

J. K. College, Purulia

Department: Botany

MODULE AND LESSON PLAN For the academic session 2020-2021

Name of the Faculty: Dr. Rimi Roy

*** All the classes/tests/activities to be performed in online mode only**

COURSE	MODULE	NO. OF CLASSES (1 hour/ class duration)	LESSON PLAN
SEM I HONOURS			
Microbiology	Unit 1: Introduction to microbial world		For each topic, lesson plan is prepared in the following way: - Objectives of the topic - Discussion of core points - Student assessment by oral questions - Sum up - Study material (MS PPT soft copy) supplied - Learning resources (Books/Journals/Websites/others) are informed MCQ test (duration: 1 hour/test) Activities: - Report writing presentation by students
	1. Microbial nutrition - autotrophy and heterotrophy, sub divisions with examples	1	
	2. Growth and metabolism - different phases, growth curve, diauxic growth, metabolism	1	
	3. Economic importance of viruses with reference to vaccine production	1	
	4. Role of viruses in research, medicine and diagnostics	1	
	5. Role of viruses as causal organisms of plant diseases	1	
	6. Economic importance of bacteria with reference to their role in agriculture	1	
	7. Economic importance of bacteria with reference to their role in industry (fermentation and	1	

	medicine-antibiotics, sources etc.)		
	Unit 2: Viruses Discovery		
	1. Physiochemical and biological characteristics	1	
	2. Classification (Baltimore)	1	
	3. General structure	1	
	4. Viroids – structure, host, mode of replication, importance etc.	1	
	5. Prions - structure, host, mode of replication, importance etc.	1	
	6. DNA virus (T4-phage), RNA virus (TMV) - ultrastructure	1	
	7. Lytic and lysogenic cycle	1	
	Unit 3: Bacteria		
	1. Discovery – historical background; General characteristics	1	
	2. Archaeobacteria and Eubacteria - types, general features, examples, comparison between Archaea, Bacteria and Eukarya	1	

	3. Wall-less forms (mycoplasma and spheroplasts);	1	
	4. Cell structure – cell morphology, external layers,	1	
	5. Cell wall, cell ultrastructure,	1	
	6. Cell inclusions, nucleoid, flagella	1	
	7. Nutritional types; vegetative and Reproductive structure - asexual	1	
	8. Recombination: Transformation – natural and artificial	1	
	9. Conjugation – F ⁺ and F ⁻ , H ^{fr} and F ⁻ , F' and F ⁻	1	
	10. Transduction – generalized and specialised	1	
SEM I GENERIC ELECTIVE			
Taxonomy	Unit 7 Identification		For each topic, lesson plan is prepared in the following way: • Introduction of the topic • Discussion of core points • Student assessment by oral questions • Sum up • Study material (MS PPT soft copy) supplied • Additional learning resources (Books/Journals/Websites/others) are informed MCQ test (duration: 1 hour/test)
	1. Herbarium Definition, preparation	1	
	2. Functions of Herbarium, important herbaria and botanical gardens of the world and India	1	
	3. Documentation: Flora- definition, types, examples	1	
	4. Keys: single access and multi-access		
	Unit 9 Taxonomic hierarchy		
	1. Definition, Ranks, categories	1	
	2. taxonomic groups	1	
	Unit 10 Botanical nomenclature		

	1. Principles and rules (ICN)	1	
	2. Ranks and names	1	
	3. binominal system, typification	1	
	4. Author citation, valid publication	1	
	5. Rejection of names	1	
	6., Principle of priority and its limitations	1	
	Unit 12 Biometrics, numerical taxonomy and cladistics		
	1. Characters; variations; OTUs	1	
	2. Character weighting and coding	1	
	3. Cluster analysis	1	
	4. Phenograms, cladograms (definitions and differences).	1	

SEM II HONOURS

Archegoniatae and Palaeobotany	Unit 4: Pteridophytes		For each topic, lesson plan is prepared in the following way: • Introduction of the topic • Discussion of core points • Student assessment by oral questions • Sum up • Study material (MS PPT soft copy) supplied • Additional learning resources (Books/Journals/Websites/others) are informed MCQ test (duration: 1 hour/test) Activities: • Report writing presentation by students
	1. General characteristics	1	
	2. Classification (Smith, 2006)	1	
	3. <i>Cooksonia</i> : introduction, systematic position, geological age and geographical distribution, morphology, reproductive structure	1	
	4. <i>Rhynia</i> : introduction, systematic position, geological age and geographical distribution, morphology, anatomy, reproductive structure, reconstruction	1	
	Unit 5: Type Studies- Pteridophytes		
	1. <i>Psilotum</i> :	1	

	introduction, systematic position, geological age and geographical distribution, morphology, anatomy, reproductive structure, life cycle		
	2. <i>Selaginella</i> : introduction, systematic position, geographical distribution, morphology, anatomy	1	
	3. <i>Selaginella</i> : reproductive structure, life cycle, heterospory	1	
	4. <i>Equisetum</i> : introduction, systematic position, geographical distribution, morphology, anatomy	1	
	5. <i>Equisetum</i> : reproductive structure, life cycle, incipient heterospory	1	
	6. <i>Pteris</i> : introduction, systematic position, geographical distribution, morphology, anatomy reproductive structure, life cycle	1	
	7. Apogamy, and apospory, heterospory and seed habit	1	
	8. Telome theory	1	
	9. Stelar evolution	1	
	10. Ecological and economic importance	1	
	Unit 7: Palaeobotany		
	1. Plant life through ages	1	
	2. Geological time table	1	
	3. Fossils - definition, types	1	
	4. Process of fossilization	1	

	5. Factors for fossilization,	1	
	6. Importance of fossil	1	
SEM II GENERIC ELECTIVE			
Plant Physiology and Metabolism	Unit 1: Plant-water relations		For each topic, lesson plan is prepared in the following way: • Introduction of the topic • Discussion of core points • Student assessment by oral questions • Sum up • Study material (MS PPT soft copy) supplied • Additional learning resources (Books/Journals/Websites/others) are informed MCQ test (duration: 1 hour/test)
	1. Importance of water, water potential and its components	1	
	2. Transpiration- types, stomatal structure and movement,	1	
	3. Significance of transpiration, it is necessary evil; Factors affecting transpiration	1	
	4. Root pressure and guttation	1	
	Unit 3: Translocation in phloem		
	1. Source and sink, phloem components, Composition of phloem sap, girdling experiment	1	
	2. Pressure flow model	1	
	3. Phloem loading and unloading- apoplast and symplast	1	
	Unit 7: Nitrogen metabolism		
	1. Biological nitrogen fixation, N ₂ fixing bacteria, nitrogenase enzyme complex,	1	
	2. Root nodule formation by bacteria	1	
	3. Nitrate assimilation, nitrate and nitrite reductase	1	
	4. Ammonia assimilation, GS-GOGAT pathway	1	
SEM III HONOURS			
Anatomy of Angiosperms	Unit 4: Vascular Cambium and Wood		For each topic, lesson plan is prepared in the following way:

	1. vascular cambium, fascicular and inter-fascicular cambium, origin, structure, function and seasonal activity	1	• Introduction of the topic • Discussion of core points • Student assessment by oral questions • Sum up • Study material (MS PPT soft copy) supplied • Additional learning resources (Books/Journals/Websites/others) are informed MCQ test (duration: 1 hour/test) Activities: • Report writing presentation by students
	2. Secondary growth in root	1	
	3. Secondary growth in stem, growth ring	1	
	4. Cork cambium, periderm structure	1	
	5. Anomalous secondary growth in <i>Bignonia</i>	1	
	6. Anomalous secondary growth in <i>Boerhaavia</i>	1	
	7. Anomalous secondary growth in <i>Aristolochia</i>	1	
	8. Anomalous secondary growth in <i>Dracaena</i>	1	
	9. Axially and radially oriented elements; Types of rays and axial parenchyma	1	
	10. reaction wood; Sapwood and heartwood	1	
	11. Ring and diffuse porous wood; Early and late wood, tyloses	1	
	12. Development and composition of periderm	1	
	13. rhytidome and lenticels	1	

SEM IV HONOURS			
Plant Systematics	Unit 2: Taxonomic hierarchy		For each topic, lesson plan is prepared in the following way: - Objectives of the topic - Discussion of core points - Student assessment by oral questions - Sum up - Study material (MS PPT soft copy) supplied - Learning resources (Books/Journals/Websites/others) are informed MCQ test (duration: 1 hour/test) Activities: - Report writing presentation by students
	1. Concept of taxa (family, genus, species)	1	
	2. Categories and taxonomic hierarchy	1	
	3. Species concept (taxonomic)	1	
	4. Species concept (biological)	1	
	5. Species concept (evolutionary)	1	
	Unit 3: Botanical nomenclature		
	1. ICN- full form, Principles	1	
	2. Rules of ICN	1	
	3. Ranks and names	1	
	4. Typification	1	
	5. Author citation	1	
	6. Valid publication	1	
	7. Rejection of names	1	
	8. Illegitimate names	1	
	9. Principle of priority and its limitations	1	
	10. Names of hybrids and cultivated plants	1	
	Unit 5: Biometrics, numerical taxonomy and cladistics		

	1. Characters	1	
	2. Variations	1	
	3. OTUs	1	
	4. Character weighting	1	
	5.Character coding	1	
	6. Cluster analysis	1	
	7. Phenograms – brief idea, construction of phenogram, related softwares	1	
	8. Cladograms- brief idea, construction of cladogram, related softwares	1	
	9. Differences between Phenogram and Cladogram	1	
Herbal Technology (SEC)	Unit 1:Herbal medicines		
	Unit 4: Analytical pharmacognosy		
	1. Drug adulteration – types	1	
	2. Methods of drug evaluation	1	
	3. Biological testing of herbal drugs	1	

	4. secondary metabolites (alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds)	1	
	5. Phytochemical screening tests for alkaloids, flavonoids	1	
	6. Phytochemical screening tests for steroids, triterpenoids	1	
	7. Phytochemical screening tests for phenolic compounds	1	

SEM V HONOURS

COURSE	MODULE	NO. OF CLASSES (1 hour/ class duration)	LESSON PLAN
Reproductive Biology of Angiosperms	Unit 1: Introduction		For each topic, lesson plan is prepared in the following way: - Objectives of the topic - Discussion of core points - Student assessment by MCQ and quizzes - Sum up - Study material (MS PPT soft copy) supplied - Learning resources (Books/e-Journals/Websites/others) are informed Assignments such as MCQ, subjective questions, project are to
	1. History (contributions of G.B. Amici, W. Hofmeister, E. Strasburger, S.G. Nawaschin)	1	
	2. P. Maheshwari, B.M. Johri, W.A. Jensen, J. Heslop-Harrison) and scope.	2	
	Unit 2: Reproductive development		

	1. Induction of flowering; flower as a modified determinate shoot.	2	be conducted online through google classroom Activities: Students have to prepare both MCQ and subjective questions from the assigned topic.
	2. Flower development: genetic and molecular aspects	2	
	Unit 3: Anther and pollen biology		
	1. Anther wall: Structure and functions and microsporogenesis	2	
	2. Callose deposition and its significance.	2	
	3. Microgametogenesis; Pollen wall structure, MGU (male germ unit) structure,	2	
	4. NPC system	2	
	5. Palynology and scope (a brief account); Pollen wall proteins; Pollen viability, storage and germination; Abnormal features: Pseudomonads, polyads, massulae, pollinia.	2	
	Unit 4: Ovule		
	1. Structure; Types	1	
	2. Special structures—endothelium, obturator, aril, caruncle and hypostase	2	

	3. Female gametophyte– megasporogenesis (monosporic, bisporic and tetrasporic)	3	
	4. megagametogenesis (details of Polygonum type);	2	
	5. Organization and ultrastructure of mature embryo sac.	2	
	Unit 5: Pollination and fertilization		
	1. Pollination types and significance;	2	
	2. Adaptations; pollinating agents	2	
	3. Structure of stigma and style; path of pollen tube in pistil; double fertilization	2	
	Unit 6: Self incompatibility		
	1. Basic concepts (interspecific, intraspecific, heteromorphic- distyly, tristyly)	2	
	2. Homomorphic (GSI and SSI)	2	
	3. Methods to overcome self- incompatibility: mixed pollination, bud pollination, stub pollination; Intra-	2	

	ovarian and in vitro pollination; Modification of stigma surface		
	4. parasexual hybridization	2	
	5. Cybrids, in vitro fertilization	2	
	Unit 7: Embryo, Endosperm and Seed		
	1. Structure and types	1	
	2. General pattern of development of dicot embryo	2	
	3. General pattern of development of monocot embryo	2	
	4. General pattern of development of endosperm; endosperm and perisperm	2	
	5. Suspensor: structure and functions; Embryo-endosperm relationship; Nutrition of embryo; Unusual features; Embryo development in Paeonia.	2	
	6. Seed structure, importance and dispersal mechanisms	2	
	Units 7: Polyembryony and apomixis		

