SACRED HEART COLLEGE (AUTONOMOUS)

Department of BOTANY

MASTER OF SCIENCE IN BOTANY

Course plan

Academic Year 2014 – 15

Semester 2

GYMNOSPERMS, EVOLUTION & DEVELOPMENTAL BIOLOGY

.Basic Reference

1Andrews H N Jr (1961). *Studies in Palaeobotany*. John Wiley and sons.

2. Arnold C A (1947). *An introduction to Palaeobotany*. John Wiley and sons.

3. Beck C E (1995). *Gymnosperm Phylogeny*. Bot. Rev. 51-176.

4. Bhatnagar S P, Moitra A (2000). *Gymnosperms*. New Age International Ltd.

5. Chamberlain C J (1935). *Gymnosperms: Structure and Evolution*. University of Chicago Press.

6. Monroe W Strickberger (1990). *Evolution*. Jones and Bartlett publishers.

7. Agashe, S.N. (1995), Palaeobotany, Oxford & IBH, New Delhi.

8. Siddiqui, K.A. (2002) Elements of Palaeobotany, Kitab Mahal, Allahabad.

9. Thomas, B.A. & Spicer R.A. (1987): The Evolution and Palaeobiology of land plants. Discordies Press, Fortland, USA.

1.	**Date**	**Topic**	**Method**	**Remarks/Reference**
1	Session 1	Origin, general characteristics, distribution and classification of Gymnosperms (K R Sporne and C J Chamberlain). Distribution of living gymnosperms in India. DNA barcoding of gymnosperms.	Presentation/Chalk and Board	
2.	Session 2			
3	Session 3	Detailed study of the vegetative morphology, internal structure, reproductive structures, and evolution of the orders and families (with reference to the genera mentioned). (a) Class Progymnospermopsida: Aneurophyton (b) Class Cycadopsida: Heterangium, Lyginopteris, Lagenostoma, Glossopteris, Medullosa, Caytonia. Bennettites,	Presentation/Chalk and Board/Assignment	
4	Session 4			
5	Session 5			
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10	Session 10			
11	Session 11			
12	Session 12			
13	Session 13			
14	Session 14			
15	Session 15			

16	Session 16	Williamsoniella, Nilsonia, Cycas, Zamia, Pentoxylon. (c) Class Coniferopsida: General account of families under Coniferales, range of form and structure of stem, leaves; range of form, structure and evolution of female cones in coniferales such as Pinus, Taxodium, Cupressus, Podocarpus, Agathis, Araucaria, Taxus and Ginkgo. (d) Class Gnetopsida: Gnetum.		
17	Session 17			
18	Session 18			
19	Session 19	(a) General account on the male and female gametophyte development in Gymnosperms (Cycas). (b) Economic importance of Gymnosperms	Presentation/Chalk and Board	
20	Session 20			
21	Session 21			
22	Session 22	Abiogenesis, Biogenesis experiment of Miller (1953). Theory of Organic evolution - Biochemical origin of life, place and time of origin and experimental evidences. Concept of Oparin and Haldane.	Presentation/Chalk and Board	
23	Session 23			
24	Session 24			
25	Session 25			
26	Session 26	History of Character Evolution, Patterns of Evolutionary change explained from systematics, Phylogeny and patterns of Evolution, Adaptive radiation, Patterns in genes and genomes	Presentation/Chalk and Board/Assignment	
27	Session 27			
28	Session 28			
29	Session 29			

