Name of Teacher: Dr. Krishna Chaudhury

Department : Botany

B.sc (Honours and General)

- **Lesson Plan (CBCS System- 2018-2023)**

Topic Serial	Class	Paper & Unit	Name of topic with details of sub-topics	No. of Classes	Learning objective of the course/Question Framing
1	SEM I (H)	BOTA-CC1-1TH, PHYCOLOGY	**1. Topic**: **General Account:** ***Sub topic***: 1.1. Thallus organization, Structure of algal cell, 1.2. Ultrastructure of Plastids and Flagella, 1.3. Origin and evolution of sex, 1.4. Life cycle patterns, 1.5. Significant contributions of important phycologists (Fritsch, Smith, R. N. Singh, T.V. Desikachary, H.D. Kumar, M.O.P. Iyengar) 2. **Topic**: **Classification:** ***Sub topic***: 2.1. Criteria and basis of Fritsch's classification 2.2. Classification by Lee (2008) upto phylum with examples 2.3. Salient features of Cyanobacteria, Rhodophyta, Chlorophyta , Charophyta, Bacillariophyta, Xanthophyta, Phaeophyta, Heterokantophyta. 3. **Topic**: Cyanobacteria ***Sub topic***: 3.1.Ultrastructure of cell, 3.2. Heterocyst - structure and function, 3.3. Ecology.	20	1. Understanding of general idea about algae in relation to cell structure, life form diversity and variation of life cycle. Contribution of pioneer worker in the field of Phycology. 2. Importance and basis of algal classification from which students can compare among different group of algae. 3. To know about the prokaryotic algae, cell structur, heterocyst and importance. 1. Draw and describe the thallus diversity of algae. 2. Discuss origin and evolution sex in algae. 3. Mention salient features of different phylum of algae. 4. Draw and describe ultrastructure of a cyanobacterial cell wall. 5. Describe heterocyst structure and mention its significance.
2	SEM II (H)	BOTA-CC-2-4-TH. ARCHAEGONIATE Pteridophyta	**Topic: Pteridophyta:** ***Sub Topic:*1. General Account:** 1.1. Colonisation and rise of early land plants, 1.2. Classification of vascular plants by Gifford & Foster (1989) upto division (Rhyniophyta to Filicophyta) with diagnostic characters and examples. ***Sub Topic:2*. Life History:** Sporophyte structure, Reproduction and Structure of gametophyte in 2.1. Psilotum, 2.2. Selaginella, 2.3. Equisetum, 2.4. Pteris. ***Sub Topic: 3.*** Telome concept and its significance in the origin of different groups of Pteridophytes.	6	1. To acquire knowledge about the first land vascular plants on earth, Knowledge about the different division of Pteridophyta. 2. To know the life history of 4 genera each representing major five extant division of Pteridophyta. 3. To know the origin and evolution of different group of Pteridophyta based on Telome theory. 4. To know the origin and development ovule. 5. Economic importance of Pteridophyta

			Sub Topic:* 4.** Heterospory and Origin of Seed habit. ***Sub Topic:5. Economic importance as food, medicine and Agriculture.		1. Discuss the colonisation of first land vascular plants. 2. With suitable characters classify Pteridophta. 3. Describe the sporophytic and gametophytic structure of *Equisetum* with suitable illustration. 4. Based on Telome theory describe the origin of Lycophyta. 5. Citing suitable examples describe the origin of ovule from heterospory.
3	SEM III (H)	BOT-A-CC-3-6-TH	**Topic:** MORPHOLOGY OF ANGIOSPERMS: 1. Inflorescence types with examples. 2. Flower, induction of flowering, flower development- genetic and molecular aspects.	22	1. To understand the inflorescence of angiosperm plant specimen, 2. To know the various parts of flower and genetic basis of flowering 1. With suitable diagram describe different type of raceme inflorescence. 2. Describe different types of cymose inflorescence. 3. Briefly describe ABC model of flowering.
4		BOT-A-CC-3-7-TH	**Topic: TAXONOMY OF ANGIOSPERMS:** ***Sub Topic. 3:* Systematics in Practice:** 3.1. Herbaria and Botanical Gardens – their role in teaching and research; important Herbaria and Botanical Gardens of India and world (3 each); 3.2. Dichotomous keys – indented and bracketed. ***Sub Topic. 4:* Phenetics and Cladistics:** Brief idea on Phenetics, Numerical taxonomy- methods and significance; Cladistics- construction of dendrogram and primary analysis; Monophyletic, polyphyletic and paraphyletic groups; Plesiomorphy and apomorphy. ***Sub Topic. 5:* Data sources in Taxonomy:** Supportive evidences from: 5.1. Phytochemistry, 5.2. Cytology, 5.3. Palynology and 5.4. Molecular	10	1. To know about hormone and their mechanism; how hormone act on cell and ligand-receptor relation; Cross talk mechanism; concept of second messenger system; 2. Details about intracellur mechanism 3. To know about apoptosis, cell death mechanism and significance in human body; How P^{53} act as anti-cancer molecule and control DNA repair mechanism. 1. Write short note on Herbaria and Botanic Garden. 2. Write short note on numerical taxonomy. Compare monophyletic, polyphyletic and paraphyletic group. 3. State the importance of cytology and phytochemistry in taxonomy mentioning two examples each. 4. State diagnostic features of Euphorbiaceae. Mention floral formula and draw floral diagram. State economic importance of Solanaceae.