	1. Introduction	1	
	2. Classification	2	
	3. Causes and applications	2	
SEM VI HONOURS			
COURSE	MODULE	NO. OF CLASSES (1 hour/ class duration)	LESSON PLAN
Plant metabolism	Unit-2 Carbon assimilation		For each topic, lesson plan is prepared in the following way: - Objectives of the topic - Discussion of core points - Student assessment by MCQ and quizzes - Sum up - Study material (MS PPT soft copy) supplied - Learning resources (Books/e-Journals/Websites/others) are informed Assignments such as MCQ, subjective questions, project are to be conducted online through google classroom Activities: - Report writing presentation by students
	1. Historical background	1	
	2. photosynthetic pigments, role of photosynthetic pigments (chlorophylls and accessory pigments)	2	
	3. antenna molecules and reaction centres, photochemical reactions, photosynthetic electron transport	2	
	4. PSI, PSII, Q cycle	2	
	5. CO ₂ reduction	2	
	6. photorespiration	2	
	7. C ₄ pathways; Crassulacean acid metabolism	2	

	8. Factors affecting CO ₂ reduction	2	
	Unit-4: Carbon Oxidation		
	1. Glycolysis,	1	
	2. fate of pyruvate,	1	
	Regulation of glycolysis		
	3. oxidative pentose phosphate pathway	1	
	4. Oxidative decarboxylation of pyruvate,	1	
	5. Regulation of PDH, NADH shuttle;	1	
	6. TCA cycle, amphibolic role, anaplerotic reactions, regulation of the cycle	2	
	7. Mitochondrial electron Transport	1	
	8. Oxidative phosphorylation, cyanide-resistant respiration, factors affecting respiration	2	
	Unit 7: Nitrogen metabolism		

	1. Nitrate assimilation	2	
	2. Biological nitrogen fixation (examples of legumes and non-legumes)	1	
	3. Physiology and biochemistry of nitrogen fixation	2	
	4. Ammonia assimilation and transamination	2	

Name of the Faculty: Dr. Asma Sultana

LESSON PLAN

COURSE TITLE	TOPICS	NO. OF CLASSES (1 hour/lecture)	LESSON PLAN
SEM I HONOURS			
Cell Biology	Unit 4: Introduction to microbial world		For each topic, lesson plan is prepared in the following way:

	a. Cell as a unit of structure and function	1	• Learning objectives of the topic • Discussion of core points and elaborations • Concluding by summing up, remedial class taken
	b. Characteristics of prokaryotic and eukaryotic cells	1	
	c. Origin of eukaryotic cell (Endosymbiotic theory)	1	
	Unit 5: Cell wall and plasma membrane		
	a. Chemistry, structure and function of Plant cell wall.	1	Activities: • Arrangement of quiz contests • Written/class tests: 1 • Group discussion • Visual demonstrations through ppts of the practical portion of the syllabus as required and possible
	b. Chemical composition of membranes; overview of membrane function; fluid mosaic model	2	
	c. Membrane transport – Passive, active and facilitated transport, endocytosis and		

	exocytosis d. Extracellular matrix	1 2	
	Unit 6: Cell organelles		
	a. Nucleus: Structure- nuclear envelope, nuclear pore complex, nuclear lamina, molecular organization of chromatin; nucleolus. b. Cytoskeleton: Role and structure of microtubules, microfilaments and intermediary filament. c. Chloroplast, mitochondria and peroxisomes: Structural organization; Semiautonomous nature of mitochondria and	4 2	

	chloroplast. Function		
	d. Endomembrane system: 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; Lysosomes	3	
	e. Golgi Apparatus – organization, protein glycosylation, protein sorting and export from	4	
		3	

	Unit 7: Cell division		
	a. Phases of eukaryotic cell cycle, mitosis and meiosis; Regulation of cell cycle- checkpoints, role of protein kinases	2	
	▪ Remedial class		
	▪ Visual demonstration through ppts were done for cell division stages, of different cell structures, different cell organelles	1	
		2	
	▪ Group discussion		
	▪ Quiz contest		
	▪ Written test		
		1	
		1	
	1		
SEM I GENERIC ELECTIVE			

Plant Ecology and Taxonomy	Unit 5: Phytogeography		For each topic, lesson plan is prepared in the following way: • Learning objectives of the topic • Discussion of core points and elaborations • Concluding by summing up, • Student assessment through interactions • Study material provided (Ppt/slides) • Information about learning resources like eBooks/Websites/others are provided Activities: • Written/class tests: 1
	a. Principle biogeographical zones;	2	
	b. Endemism	2	
	Unit 7: Identification		
	a. Functions of Herbarium, important herbaria and botanical gardens of the world and India;	2	
	b. Documentation: Flora, Keys: single access and multi-access	2	
	Unit 8 Taxonomic evidences		
	a. from palynology,	2	
	b.cytology, phytochemistry	2	
	c. and molecular data. and its limitations		
	Written tests	2	

		1	
SEM II HONOURS			
Mycology and Phytopathology	Unit 1: Introduction to true fungi		For each topic, lesson plan is prepared in the following way: • Learning objectives of the topic • Discussion of core points and elaborations • Concluding by summing up, remedial teaching when required. • Student assessment through interactions • Study material provided (Ppt/slides) • Information about learning resources like eBooks/Websites/others are provided Activities: • Arrangement of quiz contests • Written/class tests: 1 • Group discussion • Visual demonstrations through ppts of the practical portion of the syllabus as required and possible
	a. General characteristics; Affinities with plants and animals	2	
	b. Thallus organization; Cell wall composition; Nutrition; Classification reproductive structure, reconstruction	2	
	Unit 2: Chytridiomycota and Zygomycota		
	a. Characteristic features; Ecology and significance; Thallus organisation; Reproduction	2	
	b. Life cycle with reference to <i>Synchytrium</i> , <i>Rhizopus</i>	3	

	Unit 3: Ascomycota		
	a. General characteristics (asexual and sexual fruiting bodies); Ecology; Life cycle	3	
	b. Heterokaryosis and parasexuality		
	c. Life cycle and classification with reference to <i>Saccharomyces</i> , <i>Penicillium</i> , <i>Neurospora</i> and <i>Peziza</i>	2	
		5	
	Unit 4: Basidiomycota		
	Unit 4: Basidiomycota	2	
	a. General characteristics; Ecology; Life cycle and Classification		
	b. Black stem rust on wheat <i>Puccinia</i> (Physiological Specialization), loose and covered smut (symptoms only)	4	

	c. <i>Agaricus</i> ; Bioluminescence, Fairy Rings and Mushroom Cultivation (Oyster) (2 lectures).	2	
	Unit 5: Oomycota		
	a. General characteristics; Ecology; Life cycle and classification	2	
	b. <i>Phytophthora</i>	2	