30	Session 30	Biodiversity, Genetic variation, phenotypic variation, evolution of life histories, Macro evolution; evolution above the species level. Sex and Reproductive success; Paradox of sex, Inbreeding and outcrossing, Concept of sexual selection, sexual selection by mate choice.	Presentation/Chalk and Board	
31	Session 31			
32	Session 32			
33	Session 33			
34	Session 34	Genetic drift - Salient features; species concept; sub-species, sibling species, semi species, demes. Types of speciation - Phyletic speciation and True speciation. Mechanism of speciation - Genetic divergences and isolating mechanisms. Patterns of speciation - allopatric, sympatric, quantum and parapatric speciation.	Presentation/Chalk and Board	
35	Session 35			
36	Session 36			
37	Session 37			
38	Session 38	Natural selection and adaptation; nature of Natural Selection, examples of NS, levels of selection, nature of adaptations, The Genetical theory of natural selection; Fitness, models of selection, polymorphism maintained by balancing selection, multiple outcomes of evolutionary change, the strength of NS, molecular signatures of NS.	Presentation/Chalk and Board	
39	Session 39			
40	Session 40			
41	Session 41	Modern synthetic theory of evolution, molecular evolution, concepts of natural evolution, molecular divergence and molecular clocks; molecular tools in phylogeny.	Presentation/Chalk and Board	
42	Session 42			
43	Session 43			
44	Session 44			
45	Session 45	Techniques in Palaeontology - mega fossils - microfossils - nannofossils - ichnofossils -	Presentation/Chalk and Board	Laboratory
46	Session 46			

		collection, reformation & illustration - binomial nomenclature. Plant fossils – Preservation, preparation, age determination		
47	Session 47	Palaeobotany: *Lyginopteris, Pentoxylon, Lagenostroma, Cordaites,Cardiocarpus, Calamites, Sphenophyllum, Calamostachys*and *Glossopteris.*	Presentation/Chalk and Board	
48	Session 48			
49	Session 49			
50	Session 50	Fossil record – systematic, reconstruction and nomenclature; Applied aspects of paleobotany	Presentation/Chalk and Board	
51	Session 51			
52	Session 52			
PRACTICALS				
53	Session 53	Study of the morphology and anatomy of vegetative and reproductive parts of Cycas, Zamia, Pinus, Cupressus, Agathis, Araucaria and Gnetum. 2. Study of fossil gymnosperms through specimens and permanent slides. 3.Conduct field trips to familiarise various gymnosperms in nature and field identification of Indian gymnosperms and submit a report.	Laboratory	Laboratory
54	Session 54			
55	Session 55			
56	Session 56			
57	Session 57			
58	Session 58			
59	Session 59			
60	Session 60			
	Session 60	Study of fossil plants based on permanent slides and photographs	Laboratory	
	Session 62			

CELL BIOLOGY

COURSE OBJECTIVES:

To understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles

To understand how the cellsinteract among themselves and with the environment through signal molecules.

To get an in-depth knowledge in cytoskeleton, endomembrane system, protein trafficking and cell cycle.

To get a chance to familiarize with recent advancements in Chloroplast and Mitochondrial research.

To learn the molecular mechanisms of cancer.

To get a basic knowledge to prepare for competitive examinations in life science.

Basic Reference

1. 1. Gerald Karp (2013). *Cell and Molecular biology: Concepts and experiments* (VII Edn). John Wiley &Sons.
2. Harvey Lodish, Arnold Berk, Lawrence Zipursky, Paul Matsudaira, David Baltimore, James Darnell (2013). *Molecular cell biology* (VII Edn). W H Freeman & Company.
3. Geoffrey M Cooper, Robert E Hausman (2013). *The Cell: A molecular approach* (VI Edn). Sinaeur.
4. Wayne M Becker, Lewis J Kleinsmith, Jeff Hardin (2012). *The world of the cell* (VIII Edn). Pearson
5. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter (2008). *Molecular biology of the cell* (V Edn). Garland Science, Taylor and Francis group.
6. Leland H Hartwell, Leroy Hood, Michael L Goldberg, Ann E Reynolds, Lee M Silver, Ruth C Veres (2011). *Genetics from genes to genomes* (IV Edn). McGraw Hill.
7. Immo E. Scheffler (2008). *Mitochondria* (II Edn), John Wiley & Sons, Inc., Publication.
8. J. Kenneth Hoober (1990). *Chloroplasts*, Plenum Press · New York and London.
9. J. Reinert (1980), *Chloroplasts*, Springer-Verlag Berlin Heidelberg GmbH.
10. Keshav K. Singh, Leslie C. Costello (2009) *Mitochondria and Cancer,* Springer Science.