			biology data (Protein and Nucleic acid homology). ***Sub Topic.*** 6**: Diagnostic features, Systematic position (Bentham & Hooker and Cronquist), Economically important plants (parts used and uses) of the following families:** 6.1. Monocotyledons: Alismataceae, Gramineae (Poaceae), Cyperaceae, Palmae (Arecaceae), Liliaceae, Musaceae, Zingiberaceae, Cannaceae, Orchidaceae. 6.2. Dicotyledons: Nymphaeaceae, Magnoliaceae, Leguminosae (subfamilies), Polygonaceae, Euphorbiaceae, Malvaceae, Umbelliferae (Apiaceae), Labiatae (Lamiaceae), Solanaceae, Scrophulariaceae, Acanthaceae, Rubiaceae, Cucurbitaceae, Compositae (Asteraceae).		5. State diagnostic features of Poaceae. Mention floral formula and draw floral diagram. State economic importance of Liliaceae.
5	SEM 4 (H)	BOT-A-CC-4-9-TH ECONOMIC BOTANY	**Topic: Economic Botany:** ***Sub Topic:*** **4. Sugar and starches:** Morphology and processing of sugarcane, products and byproducts of sugarcane industry. Potato-morphology, propagation and uses. ***Sub Topic:*** **5. Spices:** Listing of important spices, their family and part used. ***Sub Topic:*** **6. Beverages:** Tea (morphology, processing and uses). ***Sub Topic: 7.*** **Oil and fats:** General description, classification, extraction, their uses and health implications of mustard, soybean, coconut (Botanical name, family and uses). Essential oils- general account, extraction methods, comparison with fatty oils and their uses.	47	1. To acquire knowledge on morphology, processing and uses of sugarcane and its by-product, To know propagation of potato, 2. To know the uses of diverse kind of spices and their uses, 3. To know the processing of different type of tea, 4. To know and understand extraction and health implications of oil and fats from plant origin, 5. To know the different drug plants and their procedure of extraction and uses, 6. To know the different timber yielding species, 7. To know the morphology and extraction process of jute and its uses.

			Sub Topic: 8. **Drug-yielding plants:** Therapeutic and habit forming drugs with special reference to Cinchona, Digitalis, Papavar, Cannabis and Tobacco (morphology, processing, uses and health hazards). ***Sub Topic: 9.*** **Timber:** general account with special reference to Sal and Teak. ***Sub Topic: 10.*** **Fibers:** Cotton and Jute (Morphology, extraction and uses).		1. Briefly describe the processing of sugarcane syrup to the production of sugar. Mention different by products. Briefly describe the propagation method of potato. 2. State the scientific name, family and uses of nutmeg, mace, saffron, cumin, clove and cubeb. 3. Briefly describe the processing of black tea and green tea. 4. State the extraction procedure and mention health implications of mustard and coconut oil. Write short note on essential oil. 5. Distinguish therapeutic and habituated drug. Briefly describe the extraction of digitalin and mention its uses. State the health implication of tobacco and cannabis. 6. Name two timber yielding species found in West Bengal. 7. Briefly describe extraction procedure of jute and mention their uses.
6	SEM 5 (H)	BOT-A-DSE-B-5-5-TH PLANT BIOTECHNOLOGY	**Topic: PLANT BIOTECHNOLOGY:** ***Sub Topic: 1.*** **Introduction:** 1.1. Basic concept and milestones, 1.2. Cellular totipotency, 1.3. Tissue culture media, 1.4. Aseptic manipulation, 1.5. Cyto-differentiation and dedifferentiation. ***Sub Topic: 2.*****Callus culture:** 2.1. Callus induction, maintenance and application, 2.2. Suspension culture- introductory idea. ***Sub Topic: 3.*** **Plant regeneration:** 3.1.Organogenesis (direct and indirect), 3.2. Somatic embryogenesis, 3.3. Significance of organogenesis and somatic embryogenesis, 3.4. Artificial seed. ***Sub Topic: 4.*** **Haploid Culture:** 4.1. Anther and Pollen culture methods, 4.2. Applications. ***Sub Topic: 5.*** **Protoplast Culture:** 5.1. Protoplast isolation and culture, 5.2. Protoplast fusion (somatic hybridization), 5.3.	60	1. To know the basic concept of cellular totipotency, aseptic manipulation, 2. To know the method of callus culture and its importance, 3. To know the concept of organogenesis with special reference to somatic embryogenesis, artificial seed, 4. To know the protocol of haploid production and its significance, 5. To know the protocol of protoplast culture and its significance, 6. To know the application of plant genetic engineering in relation to GM crops. 1. What is cellular totipotency? Briefly describe the aseptic manipulation of explant. 2. Briefly describe the method of callus culture and state its application. 3. Briefly describe the method of somatic embryogenesis and

			Significance. ***Sub Topic: 6.*** **Plant Genetic Engineering:** 6.1. Brief concept of different gene transfer methods, special emphasis on Agrobacterium mediated gene transfer, Role of Reporter gene, 6.2. Achievements in crop biotechnology, environment and industry (suitable example)- pest resistant plants (BT cotton), herbicide resistance, disease and stress tolerance, transgenic crop with improved quality (flavr tomato, golden rice), role of transgenic in population degradation (super-bug), leaching of minerals, production of industrial enzymes, oil, edible vaccine.		state the significance of artificial seeds. 4. Write a short note on anther culture/pollen culture. Mention the application of haploid culture. 5. Briefly describe the method of protoplast culture. What is cybrid? 6. Write short note on BT cotton, flavr tomato, and golden rice. 7. What is superbug? Briefly describe the method of leaching of minerals. Write short note on edible vaccine.

Name of Teacher: Prof. Subhasis Saha

Department : Botany

B.sc (Honours and General)

- **Lesson Plan (CBCS System- 2018-2023)**

Topic Serial	Class	Paper & Unit	Name of topic with details of sub-topics	No. of Classes	Learning objective of the course/Question Framing
1	SEM 1(H)	BOTA-CC1-1TH, PHYCOLOGY	**4. Topic**: **Bacillariophyceae:** ***Sub topic***: 4.1. Cell structure, 4.2. Cell division, 4.3. Auxospore formation in Centrales and Pennales. 5. **Topic**: **Life History:** ***Sub topic***: 5.1. Chlamydomonas, 5.2. Oedogonium, 5.3. Chara, 5.4. Ectocarpus, 5.5. Polysiphonia, 5.6.Evolutionary significance of Prochloron.	10	4. To know the unique feature, cell structure of diatoms, 5. Understanding of cell structure, reproduction of the representative of some group of algae to acquire overall knowledge about algae. 1. Draw and describe frustule structure of a pinnate diatom. 2. Describe auxospore formation in centrales and pennales. 3. Draw and describe gametophytic structure of *Chara* and *Ectocarpus.* 4. Describe sexual reproduction of *Oedogonium*. 5. Describe Prefertilisation and post fertilisation development of *Polysiphonia*.
2		BOTA-CC1-1TH, MICROBIOLOGY	**2. Topic: Microbiology:** ***Sub topic:*** 2.4. Bacterial growth curve and generation time, 2.5.Flagella (ultrastructure) & Pilli, 2.6. Cell wall – chemical structure and differences between Gram +ve & Gram – ve bacteria, 2.7. Bacterial genome and plasmid, 2.8. Endospore - formation, structure and function, 2.9.Genetic Recombination (a) Transformation – with special emphasis on Natural and Induced	17	1. Understanding of bacterial cell structure and their component, to know the nature of bacterial endospore and its importance on bacterial survival, 2. To know the genetic recombination and development of new strain of bacteria, 3. Nature of bacterial genetic material