	Unit 6 Symbiotic associations		
	a. Lichen – Occurrence; General characteristics; Growth forms and range of thallus organization; Nature of associations of algal and fungal partners.	1	
	b. Reproduction; Mycorrhiza- Ectomycorrhiza, Endomycorrhiza and their significance.	2	
	Unit 7: Applied Mycology		

	a. Role of fungi in biotechnology; Application of fungi in food industry (Flavour & texture, Fermentation, Baking, Organic acids, Enzymes, Mycoproteins)	2	
	b. Agriculture (Biofertilizers); Biological control (Mycofungicides, Mycoherbicides, Mycoinsecticides, Myconematicides); Medical mycology	4	
	▪ Remedial teaching		
	▪ Visual demonstration of different fungus, their life stages and thallus structures	1	
	▪ Quiz contest		
	▪ Group discussion		
	▪ Written test	2	

		1	
		1	
		1	

SEM II GENERIC ELECTIVE

Plant Physiology and Metabolism	Unit 2: Mineral nutrition		For each topic, lesson plan is prepared in the following way: • Learning objectives of the topic • Discussion of core points and elaborations • Concluding by summing up • Student assessment through
	a. Essential elements, macro and micronutrients; b. Criteria of essentiality of elements; Role of	1	

	essential elements;	1	interactions • Study material provided (Ppt/slides) • Information about learning resources like eBooks/Websites/others are provided Activities: • Written/class tests: 1
	c. Transport of ions across cell membrane, active and passive transport, carriers, channels and pumps.	6	
	U nit 6: Enzymes		
	a. Structure and properties	2	
	b. Mechanism of enzyme catalysis and enzyme inhibition.	2	
	Written tests	1	
SEM III HONOURS			
Economic Botany	Unit 1: Origin of Cultivated Plants		For each topic, lesson plan is prepared in the following way: • Learning objectives of the topic • Discussion of core points and elaborations • Concluding by summing up, remedial class taken • Student assessment through interactions • Study material provided (Ppt/slides) • Information about learning
	a. Concept of Centres of Origin, their importance with reference to Vavilov's work. Examples of major plant introductions b. Crop domestication and loss of genetic diversity; evolution of new crops/varieties,	2	

	importance of germplasm diversity	1	resources like eBooks/Websites/others are provided Activities: • Arrangement of quiz contests • Written/class tests: 1 • Visual demonstrations through ppts of the practical portion of the syllabus as required and possible. Students submitted practical records online.
	Unit 2: Cereals		
	a. Wheat (origin, morphology, cultivation, management, processing & uses)	2	
	b. Rice (origin, morphology, cultivation, management, processing & uses)	2	
Economic Botany	Unit 3: Legumes		
	a. Origin, morphology cultivation, management and uses of:		
	i. Chick pea	2	
	ii. Pigeon pea and	2	
	b. fodder legumes. Importance to man and ecosystem	2	
	Unit 4: Sources of sugars and starches		
	a. Morphology and processing of sugarcane, cultivation, management, products and by-products of	2	

	sugarcane industry		
	b. Potato – morphology, propagation & uses (lectures).	2	
	Unit 5: Spices		
	a. Listing of important spices, their family and part used. Economic importance	2	
	b. with special reference to fennel, saffron, clove and black pepper.	4	
	▪ Remedial classes ▪ Visual demonstration through ppts of habit sketches of cereals, legumes, starch yielding plants and spices were given, along with sectional views of cereal grains were	2	
		3	

	provided ▪ Quiz contest ▪ Written test	1 1	
SEM IV HONOURS			
Plant Ecology and Phytogeography	Unit 1: Introduction		For each topic, lesson plan is prepared in the following way: • Learning objectives of the topic • Discussion of core points and elaborations • Concluding by summing up, remedial class taken • Student assessment through
	a. Basic concepts; Levels of organization	2	
	b. Inter-relationships between the living world and the environment, the components and	2	

Plant Ecology and Phytogeography	dynamism, homeostasis		interactions • Study material provided (Ppt/slides) • Information about learning resources like eBooks/Websites/others are provided Activities: • Written/class tests: 1 • Group discussion
	Unit 2: Soil		
	a. Importance; Origin; Formation	2	
	b. Composition; Physical; Chemical and Biological components	2	
	c. Soil profile; Role of climate in soil development	2	
	Unit 3: Water		
	a. Importance: States of water in the environment	1	
	b. Atmospheric		

	moisture; Precipitation types (rain, fog, snow, hail, dew); Hydrological Cycle	2	
	c. Water in soil; Water table	1	
	Unit 4: Light, temperature, wind and fire: Variations; adaptations of plants to their variation.		
	a. Light: Variations; adaptations of plants to their variation (1 lecture).	1	
	b. Temperature: Variations; adaptations of plants to their variation (1 lecture).	1	
	c. Wind: Variations; adaptations of plants to their variation (1 lecture).	1	
	d. Fire: Variations; adaptations of plants to		

	their variation (1 lecture).	1	
	Unit 5: Ecosystems		
	a. Structure; Processes; Trophic organization	2	
	b. Food chains and Food webs; Ecological pyramids	2	
	Unit 6: Population ecology		
	a.Characteristics and Dynamics.	2	
	b. Ecological Speciation	1	
	▪ Remedial class		

	▪ Discussions on the aspect of temperature measurement, soil pH measurements, water pollution analysis were done. ▪ Written test ▪ Group discussion	1 2	
		1 1	
SEM V HONOURS			
COURSE	MODULE	NO. OF CLASSES (1 hour/ class duration)	LESSON PLAN
Plant Breeding (DSE)	Unit 1: Plant Breeding		For each topic, lesson plan is prepared in the following way: • Learning objectives of the topic • Discussion of core points and elaborations • Concluding by summing up, remedial class taken
	a. Introduction and objectives b. Modes of reproduction in crop	1	

	plants.	1	• Student assessment through interactions • Study material provided (Ppt/slides) • Information about learning resources like eBooks/Websites/others are provided Activities: • Review submission by students • Written/class tests: 1
	Unit 2: Methods of crop improvement		
	a. Introduction: Centres of origin and domestication of crop plants, plant genetic resources	5	
	b. Acclimatization; Selection methods: For self-pollinated, cross pollinated and vegetatively propagated plants	6	
	c. Hybridization: For self, cross and vegetatively propagated plants – Procedure, advantages and limitations	7	
	Unit 3: Quantitative inheritance		
	a. Concept, mechanism with examples of inheritance	2	
	b. Monogenic vs		

	polygenic Inheritance	2	
	Unit 4: Heterosis		
	a. Theories	1	
	b. Applications.	2	
	Unit 5: Crop improvement and breeding		
	a. Role of mutations; Polyploidy	5	
	b. Distant hybridization	2	
	c. role of biotechnology in crop improvement	3	
	Remedial classes		
	Written test	2	
		1	

SEM VI HONOURS	
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COURSE	MODULE	NO. OF CLASSES (1 hour/ class duration)	LESSON PLAN
Plant metabolism	Unit 1: Imaging and related techniques		For each topic, lesson plan is prepared in the following way:
	a. Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy	8	• Learning objectives of the topic • Discussion of core points and elaborations • Concluding by summing up, remedial class taken
	b. Use of fluorochromes: i. Flow cytometry (FACS)	1	• Student assessment through interactions • Study material provided (Ppt/slides) • Information about learning resources like eBooks/websites/others are provided Activities: • Student seminar
	c.		
	ii. Applications of fluorescence microscopy: Chromosome banding, FISH, chromosome painting; Transmission and Scanning electron microscopy – sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching.	7	• Written/class tests: 1 • Visual demonstrations through ppts of the practical portion of the syllabus as required and possible.