1.	Date	Topic	Method	Remarks/Reference
1	Session 1	Brief history of studies on plasma membrane structure. Fluid mosaic model.	Presentation/Chalk and Board	
2.	Session 2	The chemical composition of membranes: the structure and functions of membrane proteins, lipids and carbohydrates.	Presentation/Chalk and Board/Assignment	
3	Session 3			
4	Session 4	Membrane lipids and membrane fluidity: importance of membrane fluidity, maintaining membrane fluidity.	Presentation/Chalk and Board	
5	Session 5	The dynamic nature of the plasma membrane.	Presentation/Chalk and Board	
6	Session 6			
7	Session 7	Transport of molecule across cell membrane: passive diffusion, facilitated diffusion, active transport. Membrane functions	Assignment Presentation/Chalk and Board	
8	Session 8			
9	Session 9			
10	Session 10			
11	Session 11	Structure of eukaryotic nucleus: Nuclear Envelope, Nuclear Pore Complex.	Presentation/Chalk and Board	
12	Session 12	Transport into and out of the Nucleus: Nuclear-Localization Signals, Nuclear-Export Signals, Ran-GTP and Ran-Independent Mechanisms	Presentation/Chalk and Board	
13	Session 13	Bacterial Chromatin. Compaction of bacterial chromosome – Muk B proteins	Presentation/Chalk and Board	
14	Session 14		Presentation/Chalk and Board	

15	Session 15	Structure of chromatin and chromosomes: histones and nonhistone proteins, nucleosomal organization of chromatin, higher levels of chromatin structure. Heterochromatin and Euchromatin, formation of heterochromatin. Chromosomal packing and structure of metaphase chromosome. Molecular structure of the Centromere and Telomere		
16	Session 16	Phases of cell cycle	Presentation/Chalk and Board	
17	Session 17	Cell division: mitosis and meiosis. Significance of meiosis in generating genetic variation. Cyclins and cyclin-dependent kinases, Regulation of CDK Activity, Commitment to the Cell Cycle and DNA Replication, Entry into Mitosis, Completion of Mitosis. Surveillance Mechanisms in Cell Cycle Regulation- Cell-cycle checkpoints.	Presentation/Chalk and Board/Assignment	
18	Session 18			
19	Session 19			
20	Session 20			
21	Session 21	Introduction: outline of endomembrane system. The endoplasmic reticulum: smooth and rough endoplasmic reticulum, synthesis of proteins	Presentation/Chalk and Board	
22	Session 22			

		on membrane-bound and free ribosomes and processing.		
23	Session 23	The Golgi complex: glycosylation, movement of materials through the Golgi complex. Types of vesicle transport and their functions	Presentation/Chalk and Board	
24	Session 24			
25	Session 25	Lysosomes. Peroxisomes	Assignment	
26	Session 26			
27	Session 27	Plant cell vacuoles. Targeting of proteins to mitochondria, chloroplasts and peroxisomes. The endocytic pathway: endocytosis and phagocytosis	Presentation/Chalk and Board	
28	Session 28			
29	Session 29	Evolutionary Origin of Mitochondria, Structure and Morphology. Integration into the Cell, Biogenesis of Mitochondria, Mitochondrial Genome, Metabolic Pathways Inside Mitochondria, Mitochondrial Mutations and Disease, Mitochondrial DNA Sequencing, Mitochondria and Cancer, Mitochondria and Pharmacology	Presentation/Chalk and Board/Assignment	
30	Session 30			
31	Session 31	Historical Perspectives: The Beginnings of Research on Photosynthesis, Structure of the Chloroplast, Proplastid to Chloroplast Transformation, Characteristic Components of Chloroplast Membranes, The Chloroplast Genome and Its Expression, Development of Chloroplasts: Structure and Function, Development of	Presentation/Chalk and Board	
32	Session 32			