			competence and DNA uptake, (b) Conjugation─ F^- factor, F^+ X F −, Hfr X F^-, concept of F', chromosome mobilization, (c) Transduction– Generalised and specialized.		1. With suitable diagram describe bacterial growth curve. 2. State the chemical nature of bacterial cell wall. 3. Describe the method of endospore formation with diagram. 4. Distinguish Gram+ and Gram- negative bacterial cell wall. 5. With suitable diagram describe horizontal gene transfer in bacteria.
3	SEM 2(H)	BOTA-CC-2-4-TH. ARCHAEGONIATE Bryophyta	**Topic: Bryophyta:** ***Sub Topic:*** **1. General Account :** 1.1. General characteristics and adaptations to land habit, 1.2. Classification (Strotler and Crandle Strotler, 2009) up to class with diagnostic characters and examples. ***Sub Topic:*** **2. Life History:** Gametophyte structure and Reproduction, Development and Structure of sporophyte, Spore dispersal in: 2.1. Marchantia, 2.2. Anthoceros, 2.3. Funaria ***Sub Topic:*** **3. Phylogeny:** 3.1. Unifying features of archaegoniates; transition to land habit, 3.2. Origin of Alternation of Generations (Homologous and Antithetic theory), 3.3. Evolution of Sporophytes (Progressive and Regressive concept), 3.4. Origin of Bryophytes. ***Sub Topic:*****4. Importance :** Role of bryophytes in: 4.1. Plant succession, 4.2. Pollution Monitoring, 4.3. Economic importance of bryophytes with special reference to Sphagnum.	16	1. To know the general characters o amphibian group of plants, Classification with general characters provide idea about Bryophyta, 2. To know about the life history of major group of Bryophyta, 3. To understand the origin of Bryophyta, origin and evolution of gametophyte and sporophyte of amphibian group of plants, 4. To know the importance of Bryophyta in relation to environment. 1. Classify Bryophyta upto Class with characters and examples. 2. Briefly describe the gametophyte and sporophyte structure of *Anthoceros*. State spore dispersal mechanism of the genus. 3. Write short note on homologous and antithetic theory of alternation of generation in Bryophyta. 4. With suitable diagram describe the evolution of sporophyte in Bryophyta. 5. Write short note on role of bryophyte in pollution monitoring and succession.
4	SEM-III (H)	BOT-A-CC-3-6-TH	**Topic: MORPHOLOGY OF ANGIOSPERMS**: ***Sub Topic. 3.*** Fruits and seeds - types with examples.	30	1. To know about the different fruits and its morphology. 1. Discuss different types of dry dehiscent and indehiscent fruits. 2. Briefly describe different types of schizocarpic fruit and fleshy fruit.

5			**Topic: EMBRYOLOGY** ***Sub Topic. 1:*** **Pre-fertilisation changes :** 1.1. Microsporogenesis and Microgametogenesis, 1.2. Megasporogenesis and Megagametogenesis (monosporic, bisporic and tetrasporic). ***Sub Topic. 2:*** **Fertilisation:** 2.1. Pollen germination, 2.2. Pollen tube- growth, entry into ovule and discharge, 2.3. Double Fertilization. ***Sub Topic.*** **3: Post-fertilization changes :** 3.1. Embryogenesis in Capsella, 3.2. Development of Endosperm (3 types). ***Sub Topic.*** **4: Apomixis & Polyembryony:** 4.1. Apomixis- Apospory and Apogamy, 4.2.Polyembryony- different types.		1. To know about the pre fertilisation development in plants, 2. To know the mechanism of fertilisation, 3. To know about the post fertilisation development in plants, 4. To understand abnormal development of gametophyte as well as sporophyte and to know about polyembryony. 1. With suitable illustration describe different types of mega gametogenesis. 2. Describe pollen tube growth and entry of pollen tube into ovule. 3. What is double fertilisation? 4. With suitable diagram describe embryogeny in *Capsella bursa-pastoris*. 5. Write short note on apomixes and polyembryony.
6		BOT-A-CC-3-7-TH	**Topic: TAXONOMY OF ANGIOSPERMS** ***Sub Topic.*** **1: Introduction:** 1.1. Components of Systematic: Nomenclature, Identification, Classification; 1.2. Taxonomy and its phases - Pioneer, Consolidation, Biosystematic and Encyclopaedic; alpha- and omega- taxonomy. ***Sub Topic.*** **2: Nomenclature:** Type method, Publication, Rank of taxa, Rules of priority, Retention and rejection of names, Author Citation, Effective and valid publication, Elementary knowledge of ICN-Principles. ***Sub Topic.*** **3:** Systems of classification: Broad outline of Bentham & Hooker (1862-1883), Cronquist (1988), Takhatajan (1991) - system of classification with merits and demerits. Brief reference of angiosperm phylogeny group (APG III) classification.	22	1. To know about the scope and importance of Taxonomy and its phases, 2. To know the method of nomenclature and its guiding principles, 3. To get comprehensive knowledge about angiosperms various classifications are studied. 1. Briefly describe different phases of taxonomy. 2. State the ICN principles. Enumerate conditions of effective and valid publication. 3. Give broad outline of Bentham and Hooker's system of classification and mention its merits and demerits. 4. Write short note on APG system of classification.
7	SEM 4(H)		**Topic: Genetics**	40	1. To know the concept of Mendelian genetics,