	Unit 2: Cell fractionation		
	a. Centrifugation: Differential and density gradient centrifugation, sucrose density gradient	5	
	b. CsCl ₂ gradient, analytical centrifugation, ultracentrifugation, marker enzymes	3	
	Unit 3: Radioisotopes		
	a. Use in biological research,	1	
	b. auto-radiography,	1	
	c. pulse chase experiment.	2	
	Unit 4: Spectrophotometry		
	a. Principle	1	
	b. application in biological research.	1	

	Unit 5: Chromatography		
	a. Principle; Paper chromatography	2	
	b. Column: sieve chromatography; Affinity chromatography	4	
	Unit 6: Characterization of proteins and nucleic acids		
	a. Mass spectrometry; X-ray diffraction; X-ray crystallography	3	
	b. Characterization of proteins and nucleic acids; Electrophoresis: AGE, PAGE, SDS-PAGE	3	
	Unit 7: Biostatistics		
	a. Statistics, data, population, samples, parameters; Representation of Data: Tabular, Graphical	5	
	b. Measures of central tendency: Arithmetic mean, mode, median		

	c. Measures of dispersion: Range, mean deviation, variation, standard deviation; Chi-square test for goodness of fit	3	
		5	
	▪ Practice of sums/problems		
	▪ Remedial class ▪ Studies of blotting techniques, microscopic techniques, staining techniques, methods of slide preparation were done through visual ppt demonstration. Required materials are provided as well for study purpose.	2	
		2	
		4	
	▪ Written test	1	

Name of the Faculty: Dr. Sujit Ghosh (SG)

Miss Purnima Paramanik (PP)

SEM VI

Title:

Syllabus:

Title:

Plant Biotechnology (SG)

Syllabus:

Unit 1: Plant Tissue Culture (16 lectures)

- a. Historical perspective; Composition of media; Nutrient and hormone requirements (role of vitamins and hormones); Totipotency;(4)
- b. Organogenesis; Embryogenesis (somatic and zygotic); (4)
- c. Protoplast isolation, culture and fusion; (4)
- d. Tissue culture applications (micropropagation, androgenesis, virus elimination, secondary metabolite production, haploids, triploids and hybrids; (3)
- e. Cryopreservation; Germplasm Conservation).(1)

Unit 2: Recombinant DNA technology (12 lectures)

Restriction Endonucleases (History, Types I-IV, biological role and application) ;(2)

Restriction Mapping (Linear and Circular); (2)

Cloning Vectors: Prokaryotic (pUC 18 and pUC19, pBR322, Ti plasmid, BAC); Lambda phage, M13 phagemid, Cosmid, Shuttle vector; Eukaryotic Vectors (YAC).(8)

Unit 3: Gene Cloning (10 lectures)

Recombinant DNA, (2)

Bacterial Transformation and selection of recombinant clones, (2)

PCR and PCRmediated gene cloning; (2)

Gene Construct; construction of genomic and cDNA libraries, screening DNA libraries to obtain gene of interest by genetic selection; (2)

complementation, colony hybridization;(2)

Unit 4: Methods of gene transfer (8 lectures)

Agrobacterium-mediated, (2)

Direct gene transfer by Electroporation, Microinjection, Microprojectile bombardment;(4)

Selection of transgenics– selectable marker and reporter genes (Luciferase, GUS, GFP).(2)

Unit 5: Applications of Biotechnology (14 lectures)

Pest resistant (Bt-cotton) (1)

herbicide resistant plants (RoundUp Ready soybean); (1)

Transgenic crops with improved quality traits (FlavrSavr tomato, Golden rice);(2)

Improved horticultural varieties (Moondust carnations); (1)

Role of transgenics in bioremediation (Superbug);(1)

edible vaccines;(1)

Industrial enzymes (Aspergillase, Protease, Lipase); (3)

Genetically Engineered Products–Human Growth Hormone; Humulin; (3)

Biosafety concerns. (2)

- Ppts to be provided for all the classes. Photographic demonstration to be done for gene transfer and genetic engineering through ppts.

Title:

Title:

Horticultural Practices and Post-Harvest Technology (**PP**)

Syllabus:

PP:

Unit 1: Introduction (4 lectures)

Scope and importance, Branches of horticulture (1 lecture); Role in rural economy and employment generation (1 lecture); Importance in food and nutritional security; Urban horticulture and ecotourism (2 lectures).

Unit 2: Ornamental plants (4 lectures)

Types, classification (annuals, perennials, climbers and trees)(1 lecture); Identification and salient features of some ornamental plants [rose, marigold, gladiolus, carnations, orchids, poppies, gerberas, tuberose, sages, cacti and succulents (opuntia, agave and spurges) (2lectures) Ornamental flowering trees (Indian laburnum, gulmohar, Jacaranda, Lagerstroemia, fishtail and areca palms, semul,coral tree)(1 lecture).

Unit 3: Fruit and vegetable crops (4 lectures)

Production, origin and distribution (1 lecture); Description of plants and their economic products(1 lecture); Management and marketing of vegetable and fruit crops; Identification of some fruits and vegetable varieties (citrus, banana, mango, chillies and cucurbits)(2 lectures).

Unit 4: Post-harvest technology (10 lectures)

Importance of post harvest technology in horticultural crops (2 lectures); Evaluation of quality traits; Harvesting and handling of fruits, vegetables and cut flowers (3 lectures); Principles, methods of preservation and processing (2 lectures); Methods of minimizing loses during storage and transportation (2 lectures); Food irradiation - advantages and disadvantages; food safety (1 lectures).

Unit 5: Disease control and management (8 lectures)

Field and post-harvest diseases; Identification of deficiency symptoms; remedial measures and nutritional management practices (2 lectures); Crop sanitation; IPM strategies (genetic, biological andchemical methods for pest control)(2 lectures); Quarantine practices; Identification of common diseasesandpests of ornamentals (3 lectures), fruits and vegetable crops (1 lecture).

Unit 6: Horticultural crops - conservation and management (10 lectures)

Documentation and conservation of germplasm (1 lecture); Role of micropropagation and tissue culture techniques (2 lectures); Varieties and cultivars of various horticultural crops(2 lectures); IPR issues (1 lecture); National, international and professional societies and sources of information on horticulture(4 lectures).