		Chloroplasts: Biosynthetic Pathways and Regulation		
33	Session 33	Overview of the major functions of the cytoskeleton. Microtubules: microtubule structure and organization, microtubule dynamics, microtubule-based motor proteins: kinesins and dyneins	Presentation/Chalk and Board	
34	Session 34			
35	Session 35			
36	Session 36	Microfilaments: microfilaments and actin structures, dynamics of actin filaments, actin-based motor proteins: myosins. Intermediate filaments: intermediate filament assembly and disassembly, types and functions of intermediate filaments. Coordination and cooperation between cytoskeletal elements.	Presentation/Chalk and Board	
37	Session 37			
38	Session 38			
39	Session 39	Modes of cell-cell signaling. Signaling molecules and their receptors: Steroid hormones and the nuclear receptor superfamily, Nitric oxide and carbon monoxide, Neurotransmitters, Peptide hormones and growth factors, Eicosanoids, Plant hormones.	Presentation/Chalk and Board	
40	Session 40			
41	Session 41	Cell Surface Receptors: G protein-coupled receptors, Receptor protein-tyrosine kinases, Cytokine receptors and nonreceptor protein-tyrosine kinases, Receptors linked to other enzymatic activities. Pathways of Intracellular Signal Transduction: cAMP pathway, Cyclic GMP, Phospholipids and Ca2+.	Presentation/Chalk and Board	
42	Session 42			
43	Session 43		Presentation/Chalk and Board	

44	Session 44	Stem cells, Early Metazoan Development, Embryonic Stem Cells, Factors Controlling the Pluripotency of ES Cells, Induced Pluripotent Stem (iPS) Cells. Programmed cell death, Extrinsic and Intrinsic Pathway of Apoptosis, Proteins involved in the Apoptotic Pathway		
45	Session 45			
46	Session 46	The Development and Causes of Cancer: Types of cancer, the development of cancer, Causes of cancer, Properties of cancer cells, Transformation of cells in culture. Tumor Viruses: Hepatitis 8 and C viruses, Small DNA tumor viruses, Herpesviruses, Retroviruses.	Presentation/Chalk and Board	
47	Session 47			
48	Session 48	Oncogenes Retroviral oncogenes, Proto-oncogenes, Oncogenes in human cancer, Functions of oncogene products	Presentation/Chalk and Board	
49	Session 49	Tumor Suppressor Gene: Identification of tumor suppressor genes, Functions of tumor suppressor gene products, Roles of oncogenes and tumor suppressor genes in tumor development	Presentation/Chalk and Board	
50	Session 50			
51	Session 51			
PRACTICALS				
52	Session 52	1. Study of meiosis in Rhoeo/Chlorophytum by smear preparation of PMCs. 2. Study of giant chromosomes in Drosophila/Chironomus. 3. Determination of mitotic index in the squash preparation of onion root tip	Laboratory/Demonstration	
53	Session 53			
54	Session 54			
55	Session 55			

		4. Effect of drugs on cell division (Colchicine or any other inhibitor). 5. Chromosome banding and staining techniques- Giemsa Staining, Q-Banding, G-Banding, R-Banding, C-Banding. 6. Isolation of plant cell organelles.		

PLANT ANATOMY, PRINCIPLES OF ANGIOSPERM SYSTEMATICS & MORPHOLOGY

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asic Reference

1Eames A J, McDaniel (1976). An introduction to plant Anatomy. Tata McGraw-Hill, New Delhi

2. Edred John, Henry Corner (1976). The seeds of dicotyledons (Vol. I, II). Cambridge University Press.

3. Ella Werker (1997). Seed Anatomy. Borntreager. University of Michigan

4. Elizabeth G Cutter (1978). Plant Anatomy Part I & II. Clive and Arnald Ltd.

5. Elizabeth G Cutter (1978). Applied Plant Anatomy. Clive and Arnald Ltd.

6. Cronquist A (1981). An Integrated system of classifications of flowering plants. Columbia University Press.

7. Heywood V H, D M Moore (Eds) (1984). Current concept in Plant Taxonomy.

8. Naik V V (1984). Taxonomy of Angiosperms. Tata McGraw Hill Publ. Co. Ltd.

9. Radford A E (1986). Fundamentals of Plant Systematics. Harper & Row Publ.

10. Davis P H, V H Heywood (1991). Principles of Angiosperm Taxonomy. Today and Tomorrow Publications.

1.	Date	Topic	Method	Remarks/Reference
1	Session 1	Scope and significance of plant anatomy, interdisciplinary relations.	Presentation/Chalk and Board	
2.	Session 2	Apical organization: Stages of development of primary meristem; origin of branches and lateral roots.	Presentation/Chalk and Board	
3	Session 3	Secretory tissues in plants: Structure and distribution of secretory trichomes (Drocera, Nepenthes), salt glands, colleters, nectaries, resin ducts and laticifers. Structure of bark and distribution pattern of laticifers in Heveabrasiliensis.	Presentation/Chalk and Board/Assignment	
4	Session 4			