		BOT-A-CC-4-10-TH GENETICS	***Sub Topic: 1.*** **Introduction:** Mendelian genetics and its extension ***Sub Topic: 2.*** **Linkage, Crossing over and Gene Mapping:** 2.1.Complete and incomplete linkage (example), linked gene does not assort independently (example), linkage group, 2.2. Crossing over, crossing over produces recombination (example), detection of crossing over (McClintock's experiment), and 2.3.Molecular mechanism of crossing over (Holliday model), 2.4. Gene mapping with three point test cross, detection of middle gene in three point test cross, calculation of recombination frequencies, 2.5. Co-efficient of coincidence and interference, mapping function, 2.6. Problems on gene mapping, 2.7. Molecular mapping – ISH, FISH (brief idea). ***Sub Topic: 3.*** Epistasis and Polygenic inheritance in plants. ***Sub Topic: 4.*** Aneuploidy and Polyploidy: Types, examples, meiotic behaviour and importance of: 4.1. Aneuploidy, 4.2. Polyploidy, 4.3. Speciation and evolution through polyploidy. ***Sub Topic: 5.*** **Chromosomal aberration:** Types and meiotic behaviour of: 5.1. Deletion, 5.2. Duplication, 5.3. Translocation, and 5.4. Inversion.		2. To understand complete and incomplete linkage, to know the discovery of cytological cytological basis of crossing over, mechanism of crossing over, To perform three point test cross mapping, 3. To know the concept of epistasis and polygenic inheritance, 4. To gain knowledge about aneuploidy and euploidy, to understand the meiotic behaviour in aneuploidy and euploid cells, 5. To know the various type of chromosomal abnormalities and its meiotic behaviour. 1. What is test cross? Distinguish complete and incomplete linkage. 2. Describe cytological basis of crossing over. 3. With suitable diagram describe molecular basis of crossing over. 4. Write short note on ISH and FISH. 5. Briefly describe types, meiotic behaviour in trisomic. 6. Describe the role of amphidiploidy in the evolution of crop citing suitable example. 7. With proper diagram describe the mechanism of reciprocal translocation and comment on the fate of fertility of gametes.
8	SEM 5 (H)	BOT-A-CC-5-11-TH CELL AND MOLECULAR BIOLOGY	**Topic: CELL BIOLOGY:** ***Sub Topic: 1.*** **Origin and Evolution of Cells:** 1.1. Evolution of nucleic acid (from PNA to DNA), Concept of RNA world, Ribozymes, First cell, 1.2. Origin of eukaryotic cell (endosymbiotic theory), 1.3. Small RNA- riboswitch, RNA interference, si RNA, mi RNA- brief	18	1. To know the early development of cell and genetic material in ancient earth, To understand different types of RNA and its function, 2. To know the ultra-structure of nucleus and genetic material and chromosome, 3. To understand the mechanism of cell cycle and its regulatory method.

			idea, 1.4.Organellar DNA (cp- and mt-DNA). ***Sub Topic: 2.*** **Nucleus and Chromosome:** 2.1. Nuclear envelope, Nuclear lamina and Nuclear pore complex, 2.2. Nucleolus-ultrastructure and ribosome biogenesis, 2.3. Chromatin ultrastructure and DNA packaging in eukaryotic chromosome, 2.4. Centromere: types, structure and function. ***Sub Topic:*** *3.* **Cell cycle and its regulation:** 3.1. Kinetochore and spindle apparatus-structural organization and functions, 3.2.Microtubules-structure, organization and function, 3.3. Mechanism of cell cycle control in Yeast (checkpoints and role of MPF), Apoptosis (Brief idea).		1. What is RNA world? Briefly describe origin of eukaryotic cell based on endosymbiotic theory. 2. Write short note on riboswitch and si RNA. 3. Write short note on cp and mt DNA. 4. With suitable diagram describe nuclear membrane structure. Describe the development of DNA packaging to form metaphasic chromosome. 5. Write short note on kinetochore. 6. State the mechanism of cell cycle regulation in yeast. What is apoptosis?

Name of Teacher: Dr. Mithun Maji

Department : Botany

B.sc (Honours and General)

- **Lesson Plan (CBCS System- 2018-2023)**

Topic Serial	Class	Paper & Unit	Name of topic with details of sub-topics	No. of Classes	Learning objective of the course/Question Framing
1	SEM 1(H)	BOTA-CC1-1TH, MICROBIOLOGY	**1. Topic**: **Virus:** ***Sub topic***: 1.1. Discovery, 1.2.Plant virus- types, 1.3. Transmission and translocation of Plant virus, 1.4. TMV-Physicochemical characteristics and Multiplication, 1.5. One step growth curve, 1.6. Lytic cycle (T4 phage) and Lysogenic cycle (Lambda phage), Significance of lysogeny, 1.7.Viroids and Prions. **2. Topic: Bacteria:** ***Sub topic***: 2.1. Discovery, .2.2. Distinguishing features of Archaea and Bacteria, 2.3. Characteristics of some major groups: Proteobacteria (Enterobacteria), Firmicutes, Mollicutes, Actinobacteria, Spirochaetes, Chlamydiae,	13	1. To know the concept of virus, structure of plant virus and its unique multiplication system, to know the method of lytic and lysogenic cycle, importance and concept of viroid and prions. 2. To acquire knowledge on structure of bacterial diversity and their importance in environment and disease.
					1. Write short note on transmission and translocation of plant virus. 2. State physicochemical characters of TMV. 3. Describe lytic cycle of lambda phage. Distinguish lytic and lysogenic replication cycle. 4. Distinguish archaea and bacteria. State salient features of major groups of bacteria.
2	SEM-II (H)	BOT-A-CC-2-3-TH, CC-3 Plant Anatomy	**Topic: ANATOMY:** ***Sub Topic:*** **5. Secondary growth:** 5.1. Normal (intra- & extra-stelar), 5.2. Anomalous (stem of Bignonia, Boerhavia, Tecoma, Dracaena and root of Tinospora). ***Sub Topic:*** **6**. Mechanical tissues and the Principles governing their distribution in plants. ***Sub Topic:*** **7. Developmental Anatomy:** 7.1. Organisation of shoot apex (Tunica–Corpus) and Root apex (Korper-Kappe), 7.2. Plastochrone. ***Sub Topic:*** **8. Ecological Anatomy:**	36	5. To know the internal organisation of perennial woody dicot plant exhibiting normal and abnormally grown secondary growth, 6. To understand the role of mechanical tissue and their role to provide mechanical support to the plants, 7. To know root and shoot apex organisation, 8. To understand anatomical adaptation in hydrophytes and xeroophytes,

