Mustard–plant specimen, seeds; tests for fats in crushed seeds.		<b>IB</b>
<b>Essential oil-yielding plants:</b> Habit sketch of <i>Rosa</i> and <i>Eucalyptus</i> -specimens/photographs.		<b>IB/SM2</b>
<b>Rubber:</b> specimen, photograph/model of tapping, samples of rubber products.		<b>SM2</b>
<b>Drug-yielding plants:</b> Organoleptic study of specimens of <i>Andrographis</i> and <i>Catharanthus</i>		<b>IB/SM2</b>
<b>Woods:</b> <i>Tectona</i> , <i>Pinus</i> : Specimen, Section of young stem.		<b>SM2</b>
<b>Fiber-yielding plants:</b> Jute (specimen, transverse section of stem, test for lignin on transverse section of stem and fiber)		<b>IB</b>

# SEMESTER IV

## CC 8

Topics Name	Lectures	Teacher
<b>THEORY: Palaeobotany &amp; Palynology</b>		
<b>Unit 1:</b> Introduction, importance of Palaeobotany.	<b>05</b>	<b>MB</b>
<b>Unit 2:</b> Definition of fossil, process of fossilization, types of fossils on the basis of their preservation; concept of Form Genus.	<b>15</b>	<b>MB</b>
<b>Unit 3:</b> Introductory idea of correlation and stratigraphy; stratigraphic deductions based on plant fossils.	<b>15</b>	<b>MB</b>
<b>Unit 4:</b> Age of the earth, Geologic Time Scale, major events of plant life through geologic time.	<b>10</b>	<b>MB</b>
<b>Unit 5:</b> Microsporogenesis; Spore/pollen morphology with reference to polarity, size, shape, symmetry, aperture and sculpture.	<b>15</b>	<b>MB</b>
<b>Unit 6:</b> Organization of orthotropous ovule, types of ovules; megasporogenesis.	<b>10</b>	<b>MB</b>
<b>Unit 7:</b> Pollination: Types and contrivances.	<b>10</b>	<b>MB</b>
<b>PRACTICAL</b>		
Study (including mode of preservation) of the following: <i>Lepidodendron</i> , (stem in T. S.), <i>Calamites</i> (stem in T. S.), <i>Bucklandia</i> (stem, specimen), <i>Glossopteris</i> (leaf, specimen), <i>Lyginopteris</i> (stem in T. S.), <i>Vertebraria</i> (root, specimen).		<b>MB</b>
Pollen morphological studies of <i>Impatiens</i> and <i>Hibiscus</i> pollens form prepared slides.		<b>MB</b>

Topics Name	Lectures	Teacher
<b>THEORY : Biomolecules and Cell Biology</b>		
<p><b>Unit 1: Biomolecules</b></p> <p>Types and significance of chemical bonds; Structure and properties of water; pH and buffers. <b>Carbohydrates:</b> Nomenclature and classification; Monosaccharides; Disaccharides; Oligosaccharides and polysaccharides. <b>Lipids:</b> Definition and major classes of storage and structural lipids; Fatty acids structure and functions; Essential fatty acids; Triacyl glycerols structure, functions and properties; Phosphoglycerides.</p> <p><b>Proteins:</b> Structure of amino acids; Levels of protein structure-primary, secondary, tertiary and quaternary; Biological roles of proteins in plants.</p> <p><b>Nucleic acids:</b> Structure of nitrogenous bases; Structure and function of nucleotides; Types of nucleic acids; Structure of A, B, Z types of DNA; Types of RNA; Structure of tRNA.</p>	20	SM2, CD
<p><b>Unit 2: Bioenergetics</b></p> <p>Laws of thermodynamics, concept of free energy, endergonic and exergonic reactions, coupled reactions, redox reactions. ATP: structure, its role as a energy currency molecule. .</p>	04	SM2, IB
<p><b>Unit 3: Enzymes</b></p> <p>Structure of enzyme: holoenzyme, apoenzyme, cofactors, coenzymes and prosthetic group; Classification of enzymes; Features of active site, substrate specificity, mechanism of action (activation energy, lock and key hypothesis, induced - fit theory), Michaelis – Menten equation, enzyme inhibition and factors affecting enzyme activity.</p>	06	SM2
<p><b>Unit 4: The cell</b></p> <p>Cell as a unit of structure and function; Characteristics of prokaryotic and eukaryotic cells; Origin of eukaryotic cell (Endosymbiotic theory).</p>	04	CD
<p><b>Unit 5: Cell wall and plasma membrane</b></p> <p>Chemistry, structure and function of Plant cell wall. Overview of membrane function; fluid mosaic model; Chemical composition of membranes; Membrane transport – Passive, active and facilitated transport, endocytosis and exocytosis</p>	04	IB, CD
<p><b>Unit 6: Cell organelles</b></p> <p><b>Nucleus:</b> Structure-nuclear envelope, nuclear pore complex, nuclear lamina, molecular organization of chromatin; nucleolus.</p> <p><b>Cytoskeleton:</b> Role and structure of microtubules, microfilaments and intermediary filament. <b>Chloroplast, mitochondria and peroxisomes:</b> Structural organization, function,</p>	16	CD