5	Session 5	Vascular cambium and cork cambium: Structure and function, factors affecting cambial activity	Presentation/Chalk and Board	
6	Session 6	Secondary xylem and phloem: Ontogeny, structure and function. Lignification patterns of xylem. Reaction wood: Compression wood and tension wood. Factors affecting reaction wood formation	Presentation/Chalk and Board Assignment	
7	Session 7			
8	Session 8			
9	Session 9	Anomalous secondary growth in dicots and monocots (Piper, Strychnos)	Presentation/Chalk and Board	
10	Session 10	Wood: Physical, chemical and mechanical properties. Plant fibers: Distribution, structure and commercial importance of coir, jute, and cotton	Presentation/Chalk and Board	
11	Session 11			
12	Session 12	Leaf: Initiation, plastochronic changes, ontogeny and structure of leaf. Structure, development and classification of stomata and trichomes. Krantz anatomy, anatomical peculiarities in CAM plants. Leaf abscission.	Presentation/Chalk and Board	
13	Session 13			
14	Session 14	Nodal anatomy: Unilacunar, trilacunar and multilacunar nodes, nodal evolution	Presentation/Chalk and Board	
15	Session 15	Root-stem transition in angiosperms	Presentation/Chalk and Board	
16	Session 16	Floral Anatomy: Anatomy of floral parts - sepal, petal, stamen and carpel; Floral vasculature	Presentation/Chalk and Board	
17	Session 17			
18	Session 18			

		(Aquilegia and Pyrola). Vascular anatomy. Development of epigynous ovary - appendicular and receptacular theory		
19	Session 19	Fruit and seed anatomy: Anatomy of fleshy and dry fruits - follicle, legume, berry. Dehiscence of fruits. Structure of seeds. Anatomical factors responsible for seed dormancy and drought resistance.	Presentation/Chalk and Board	
20	Session 20			
21	Session 21			
22	Session 22	Morphological and structural adaptations in different ecological groups - hydrophytes, xerophytes, epiphytes and halophytes	Presentation/Chalk and Board	
23	Session 23			
24	Session 24	Applications of anatomy in systematics (histotaxonomy) and Pharmacognosy. Research prospects in anatomy.	Presentation/Chalk and Board	
25	Session 25			
26	Session 26	Historical background of classification - Artificial, natural and phylogenetic systems. Importance of taxonomy	Presentation/Chalk and Board	
27	Session 27			
28	Session 28	Species/Genus/Family and other categories; species concept and intraspecific categories - subspecies, varieties and forms.	Presentation/Chalk and Board/Assignment	
29	Session 29			
30	Session 30	Important phylogenetic terms and concepts: Plesiomorphic and Apomorphic characters; Homology and Analogy; Parallelism and Convergence; Monophyly, Paraphyly and Polyphyly. Phylogenetic tree - Cladogram and Phenogram	Presentation/Chalk and Board	
31	Session 31			
32	Session 32			
33	Session 33			
34	Session 34	Concepts of character; Sources of taxonomic characters - Anatomy, Cytology,	Presentation/Chalk and Board	
35	Session 35			