			Adaptive anatomical features of 8.1. Hydrophytes, 8.2. Xerophytes. ***Sub Topic:*** **9. Scope of plant anatomy:** application in systematics, forensics and pharmacognosy.		9. Scope of plant anatomy 1. Draw and describe inra and extra stellar secondary growth in a woody dicot stem. 2. Draw and describe abnormal secondary growth in *Bignonia* stem. 3. What is mechanical tissue? State the principles governing the distribution of mechanical tissue in plants. 4. Write short note on root apex and shoot organisation in angiosperms. 5. Write short note on anatomical adaptation of hydrophytes and xerophytes. 6. Briefly describe application of anatomy in forensic science and in pharmacognosy.
3	SEM 3 (H)	BOT-A-CC-3-5-TH Palaeobotany, Palynology	***Sub topic:*** **6. Palynology:** 6.1. Spore and Pollen, 6.2. Pollen aperture types, 6.3. NPC classification (Erdtman). 6.4. Pollen wall- Sporopollenin, Stratification and Ornamentation (sculpturing). ***Sub topic:*** **7. Applied Palynology:** Basic concepts of: 7.1. Palaeopalynology, 7.2. Aeropalynology, 7.3. Forensic palynology, 7.4. Melissopalynology.	18	1. To get basic knowledge of palynology, to understand applied aspects of palynology 1. Discuss NPC system of classification, With suitable diagram state sporoderm stratification and ornamentation, 2. Write short note on Aeropalynology and forensic palynology.
4.	SEM-IV (H)	BOT-A-CC-4-8-TH PLANT GEOGRAPHY, ECOLOGY AND EVOLUTION	**Topic: EVOLUTION** ***Sub Topic: 1.*** 1.1 Introduction, 1.2. Theories of evolution: Natural selection, Group selection, Neutral theory of molecular evolution, 1.3. Phyletic gradualism, Punctuated equilibrium and Stasis ***Sub Topic: 2.*** 2.1 Brief idea on: Stabilizing directional, disruptive and sexual selection; Speciation:	16	1. To understand the basic concept of evolution of biological species and relevant theories and hypothesis, 2. To know the different types of selection and speciation, 3. To get the general idea of phylogeny of different group of plants.

			Sympatric and allopatric speciation; Coevolution, Adaptive radiation, Reproductive isolation ***Sub Topic: 3.*** 3.1. Simplified phylogeny of bacteria, algae, fungi, bryophyte, pteridophyte and gymnosperm, 3.2. Phylogenetic tree.		1. What do you mean by group selection? 2. Write short note on neutral theory of molecular evolution and punctuated equilibrium. 3. Briefly describe disruptive and sexual selection. 4. Write short note on phylogenetic tree.
5	SEM-V (H)	BOT-A-CC-5-11-TH CELL AND MOLECULAR BIOLOGY	**Topic: MOLECULAR BIOLOGY.** ***Sub Topic: 2.*** **Gene Regulation:** 2.1 Concept of Lac-operon, 2.2. Positive and negative control. ***Sub Topic: 3.*** **Genetic Code:** 3.1Properties-evidences & exceptions, 3.2. Decipherence of codon (Binding technique). ***Sub Topic: 4.*** **Recombinant DNA Technology:** 4.1. Restriction endonuclease, -types and roles, 4.2. Vector (plasmid pBR 322), 4.3. Marker gene, 4.4. Steps of cloning technique, 4.5. PCR and its application, 4.6. Genomic DNA and cDNA library. ***Sub Topic: 5.*** Development and causes of Cancer (in general and brief), tumor suppressor gene and oncogene.	22	1. 1. To know the concept of gene regulation, 2. To understand the nature and properties of genetic code, 3. To get knowledge about the concept of recombinant DNA technology, To know the various enzymes and tools of recombinant DNA technology. 1. Briefly describe positive and negative control of lac-operon. 2. State the properties of genetic code. Write the decipherence of genetic code. 3. Write short note on pBR322 and gene cloning. 4. Distinguish genomic DNA and cDNA library. 5. Write short note on development and causes of cancer.
6.		BOT-A-CC-5-12-TH BIOCHEMISTRY	**Topic: BIOCHEMISTRY** ***Sub Topic: 3.*** **Energy flow and enzymology:** 3.1. Bioenergetics-Thermodynamic principles; free energy; energy rich bonds- phosphoryl group transfer and ATP; redox potentials and Biological redox reactions, 3.2. Enzymes – classification and nomenclature (IUBMB); Co-factors and co-enzymes; isozymes, 3.3. Mechanism of enzyme action; enzyme inhibition; 3.4. Enzyme kinetics (Michaelis- Menten equation) and simple problems. ***Sub Topic: 4.*** **Cell membrane:** 4.1. Membrane chemistry, 4.2. Membrane transport (uniport, symport, antiport), mechanism of ion uptake. ***Sub Topic: 5.*** **Phosphorylation:** ATP Synthesis- Chemiosmotic model, Oxidative and Photophosphorylation- Mechanism and differences.	30	1. To know basic and fundamental aspects of energy flow and ezymology (classification and nomenclature) and kinetics of enzyme, 2. To know the structure and function of biological membrane. 3. To understand the mechanism of ATP synthesis based on chemiosmotic model. 1. State the principles of thermodynamics. What is free energy? 2. Briefly state the classification and nomenclature of enzyme. 3. With suitable diagram describe the membrane chemistry. 4. Briefly describe the method of photophosphorylation/oxidative phosphorylation.