Semiautonomous nature of mitochondria and chloroplast. <b>Endomembrane system:</b> Endoplasmic Reticulum – Structure, targeting and insertion of proteins in the ER, protein folding, processing; Smooth ER and lipid synthesis, export of proteins and lipids; Golgi Apparatus – organization, protein glycosylation, protein sorting and export from Golgi Apparatus; Lysosomes		
<b>Unit 7: Cell division</b> Phases of eukaryotic cell cycle, mitosis and meiosis; Regulation of cell cycle- checkpoints, role of protein kinases.	<b>06</b>	<b>CD</b>
<b>PRACTICAL</b>		
Qualitative tests for carbohydrates, reducing sugars, non-reducing sugars, lipids and proteins.		<b>SM1</b>
Study of plant cell structure with the help of epidermal peel mount of Onion/ <i>Rhoeo</i> / <i>Crinum</i> .		<b>CD</b>
Demonstration of the phenomenon of protoplasmic streaming in <i>Hydrilla</i> leaf.		<b>SM2</b>
Measurement of cell size by the technique of micrometry		<b>CD</b>
Cytochemical staining of: DNA- Feulgen and cell wall in the epidermal peel of onion using Periodic Schiff's (PAS) staining technique.		<b>CD</b>
Study the phenomenon of plasmolysis and deplasmolysis.		<b>SM2</b>
Study the effect of organic solvent and temperature on membrane permeability.		<b>CD</b>
Study different stages of mitosis and meiosis of <i>Allium cepa</i> .		<b>CD</b>

## CC 10

Topics Name	Lectures	Teacher
<b>THEORY : Molecular Biology</b>		
<b>Unit 1: Nucleic acids: Carriers of genetic information</b> Historical perspective; DNA as the carrier of genetic information (Griffith's, Hershey & Chase, Avery, McLeod & McCarty, Fraenkel-Conrat's experiment.	<b>04</b>	<b>CD</b>
<b>Unit 2. The Structures of DNA and RNA / Genetic Material</b> DNA Structure: Miescher to Watson and Crick- historic perspective, DNA structure, Salient features of double helix, Types of DNA, Types of genetic material, denaturation and renaturation, cot curves; Organization of DNA- Prokaryotes, Viruses, Eukaryotes. RNA Structure Organelle DNA -- mitochondria and chloroplast DNA. The Nucleosome Chromatin structure- Euchromatin, Heterochromatin- Constitutive and Facultative heterochromatin.	<b>10</b>	<b>CD</b>
<b>Unit 2: The replication of DNA</b> Chemistry of DNA synthesis (Kornberg's discovery); General principles – bidirectional, semi-conservative and semi discontinuous replication, RNA priming; Various models of DNA replication, including rolling circle, $\theta$ (theta) mode of replication, replication of linear ds-DNA, replication of the 5' end of linear chromosome; Enzymes involved in DNA replication.	<b>10</b>	<b>CD</b>
<b>Unit 3: Central dogma and genetic code</b> Key experiments establishing- The Central Dogma (Adaptor hypothesis and discovery of mRNA template), Genetic code (deciphering & salient features)	<b>02</b>	<b>SM1</b>
<b>Unit 4: Transcription</b> Transcription in prokaryotes and eukaryotes. Principles of transcriptional regulation; Prokaryotes: Regulation of lactose metabolism and tryptophan synthesis in <i>E. coli</i> . Eukaryotes: transcription factors, heat shock proteins, steroids and peptide hormones; Gene silencing.	<b>18</b>	<b>SM1</b>
<b>Unit 5: Processing and modification of RNA</b> Split genes-concept of introns and exons, removal of introns, spliceosome machinery, splicing pathways, group I and group II intron splicing, alternative splicing eukaryotic mRNA processing (5' cap, 3' polyA tail); Ribozymes; RNA editing and mRNA transport.	<b>08</b>	<b>SM1</b>