Unit 7: Field trip Field visits to gardens, standing crop sites, nurseries, vegetable gardens and horticultural fields at IARI or other suitable locations.

- Ppts to be provided for all the classes. Materials to be provided for different method of horticulture techniques, photographic visualization to be done for propagation method, landscaping and garden design through ppts.

SEM V:

Title:

Plant Physiology (**PP**)

Syllabus:

PP:

Unit 1: Plant-water relations (10 lectures)

Water Potential and its components, water absorption by roots, aquaporins, pathway of water movement, symplast, apoplast, transmembrane pathways(4 lectures), root pressure, guttation. Ascent of sap– cohesion-tension theory(2 lectures). Transpiration and factors affecting transpiration, antitranspirants(2 lectures), mechanism of stomatal movement(2 lectures).

Unit 2: Mineral nutrition (8 lectures)

Essential and beneficial elements, macro and micronutrients, methods of study and use of nutrient solutions, criteria for essentiality(3 lectures), mineral deficiency symptoms, roles of essential elements(4 lectures), chelating agents(1 lecture).

Unit 3: Nutrient Uptake (8 lectures)

Soil as a nutrient reservoir, transport of ions across cell membrane, passive absorption, electrochemical gradient, facilitated diffusion, active absorption(3 lectures), role of ATP, carrier systems, proton ATPase pump and ion flux, uniport, co-transport, symport, antiport(5 lectures).

Unit 4: Translocation in the phloem (8 lectures)

Experimental evidence in support of phloem as the site of sugar translocation(2 lectures). Pressure–Flow Model; Phloem loading and unloading (4 lectures); Source–sinkrelationship(2 lectures).

Unit 5: Plant growth regulators (14 lectures)

Discovery, chemical nature (basic structure), bioassay and physiological roles of Auxin(2 lectures), Gibberellins(2 lectures), Cytokinin(2 lectures), Absciscic acid(2 lectures), Ethylene(2 lectures), Brassinosteroids(2 lectures) and Jasmonic acid(2 lectures).

Unit 6: Physiology of flowering (6 lectures)

Photoperiodism(2 lectures), flowering stimulus, florigen concept, vernalization(2 lectures), seed dormancy(2 lectures).

Unit 7: Phytochrome, cryptochromes and phototropins (6 lectures)

Discovery, chemical nature, role in photomorphogenesis(4 lectures), low energy responses (LER) and high irradiance responses (HIR), mode of action(2 lectures).

Ppts to be provided for all the classes. Audio-visual demonstrations to be given for suction due to transpiration using ppts. Visual demonstration of fruit ripening/rooting from cutting and bolting experiment/Avena coleptile bioassay using ppts.

Title:

Industrial and Environmental Microbiology (SG)

Syllabus:

SG

Title:

Industrial and Environmental Microbiology

Syllabus:

Unit 1: Scope of microbes in industry and environment (6 lectures)

Unit 2: Bioreactors/Fermenters and fermentation processes (12 lectures)

Batch and continuous fermentations. Components of a typical bioreactor, (2)

Solid-state- Types of bioreactors tray, fixed bed, air-lift fermenter(4)

liquid-state (stationary and submerged) fermentations; Types of bioreactors Constantly stirred tank fermenter, tower fermenter (4)

Types of bioreactors-laboratory, pilot scale and production fermenters;(2)

A visit to any educational institute/ industry to see an industrial fermenter, and other downstream processing operations. (2 days)

Unit 3: Microbial production of industrial products (12 lectures)

Upstream: Microorganisms involved, media, fermentation conditions, (3)

downstream processing and uses; Filtration, centrifugation, cell disruption, solvent extraction, precipitation and ultrafiltration, lyophilization, spray drying;(3)

Hands on microbial fermentations for the production and estimation (qualitative and quantitative) of Enzyme: amylase or lipase activity, Organic acid (citric acid or glutamic acid), alcohol (Ethanol) and antibiotic (Penicillin)(6)

Unit 4: Microbial enzymes of industrial interest and enzyme immobilization (8 lectures)

Microorganisms for industrial applications–and hands on screening microorganisms for casein hydrolysis; starch hydrolysis; cellulose hydrolysis.(4)

Methods of immobilization, advantages and applications of immobilization, large scale applications of immobilized enzymes (glucose isomerase and penicillin acylase).(4)

Unit 5: Microbes and quality of environment. (6 lectures)

Distribution of microbes in air;(2)

Isolation of microorganisms from soil, air and water.(4)

Unit 6: Microbial flora of water. (8 lectures)

Water pollution, role of microbes in sewage and domestic waste water treatment systems.(4)

Determination of BOD, COD, TDS and TOC of water samples; (1)

Microorganisms as indicators of water quality, check coliform and fecal coliform in water samples. (4)

Unit 7: Microbes in agriculture and remediation of contaminated soils. (8 lectures)

Biological fixation; Isolation of root nodulating bacteria, (4)

Mycorrhizae; arbuscular mycorrhizal colonization in plant roots. (2)

Bioremediation of contaminated soils. (2)

Ppts to be provided for all the classes. Also, visual demonstrations of several instruments and sterilization of techniques to be given using ppts.

Sem IV:

Title:

Molecular Biology (**SG**)

Syllabus:

SG:

Unit 1: Nucleic acids: Carriers of genetic information (4 lectures) Historical perspective; DNA as the carrier of genetic information (Griffith's, Hershey & Chase, Avery, McLeod & McCarty, Fraenkel-Conrat's experiment.

Unit 2. The Structures of DNA and RNA / Genetic Material (10 lectures)

DNA Structure: Miescher to Watson and Crick- historic perspective, DNA structure, Salient features of double helix, Types of DNA, Eukaryotes. RNA Structure. (4)

Types of genetic material, denaturation and renaturation, cot curves;(2)

The Nucleosome. Chromatin structure- Euchromatin, Heterochromatin- Constitutive and Facultative heterochromatin. (2)

Organization of DNA-Viruses, Prokaryotes, (1)

Organelle DNA -- mitochondria and chloroplast DNA. (1)

Unit 2: The replication of DNA (10 lectures)

Chemistry of DNA synthesis (Kornberg's discovery); 1

General principles – bidirectional, semiconservative and semi discontinuous replication, RNA priming; 2

Various models of DNA replication, including rolling circle, θ (theta) mode of replication, replication of linear ds-DNA, 2

replication of the 5' end of linear chromosome; 1

Enzymes involved in DNA replication. 2

Unit 3: Central dogma and genetic code (2 lectures)

Key experiments establishing-The Central Dogma (Adaptor hypothesis and discovery of mRNA template), 1

Genetic code (deciphering & salient features)1

Unit 4: Transcription (18 lectures)

Transcription in prokaryotes and eukaryotes.6

Principles of transcriptional regulation; Prokaryotes: Regulation of lactose metabolism and tryptophan synthesis in E. coli. 6

Eukaryotes: transcription factors, heat shock proteins, steroids and peptide hormones; Gene silencing.6

Unit 5: Processing and modification of RNA (8 lectures)

Split genes-concept of introns and exons, removal of introns, spliceosome machinery, splicing pathways, group I and group II intron splicing, 4

alternative splicing eukaryotic mRNA processing (5' cap, 3' polyA tail); 2

Ribozymes; RNA editing and mRNA transport.2

Unit 6: Translation (8 lectures)

Ribosome structure and assembly, mRNA; 1

Charging of tRNA, aminoacyl-tRNA synthetases;1

Various steps in protein synthesis, proteins involved in initiation, elongation and termination of polypeptides; 4

Fidelity of translation;1

Inhibitors of protein synthesis; 1

Post-translational modifications of proteins.