Name of Teacher: Dr. Joy Sarkar

Department : Botany

B.sc (Honours and General)

- **Lesson Plan (CBCS System- 2018-2023)**

Topic Serial	Class	Paper & Unit	Name of topic with details of sub-topics	No. of Classes	Learning objective of the course/Question Framing
1	SEM 1(H)	MYCOLOGY AND PHYTO-PATHOLOGY (BOT-A-CC-1-2-TH): MYCOLOGY	**Topic**: **Mycology:** ***Sub topic***: **1. General Account:** 1.1. Hyphal forms, 1.2. Fungal spore forms and mode of liberation, 1.3. Sexual reproduction and degeneration of sex, 1.4. Parasexuality and sexual compatibility, 1.5. Life cycle patterns. ***Sub topic:*** **2. Classification:** 2.1. Classification of Fungi (Ainsworth, 1973) upto sub-division with diagnostic characters and examples. 2.2. General characteristics of Myxomycota, Oomycota, Zygomycota, Ascomycota, Basidiomycota, Deuteromycota. ***Sub topic:*** **3. Life history:** 3.1. Synchytrium, 3.2. Rhizopus, 3.3. Ascobolus, 3.4. Agaricus. ***Sub topic:*** **4. Mycorrhiza:** 4.1. Types with salient features, 4.2. Role in Agriculture & Forestry. ***Sub topic: 5:*** **Lichen:** 5.1. Types, 6.2. Reproduction, 6.3. Economic and ecological importance	30	1. To know the genral concept of fungus and its structure in relation to thallus and reproductive structure. 2. To know the characters with example of different sub division of fungus. 3. To acquire knowledge about the life history of some fungus of some major sub division. 4. To know about the types and importance of mycorrhiza. 5. To know about the types and importance of lichen.
					1. State different hyphal forms of fungi. 2. State different spore forms of fungi with example. 3. Classify fungi up to sub division with characters. 4. Draw and describe sexual reproduction of *Rhizopus* and *Ascobolus*. 5. Describe life cycle of *Synchitrium*. 6. Describe structure and development of basidiocarp of *Agaricus*. 7. State the types and role of mycorrhiza in agiculture and forestry.

					8. State the types and importance of lichen.
2.	SEM-II (H)	BOT-A-CC-2-3-TH, CC-3 Plant Anatomy	***Sub Topic: 1.*** **Cell wall:** 1.1. Ultrastructure & Chemical constituents, 1.2. Plasmodesmata-ultrastructure, 1.3. Concept of Apoplast and Symplast, 1.4. Growth and Thickening of cell wall. ***Sub Topic:*** **2. Stomata:** 2.1. Types (Metcalfe and Chalk, Stebbins and Khush) ***Sub Topic:*** **3. Stele:** 3.1 Leaf-trace and leaf-gap, 3.2. Stelar types & evolution ***Sub Topic:*** **4. Primary structure of stem and root**- Monocot and Dicot. Leaf- dorsiventral and isobilateral.	24	1. To know the structure of plant cell wall, 2. To know the stomata and its structure and types, 3. To understand internal organisation of plant axes with special reference to stele, 4. To acquire knowledge about the primary structure of root, stem and leaves, 1. Describe ultruscture of plant cell wall with suitable diagram. 2. State chemical constituents of cell wall. 3. Draw and describe stomata according to Metcalfe and Chalk/Stebbins and Khush 4. Draw and describe protostele and siphonostele and state their evolutionary pattern. 5. Distinguish monocot and dicot root and monocot and dicot stem.
3	SEM 3 (H)	BOT-A-CC-3-5-TH Palaeobotany, Palynology	**Topic: Palaeobotany** ***Sub topic: 4.*** **Fossil gymnosperms:** Structural features and Geological distribution of reconstructed genera: 4.1. Lyginopteris, 4.2. Williamsonia, 4.3.Cordaites. ***Sub topic:*** **5. Indian Gondwana System**: - Three fold division with major megafossil assemblages.	16	1. To know morphological study and evolutionary significance of major Gymnospermic fossils, 2. To understand major megafossil assemblage in Indian Gondwana system.
					5. Draw and describe vegetative and reproductive features of *Williamsonia sewardiana* (reconstructed after Prof. B. Sahani).

					6. State three fold system of Indian gondwana system with major megafossil assemblages.
4	SEM-IV (H)	BOT-A-CC-4-8-TH PLANT GEOGRAPHY, ECOLOGY AND EVOLUTION	**Topic: PLANT GEOGRAPHY** ***Sub Topic:* 1. Phytogeographical regions:** 1.1. Phytogeographical regions of India (Chatterjee 1960); 1.2. Dominant flora of Eastern Himalaya, Western Himalaya and Sunderban. ***Sub Topic:* 2. Endemism:** 2.1 Endemic types and Factors; 2.2. Age & Area hypothesis and Epibiotic theory; 2.3. Endemism in Indian flora.	14	1. To understand the general vegetation pattern in India, To known the vegetation pattern of Himalaya, 2. To understand the concept of endemism, and endemism in Indian flora. 1. Enumerate different phytogeographical regions of India according to D. Chatterjee (1960). 2. Briefly state vegetation of Eastern Himalaya. 3. State the factors and types of endemism. Write short note on endemism of Indian flora.
5.		BOT-A-CC-4-10-TH GENETICS	**Topic: GENETICS** ***Sub Topic: 6.* Mutation :** 6.1. Point mutation-Transition, Transversion and Frame shift mutation, 6.2. Molecular mechanisms (tautomerisation, alkylation, deamination, base analogue incorporation, dimerisation), 6.3. DNA repair (brief idea). ***Sub Topic: 7.* Structural organisation of Gene:** 7.1. One Gene–one polypeptide concept, 7.2. Split gene, 7.3. Overlapping gene, 7.4. Repetitive DNA- tandem and interspersed, 7.5. Transposon (Ac-Ds system), 7.6. Homoeotic gene in plants (ABCE (Quartet model of flowering).	20	1. To know the molecular mechanism of mutation and repair, 2. To know the structural and functional aspects of gene, *viz.* repeated DNA, Ac-Ds system, ABCE model *etc.* 1. Distinguish transition and transversion mutation. State molecular mechanism of tautomerisation and base analogue incorporation. 2. Write short note on one gene one polypeptide and overlapping gene. 3. Briefly describe ABCE model.
5	SEM-V (H)	BOT-A-CC-5-11-TH CELL AND MOLECULAR BIOLOGY	**Topic: MOLECULAR BIOLOGY** **Sub Topic: 1. DNA Replication, Transcription and Translation (Prokaryotes & Eukaryotes):** 1.1. Central Dogma, 1.2. Semiconservative DNA replication – mechanism, enzymes involved in DNA replication- DNA polymerase, DNA gyrase, Helicase, Ligase, primase and other accessory proteins,		1. To know the basic procedure of central dogma that is replication, transcription and translation and role subsequent enzymes in the process, to understand the mechanism replication at the end of chromosome, to know the processing of RNA after transcription, to know aminoacylation during translation.