<b>Unit 6: Translation</b> Ribosome structure and assembly, mRNA; Charging of tRNA, aminoacyl tRNA synthetases; Various steps in protein synthesis, proteins involved in initiation, elongation and termination of polypeptides; Fidelity of translation; Inhibitors of protein synthesis; Post-translational modifications of proteins.	<b>08</b>	<b>CD</b>
<b>PRACTICAL</b>		
Preparation of LB medium and raising <i>E. coli</i> .		<b>IB</b>
Study of genomic DNA from <i>E. coli</i> . through photographs		<b>IB</b>
Study of DNA replication mechanisms through photographs (Rolling circle, Theta replication and semi-discontinuous replication).		<b>CD</b>
Study of structures of prokaryotic RNA polymerase and eukaryotic RNA polymerase II through photographs.		<b>SM1</b>
Photographs establishing nucleic acid as genetic material (Messelson and Stahl's, Avery et al, Griffith's, Hershey & Chase's and Fraenkel & Conrat's experiments)		<b>SM1</b>
Cytochemical staining of: DNA- Feulgen and cell wall in the epidermal peel of onion using Periodic Schiff's (PAS) staining technique.		<b>CD</b>
Study of the following through photographs: Assembly of Spliceosome machinery; Splicing mechanism in group I & group II introns; Ribozyme and Alternative splicing.		<b>CD/SM1</b>

## SEC –I

Topics Name	Lectures	Teacher
<b>Theory:(Agricultural Botany)</b>	<b>Total:30</b>	
<b>Unit: 1 Plant physiology</b> a) Plant water relation, stomatal regulation, mineral nutrition, N <sub>2</sub> cycle.	4	SM2
b) CO <sub>2</sub> fixation mechanism in C <sub>2</sub> ,C <sub>3</sub> ,C <sub>4</sub> and CAM plants. Transport of water and photosynthate.	6	SM2
c) Plant development Phytohormones : IAA, GA, Cytokinin, ABA, Ethylene; their role and regulation in plant system	5	MB
d) Physiology of flowering and seed development	3	MB
<b>Unit: 2 Organic farming</b> a) Microbes used as bio fertilizer	1	IB
b) Cyanobacteria isolation and mass multiplication	1	IB
c) Mycorrhizal association in Agriculture	1	IB
<b>Unit:3 Plant breeding, Tissue culture and Biotechnology</b> a) Mass selection and pure line selection, heterosis breeding	2	SM1
b) Marker assisted breeding for agronomic crops	1	SM1
c) Micro propagation techniques, different organ culture	1	SM1
d) <i>Agrobacterium</i> mediated transformation, vector mediated transformation, Biolistics	3	CD
e) GMO, transgenic plant, patent.	1	CD
f) Molecular markers used in Agriculture	1	CD

Abbreviation for teachers' name : SM1-Dr Sanjukta Maiti, CD-Chandan Das,SM2-Swarnendu Mondal, MB-Dr Moumita Basu, IB-Dr Irani Biswas