- Ppts to be provided for all the classes. Photographic demonstrations to be done for prokaryotic RNA details, genetic materials and spliceosome assembly.

Title:

Plant Ecology and Phytogeography (AS+PP)

Syllabus:

PP:

Unit 7: Plant communities (8 lectures)

Concept of ecological amplitude; Habitat and niche(2 lectures); Characters: analytical and synthetic(2 lectures); Ecotone and edge effect(1 lecture); Dynamics: succession – processes, types; climax concepts(3 lectures).

Unit 8: Biotic interactions (2 lectures)

Trophic organization, basic source of energy, autotrophy, heterotrophy; symbiosis, commensalism, parasitism(1 lecture); food chains and webs; ecological pyramids; biomass, standing crop(1 lecture).

Unit 9: Functional aspects of ecosystem (8 lectures)

Principles and models of energy flow; Production and productivity(2 lectures); Ecological efficiencies(2 lectures); Biogeochemical cycles; Cycling of Carbon, Nitrogen and Phosphorus (4 lectures).

Unit 10: Phytogeography (12 lectures)

Principles; Continental drift; Theory of tolerance (3 lectures); Endemism(1 lecture); Brief description of major terrestrial biomes (one each from tropical, temperate & tundra)(4 lectures); Phytogeographical division of India; Local Vegetation(4 lectures).

- Ppts to be provided for all the classes. Visual demonstrations of several instruments used to measure microclimate variables were given using slides. Photographic demonstrations to be done for morphological adaptations of hydrophytes and xerophytes through ppts.

Title:

Herbal Technology (**SG sir**)

Syllabus:

SG sir:

Unit 1:Herbal medicines: history and scope - definition of medical terms - role of medicinal plants in Siddha systems of medicine; cultivation - harvesting - processing - storage - marketing and utilization of medicinal plants. (6 Lectures)

Unit 2:Pharmacognosy - systematic position m edicinal uses of the following herbs in curing various ailments; Tulsi, Ginger, Fenugreek, Indian Goose berry and Ashoka. (6 Lectures)

Unit 3:Phytochemistry - active principles and methods of their testing - identification and utilization of the medicinal herbs; Catharanthusroseus (cardiotonic), Withaniasomnifera (drugs

acting on nervous system), *Clerodendron phlomisoides* (anti-rheumatic) and *Centella asiatica* (memory booster). (6 Lectures)

Unit 4: Analytical pharmacognosy: Drug adulteration - types, methods of drug evaluation - Biological testing of herbal drugs - Phytochemical screening tests for secondary metabolites (alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds) (8 Lectures)

Unit 5: Medicinal plant banks micro propagation of important species (*Withania somnifera*, neem and tulsi- Herbal foods-future of pharmacognosy) (4 Lectures)

SEM III:

Title:

Economic Botany (**SG**)

Syllabus:

SG:

Unit 6: Beverages (4 lectures) Tea, Coffee (morphology, processing & uses)

Unit 7: Sources of oils and fats (10 lectures) General description, lectureification, their uses and health implications groundnut, coconut, linseed, soybean, mustard and coconut (Botanical name, family & uses). Essential Oils: General account, comparison with fatty oils & their uses.

Unit 8: Natural Rubber (3 lectures) Para-rubber: tapping, processing and uses.

Unit 9: Drug-yielding plants (8 lectures) Therapeutic and habit-forming drugs with special reference to *Cinchona*, *Digitalis*, *Papaver* and *Cannabis*; Tobacco (Morphology, processing, uses and health hazards).

Unit 10: Timber plants (3 Lectures) General account with special reference to teak and pine.

Unit 11: Fibers (4 lectures) Lectureification based on the origin of fibers; Cotton, Coir and Jute (morphology, extraction and uses).

12. Fiber-yielding plants: Cotton (specimen, whole mount of seed to show lint and fuzz; whole mount of fiber and test for cellulose), Jute (specimen, transverse section of stem, test for lignin on transverse section of stem and fiber).

- Ppts to be provided for all the classes. Also, visual demonstrations for habit sketches and required transverse sections to be provided through slides.

Title:

Genetics (**PP**)

Syllabus:

Unit 1: Mendelian genetics and its extension (16 lectures)

Mendelism: History; Principles of inheritance(2 lectures); Chromosome theory of inheritance(1 lecture); Autosomes and sex chromosomes; Probability and pedigree analysis(2 lectures); Incomplete dominance and codominance; Multiple alleles, Lethal alleles(1 lecture), Epistasis(3 lectures), Pleiotropy, Recessive and Dominant traits, Penetrance and Expressivity(3 lectures), Numericals; Polygenic inheritance(4 lectures).

Unit 2: Extrachromosomal Inheritance (6 lectures)

Chloroplast mutation: Variegation in Four o'clock plant; Mitochondrial mutations in yeast(2 lectures); Maternal effects-shell coiling in snail(2 lectures); Infective heredity- Kappa particles in Paramecium(2 lectures).

Unit 3: Linkage, crossing over and chromosome mapping (12 lectures)

Linkage and crossing over-Cytological and molecular basis of crossing over(3 lectures); Recombination frequency, twofactor and three factor crosses(4 lectures); Interference and coincidence(1 lecture); Numericals based on gene mapping(2 lectures); Sex Linkage(1 lecture).

Unit 4: Variation in chromosome number and structure (8 lectures)

Deletion, Duplication, Inversion, Translocation(4 lectures), Position effect(1 lecture), Euploidy and Aneuploidy(3 lectures).

Unit 5: Gene mutations (6 lectures) Types of mutations; Molecular basis of Mutations; Mutagens – physical and chemical (Base analogs, deaminating, alkylating and intercalating agents)(2 lectures); Detection of mutations: ClBmethod.Role of Transposons in mutation(2 lectures).DNA repair mechanisms(2 lectures).