			1.3. Eukaryotic replication with special reference to replication licensing factor, assembly of new nucleosome, replication at the end chromosome telomere, telomerase concept, 1.4. Fidelity of DNA replication- prokaryote: nucleotide selection, proof reading, mismatch repair; eukaryote: through selection of error prone DNA polymerase, 1.5.Transcription, 1.6 RNA processing, 1.7. Aminoacylation of tRNA, 1.8. Translation.		1. Briefly describe initiation and elongation of prokaryotic DNA replication mentioning the role of different enzymes. 2. Briefly state the mechanism of initiation of eukaryotic DNA replication. 3. Write short note on assembly of new nucleosome in eukaryotic replication. 4. Describe the mechanism of prokaryotic transcription and RNA processing. 5. Briefly describe initiation and elongation process of prokaryotic translation.
6.		BOT-A-CC-5-12-TH BIOCHEMISTRY	**Topic: Biochemistry:** ***Sub Topic. 1:*** **Biochemical Foundations:** 1.1. Covalent and non-covalent bonds; hydrogen bond; Van der Waal's forces; 1.2. Structure and properties of water; 1.3. pH and buffer (inorganic and organic); 1.4. Handerson-Hasselbalch equation; 1.5. Isoelectric point. ***Sub Topic. 2.*** **Molecules of life:** 2.1. Nucleic Acids – structure of nucleosides and nucleotides ; oligo- and poly nucleotides , B & Z form of DNA, RNA- different forms; nucleotide derivatives (ATP, NADP), 2.2. Proteins – structure and classification of amino acids; primary, secondary, tertiary and quaternary structure of proteins; 2.3. Carbohydrates - structure of mono-, di- and polysaccharide; stereoisomers, enantiomers and epimers; 2.4. Lipids - structure of simple lipid and compound lipid (phospholipids and glycolipids), fatty acids- saturated and unsaturated.	30	

Name of Teacher: Dr. Rupa Chakraborty

Department : Botany

B.sc (Honours and General)

- **Lesson Plan (CBCS System- 2018-2023)**

Topic Serial	Class	Paper & Unit	Name of topic with details of sub-topics	No. of Classes	Learning objective of the course/Question Framing
1	SEM 1(H)	MYCOLOGY AND PHYTO-PATHOLOGY (BOT-A-CC-1-2-TH): PATHOLOGY	**Topic**: **Phyto Pathology:** ***Sub topic***:**1. Terms and Definitions**: 1.1. Disease concept, 1.2. Symptoms, 1.3. Etiology & causal complex, 1.4. Primary and secondary inocula, 1.5. Infection, 1.6. Pathogenecity and pathogenesis, 1.7. Necrotroph and Biotroph, 1.8. Koch's Postulates, 1.9. Endemic, Epidemic, Pandemic and Sporadic disease, 1.10. Disease triangle, 1.11. Disease cycle (monocyclic, polycyclic and polyetic). ***Sub topic:*** **2. Host – Parasite Interaction:** 2.1. Mechanism of infection (Brief idea about Pre-penetration, Penetration and Post-penetration), 2.2. Pathotoxin (Definition,criteria and example), 2.3. Defense mechanism with special reference to Phytoalexin, 2.4. Resistance-Systemic acquired and Induced systemic. ***Sub topic:*** **3. Plant Disease Management:** Quarantine, 3.2. Chemical, 3.3. Biological, 3.4. Integrated.	30	1. To know the genral terms and definition of plant pathology. 2. To know the mechanism of infection by pathogen and method of defence by plants, To know the function of pathotoxin and phytoalexins. 3. To acquire knowledge about the different method of plant disease management. 4. To know the symptoms, general method of disease cycle and management of late blight of potato, brown spot of rice, and black stem rust of wheat and stem rot of jute. 1. What is etiology and causal complex? 2. Write short note on disease cycle and disease triangle. 3. Briefly describe prepenetration and penetration mechanism of infection.