		Phytochemistry and molecular taxonomy.		
36	Session 36	Phenetic - Numerical Taxonomy - principles and methods; Cladistic - Principles and methods	Presentation/Chalk and Board	
37	Session 37			
38	Session 38	History of ICN, aims and principles, rules and recommendations: rule of priority, typification, author citation, retention, rejection and changing of names, effective and valid publication.	Presentation/Chalk and Board	
39	Session 39			
40	Session 40			
41	Session 41	Chemotaxonomy, basic concepts of genome analysis – DNA bar coding.	Presentation/Chalk and Board	
42	Session 42	Habitat and habit; Morphology of root, stem, leaf, bract and bracteoles, inflorescence, flowers, fruits and seeds	Presentation/Chalk and Board	
43	Session 43			
44	Session 44			
PRACTICALS				
45	Session 45	1. Study of cambia - non storied and storied. 2. Study of the anomalous primary and secondary features in Amaranthus, Boerhaavia, Mirabilis, Nyctanthes, Piper and Strychnos. 3. Study of stomata, trichomes, and laticifers. Determination of stomatal index. 4. Study of the anatomical peculiarities of C4 and CAM plants (Leaf/Stem). 5. Study of nodal patterns. 6. Preparation of a histotaxonomic key. 7. Study of the pericarp anatomy of a legume, follicle and berry. 8. Identification of wood - soft wood and hard wood.	Laboratory	
46	Session 46			
47	Session 47			
48	Session 48			
49	Session 49			
50	Session 50			
51	Session 51			

52	Session 52	1. Morphology of leaf: Leaf attachment, Stipules, Patterns of leaf, Phyllotaxy, Shapes of leaf lamina, bases, margins and tips, Venation. 2. Inflorescence: Racemose - Simple raceme, Compound raceme, Spike, Spikelet, Catkin, Spadix, Corymb, Simple umbel, Compound umbel, Panicle, Capitulum. Cymose - Solitary cyme, Mono-, Di-and polychasial cyme. Special types - Cyathium, Verticillaster, Hypanthodium, Coenanthium. 3. Morphology of stamens: Mono-, Di- and Polyadelphous; Epipetalous, Syngenesious, Synandrous, Polyandrous, Didynamous, Tetradynamous, Basifixed, Dorsifixed, Versatile. 4. Morphology of carpels: Apocarpous, Syncarpous, Gynostegium. Placentation - Marginal, Parietal, Axile, Free central, Basal and Pendulous. 5. Morphology of fruits: Berry, Drupe, Hesperidium, Pepo, Balausta, Amphisarca, Achene, Follicle, Capsule, Legume, Lomentum, Nut, Caryopsis, Cypsela, Samara, Cremocarp, Siliqua, Carcerule, Regma. 6. Aggregate fruits; Composite fruits - Sorosis and Syconus; Pome. 7. Draw the L.S and floral diagram of at least 10 flowers having different ovary positions - hypogyny, perigyny and epigyny.	Laboratory	
53	Session 53			
54	Session 54			
55	Session 55			

		8. Workout nomenclatural problems regarding priority and author citations.		

GENETICS AND BIOCHEMISTRY

COURSE OBJECTIVES:

To understand the Mendelian and Non-Mendelian modes of inheritance that governs passage of genetic traits across generation.

To understand the Hardy-Weinberg equilibrium.

To have a clear-cut idea of linkage and mapping which will help them to work out problems related to map distance, gene order, coefficient of coincidence and interference.

To get a basic knowledge regarding the structure and functions of biomolecules.

To learn a detailed account on enzymology, nucleotide metabolism and secondary metabolites.

Basic Reference

1. Benjamin Lewin (2000). Genes VII. Oxford university press.
2. Gardner E J, Simmons M J, Snustad D P (1991). Principles of Genetics (III Edn). John Wiley and
Sons Inc.
3. Snustad D P, Simmons M J (2000). Principles of Genetics (III Edn). John Wiley and Sons.
4. Strickberger (2005). Genetics (III Edn). Prentice Hall of India Pvt. Ltd.
5. William S Klug, Michael R Cummings (1994). Concepts of Genetics. Prentice Hall.
6. Reginald H Garrett, Charles M Grisham (2005). Biochemistry. Thomson Brooks/Cole.
7. Robert K Murray, David A Bender, Kathleen M Botham, Peter J Kennelly, Victor W Rodwell, P
Anthony Weil (2009). Harper's Illustrated Biochemistry (XXVIII Edn). Mc Graw Hill.
8. H Robert Horton, Laurence A Moran, Raymond S Ochr, J David Rawn, K Gray Scrimgeour (2002).
Principles of Biochemistry (III Edn). Prentice Hall.
9. Bob B Buchanan, Wilhelm Gruissem, Russel L Jones (2000). Biochemistry and molecular biology of plants. L K International Pvt. Ltd.
10.S Sadasivam, AManickam (1996). Biochemical methods (II Edn). New age international Publishers.