Unit 6: Fine structure of gene (6 lectures)

Classical vs molecular concepts of gene(2 lectures); Cis-Trans complementation test for functional allelism(2 lectures); Structure of Phage T4, rII Locus(2 lectures).

Unit 7: Population and Evolutionary Genetics (6 lectures)

Allele frequencies, Genotype frequencies, Hardy-Weinberg Law(2 lectures), role of natural selection, mutation, genetic drift(2 lectures). Genetic variation and Speciation(2 lectures).

- Ppts to be provided for all the classes. Photographic demonstration were done for Translocation Ring, Laggards and Inversion Bridge through ppts. Also, Idea about pretreatment, fixation, staining and smear preparation were given using ppts.

Title:

Biofertilizers (**SG**)

Syllabus:

SG:

Unit 1: General account about the microbes used as biofertilizer – Rhizobium – isolation, identification, mass multiplication, carrier-based inoculants, Actinorrhizal symbiosis.

(4 lectures)

Unit 2: Azospirillum: isolation and mass multiplication – carrier based inoculant, associative effect of different microorganisms. Azotobacter: classification, characteristics – crop response to Azotobacter inoculum, maintenance and mass multiplication. (8 lectures)

Unit 3: Cyanobacteria (blue green algae), Azolla and Anabaena azollae association, nitrogen fixation, factors affecting growth, blue green algae and Azolla in rice cultivation. (4 lectures)

Unit 4: Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants.

(8 lectures)

Unit 5: Organic farming – Green manuring and organic fertilizers, Recycling of biodegradable municipal, agricultural and Industrial wastes – biocompost making methods, types and method of vermicomposting – field Application. (6 lectures)

SEM II:

Title:

Mycology and Phytopathology (**SG**)

Syllabus:

SG:

Unit 8: Phytopathology (14 lectures)

Terms and concepts; General symptoms; Geographical distribution of diseases; 1

Etiology; 1

Symptomology; 2

Host-Pathogen relationships; 1

Disease cycle and environmental relation; 1

prevention and control of plant diseases, and role of quarantine. 2

Bacterial diseases – Citrus canker and angular leaf spot of cotton. 1

Viral diseases – Tobacco Mosaic viruses, vein clearing. 1

Fungal diseases – Early blight of potato, Black stem rust of wheat, White rust of crucifers. 2

- Ppts to be provided for all the classes. Visual demonstrations were given for several diseases using ppts.

Title:

Archegoniate and Palaeobotany (**PP**)

Syllabus:

PP

Unit 1: Introduction (4 lectures)

Unifying features of archegoniates (2 lectures); Transition to land habit; Alternation of generations (2 lectures).

Unit 2: Bryophytes (6 lectures)

General characteristics; Adaptations to land habit (3 lectures); Classification (1 lecture); Range of thallus organization (2 lectures).

Unit 3: Type Studies- Bryophytes (12 lectures) Classification (up to order), morphology, anatomy and reproduction of Riccia, Marchantia, Peltia, Porella, Anthoceros, Sphagnum and Funaria (7 lectures); Reproduction and evolutionary trends in Riccia, Marchantia, Anthoceros and Polytrichum (developmental stages not included) (3 lectures). Ecological and economic importance of bryophytes with special reference to Sphagnum (2 lectures).

- Ppts to be provided for all the classes. Visual demonstration of different bryophyta specimens using ppts.

SEM I

Title:

Phycology (**SG sir**) and Microbiology

Unit 4: (11 lectures)

Algae General characteristics; Ecology and distribution (2 lectures); range of thallus organization; Cell structure and components; cell wall, pigment system, reserve food (of only groups represented in the syllabus), flagella; methods of reproduction(5 lectures); Classification; criteria, system of Fritsch, and evolutionary classification of Lee (only upto groups); Significant contributions of important phycologists (F.E. Fritsch, G.M. Smith, R.N. Singh, T.V. Desikachary, H.D. Kumar, M.O.P.Iyengar).Role of algae in the environment, agriculture, biotechnology and industry(4 lectures).

Unit 5: (8 lectures)

Cyanophyta and Xanthophyta Ecology and occurrence (2 lectures); Range of thallus organization; Cell structure; Reproduction, Morphology and life-cycle of Nostoc and Vaucheria(6 lectures).

Unit 6: (8 lectures)

Chlorophyta and Charophyta General characteristics (2 lectures); Occurrence; Range of thallus organization; Cell structure; Reproduction(2 lectures). Morphology and life-cycles of Chlamydomonas, Volvox, Oedogonium, Chara.Evolutionary significance of Prochloron (4 lectures).

Unit 7: (12 lectures)

Phaeophyta and Rhodophyta Characteristics (2 lectures); Occurrence; Range of thallus organization (2 lectures); Cell structure; Reproduction (2 lectures). Morphology and life-cycles of Ectocarpus, Fucus and Polysiphonia (6 lectures).

- Ppts to be provided for all the classes. Visual demonstration of different algal specimens using ppts.

Biomolecules (PP) and Cell Biology

Syllabus:

PP:

Unit 1: Biomolecules (20 lectures):

Types and significance of chemical bonds (2 lectures)

Structure and properties of water; pH and buffers (4 lectures)
Carbohydrates: Nomenclature and classification; Monosaccharides; Disaccharides; Oligosaccharides and polysaccharides (2 lectures)
Lipids: Definition and major classes of storage and structural lipids (1 lecture)
Fatty acids structure and functions (1 lecture)
Essential fatty acids (1 lecture)
Triacylglycerols structure, functions and properties (1 lecture)
Phosphoglycerides (1 lecture).
Proteins: Structure of amino acids; Levels of protein structure-primary, secondary, tertiary and quaternary (2 lectures)
Protein denaturation and biological roles of proteins (1 lecture)
Nucleic acids: Structure of nitrogenous bases; Structure and function of nucleotides (1 lecture);
Types of nucleic acids; Structure of A, B, Z types of DNA; Types of RNA; Structure of tRNA (1 lecture).

Unit 2: Bioenergetics (4 lectures):

Laws of thermodynamics, concept of free energy, endergonic and exergonic reactions (2 lecture), coupled reactions, redox reactions (1 lecture).
ATP: structure, its role as an energy currency molecule (1 lecture).

Unit 3: Enzymes (6 lectures):

Structure of enzyme: holoenzyme, apoenzyme, cofactors, coenzymes and prosthetic group (1 lecture);
Classification of enzymes; Features of active site, substrate specificity (1 lecture), mechanism of action (activation energy, lock and key hypothesis, induced - fit theory (1 lecture),
Michaelis – Menten equation, enzyme inhibition and factors affecting enzyme activity (2 lectures).

- Ppts to be provided for all the classes. Materials to be provided for qualitative tests for carbohydrates, reducing sugars, non-reducing sugars, lipids and proteins. Visual demonstration of different biochemical test using ppts.