			***Sub topic:* 4. Symptoms , Causal organism, Disease cycle and Control measures of:** 4.1. Late blight of Potato, 4.2. Brown spot of rice, 4.3. Black stem rust of wheat, 4.4. Stem rot of jute.		4. Describe biochemical method of plant defence mechanism. 5. What do you mean by ISR and SAR? Discuss chemical and biological method of plant disease management. 6. State symptoms, causal organism, disease cycle and control measures of Late Blight disease of Potato.
2	SEM II (H)	BOTA-CC-2-4-TH. ARCHAEGONIATE CC-4 Gymnosperms	**Topic: GYMNOSPERMS** ***Sub Topic: 1.*** Classification of vascular plants by Gifford & Foster (1989) up to division (Progymnospermophyta to Gnetophyta) with diagnostic characters and examples. ***Sub Topic: 2.* Progymnosperms :** Diagnostic characters of the group, 2.2.Vegetative and reproductive features of Archeopteris, 2.3. Phylogenetic importance. ***Sub Topic: 3:* Life History :** Distribution in India; Vegetative and Reproductive structure of sporophyte, Development of gametophyte in : 3.1. Cycas , 3.2. Pinus and 3.3. Gnetum. ***Sub Topic: 4:*** Economic Importance with reference to Wood, Resins, Essential oils, and Drugs.	22	1. To know the different group of Gymnosperms, 2. To know the primitive gymnosperms –like *Archaeopteris* and its phylogenetic importance, 3. To know the life history of major group of living gymnosperms by the study of *Cycas*, *Pinus* and *Gnetum*, 4. Economic importance of gymnosperms 1. Classify gymnosperm upto class with suitable characters and examples. 2. Describe vegetative and reproductive structure of *Archaeopteris*. 3. Draw and describe male and female reproductive structure of *Pinus*. Draw and describe male and female gametophytic development of the genus. 4. Briefly describe economic importance of gymnosperms.
3	SEM 3 (H)	BOT-A-CC-3-5-TH Palaeobotany, Palynology	**Topic: Geological time scale:** ***Sub topic: 1***. Geological time scale with dominant plant groups through ages. ***Sub topic: 2***. **Topic Plant Fossil:** 2.1. Types: Body fossil (Micro- and Megafossils), Trace fossil, Chemical fossil, Index fossil, 2.2. Different modes of preservation (Schopf, 1975), 2.3. Conditions favouring fossilization, 2.4.	28	3. Understanding of geological time scale, 4. To get general idea of fossils, types and modes of preservation, Naming and classification of fossils, 5. To know morphological study and evolutionary significance of major Pteridophytic fossils.

			Nomenclature and Reconstruction, 2.5. Principle of fossil dating (a brief idea), 2.6.Importance of fossil study. ***Sub topic: 3*.** **Fossil Pteridophytes:** Structural features, Geological distribution and Evolutionary significance of 3.1. Rhynia, 3.2. Lepidodendron (Reconstructed), 3.3. Calamites (Reconstructed).		1. Enumerate geological time scale mentioning characters and age of period. 2. State different type of macrofossil with examples. 3. Describe modes of preservation and conditions of fossilisation. 4. Draw and describe vegetative and reproductive features of *Lepidodendron. Mention its evolutionary significance.*
4.	SEM-IV (H)	BOT-A-CC-4-8-TH PLANT GEOGRAPHY, ECOLOGY AND EVOLUTION	**Topic: ECOLOGY** ***Sub Topic:* 1. Preliminary idea on:** 1.1. Habitat and Niche, 1.2. Ecotone and edge–effect, 1.3. Microclimate, 1.4. Ecads, ecotype and ecoclines, 1.5. Carrying capacity. ***Sub Topic: 2*. Community ecology:** 2.1. Community-Characteristics and diversity, 2.2. Ecological succession –Primary and secondary, Seral stages (with reference to Hydrosere), autogenic and allogenic succession. ***Sub Topic: 3.*** 3.1. Plant indicators (metallophytes); 3.2. Phytoremediation. ***Sub Topic:* 4. Conservation of Biodiversity:** 4.1. Level of Biodiversity: genetic, species & ecosystem diversity, 4.2. Biodiversity hot spots- criteria, Indian hotspots, 4.3. In- situ and ex-situ conservation, 4.4. Seed-banks, 4.5. Cryopreservation	30	1. To know the basic concept of ecology, carrying capacity, 2. To understand the concept of community ecology and succession, 3. Importance of plants as indicator specially metal indicator and method of phytoremediation. 4. To explore basic method of plant conservation. 1. Write short note on microclimate and carrying capacity. 2. Characterise natural community. With suitable diagram and examples describe hydrophytic succession. 3. Write short note on phytoremediation. 4. Briefly describe the method of *ex-situ* and *in-situ* conservation. 5. Write short note on seed bank and cryopreservation.
4.	SEM-IV (H)	BOT-A-CC-4-9-TH ECONOMIC BOTANY	**Topic: Economic Botany:** ***Sub Topic: 1*. Origin of cultivated crops:** Concepts of centre 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.	12	1. To know the centre of origin of different economically used plants, concept of domestication and consequences, 2. To acquire knowledge on morphology, processing and uses of cereals, 3. To acquire knowledge on morphology, processing and importance of legumes.

			Sub Topic: 2*.** **Cereals:** Rice and wheat (origin, morphology, processing and uses). ***Sub Topic: 3. **Legumes:** Origin, morphology and uses of gram and mung bean. Importance to man and Environment.		1. Enumerate different centre of origin as proposed by I. Vavilov with examples. 2. Briefly describe the morphology, processing and uses of paddy/wheat. 3. State the origin of chick pea and Moong. Briefly state their uses and mention their importance in relation to environment.
5.	SEM-V (H)	**BIOSTATISTICS (BOT-A-DSE-A-5-1-TH)**	**Topic: BIOSTATISTICS** ***Sub Topic: 1.*** Biostatistics: Definition, statistical methods, basic principles, variables-measurements, functions, limitations and uses of statistics. ***Sub Topic: 2.*** **Biometry:** Data, Sample, Population, Random sampling, Frequency distribution-definition only. ***Sub Topic: 3.*** **Central tendency–** Arithmetic Mean, Mode and Median; Measurement of dispersion-Coefficient of variation, Standard Deviation, Standard error of Mean. ***Sub Topic: 4.*** **Test of significance:** chi- square test for goodness of fit. ***Sub Topic: 5.*** **Probability-** multiplicative and additive rules of probability: application and importance. ***Sub Topic: 6.*** **Measurement of gene frequency:** Hardy-Weinberg equilibrium- conditions applied for its implications (simple problems to calculate genotypic and allelic frequencies).	60	1. To know the different terms of biostatistics and its importance in biology, 2. To know the concept of data, population, sampling. 3. To know the idea of central tendency by practising statistical problems, 4. To understand test of significance by practising problems, 5. To know the basic concept and theorem of probability, 6. To get knowledge about population genetics. 1. State the functions and limitations of statistics. 2. What is data and sampling? What do you mean by frequency distribution? 3. Briefly state mean, median and mode citing suitable examples. 4. With a suitable example describe chi-square test of goodness of fit. 5. State the theories of probability citing suitable examples. 6. Discuss the the Hardy-Weinberg equilibrium and state the conditions applied for its implications.