1.	Date	Topic	Method	Remarks/Reference
1	Session 1	Transmission genetics, Molecular genetics and Population genetics (brief introduction). Mendelism –basic principles (brief study). Extensions of Mendelism, penetrance and expressivity of genes. Nonmendelian inheritance – cytoplasmic inheritance. Sex determination in animals and plants.	Presentation/Chalk and Board/Assignment	
2.	Session 2			
3	Session 3			
4	Session 4			
5	Session 5	Linkage and Crossing over - Stern's hypothesis, Creighton and McClintock's experiments, single cross over, multiple cross over, two-point cross, three-point cross, map distances, gene order, interference and co efficient of coincidence. Haploid mapping (Neurospora), Mapping in bacteria and bacteriophages. Inheritance of traits in humans; pedigree analysis, determination of human genetic diseases by pedigree analysis, genetic mapping in human pedigrees.	Assignment Presentation/Chalk and Board	
6	Session 6			
7	Session 7			
8	Session 8			
9	Session 9	Polygenic inheritance, QTL, effect of environmental factors and artificial selection on polygenic inheritance.	Presentation/Chalk and Board	
10	Session 10			
11	Session 11		Presentation/Chalk and Board	

12	Session 12	Gene pool, allele and genotype frequency. Hardy-Weinberg law and its applications, estimation of allele and genotype frequency of dominant genes, co-dominant genes, sex-linked genes and multiple alleles. Genetic equilibrium, genetic polymorphism. Factors that alter allelic frequencies; (i) mutation (ii) genetic drift - bottle neck effect and founder effect (iii) migration (iv) selection (v) nonrandom mating, inbreeding coefficient. Balancing of evolutionary forces		
13	Session 13			
14	Session 14			
15	Session 15			
16	Session 16	Acids and bases, strength of acids – strong acids, weak acids. Ionization of water – Kw, pH. Dissociation of acids – pKa, Henderson-Hasselbalch equation. Buffers – definition, chemical composition, requirements for a good buffer, buffer action, buffer capacity. Measurement of pH – colorimetric methods and electrometric methods.	Presentation/Chalk and Board	
17	Session 17			
18	Session 18			
19	Session 19			
20	Session 20			
21	Session 21	Sugar derivatives:Glycoproteins, proteoglycans, mucoproteins. Lectins.	Presentation/Chalk and Board	
22	Session 22			
23	Session 23	Structural lipids – membrane lipids. Lipid biosynthesis, fat breakdown – β oxidation	Presentation/Chalk and Board	
24	Session 24			
25	Session 25		Assignment	

26	Session 26	Structure and classification of amino acids. Biosynthesis of amino acids.		
27	Session 27	Classification of proteins based on structure and function. Oligo- and polypeptides. Primary structure – peptide bond. Secondary structure – Ramachandran plots, α-helix, β sheet. Tertiary structure – forces that stabilize tertiary structure. Quaternary structure, domains, motif and folds. Protein sequencing – Edman method. Functions of proteins.	Presentation/Chalk and Board/Assignment	
28	Session 28			
29	Session 29			
30	Session 30			
31	Session 31	Degradation of proteins to amino acids, Protein turnover and its tight regulation, steps involved in amino acid degradation.	Presentation/Chalk and Board	
32	Session 32			
33	Session 33			
34	Session 34			
35	Session 35			
36	Session 36	(a) Principles of catalysis: Activation energy of a reaction. General characters of enzymes -specificity, catalytic power, regulation. IUB system of enzyme classification and naming. (b) Mechanism of enzyme activity: Formation of ES complex, acid-base catalysis, covalent catalysis, metal ion catalysis, proximity and orientation effect, strain and distortion theory. Factors affecting enzyme activity. (c) Enzyme Kinetics: Michaelis-Menton kinetics, Lineweaver-Burk plot.	Presentation/Chalk and Board	
37	Session 37			
38	Session 38			
39	Session 39			
40	Session 40			
41	Session 41			
42	Session 42			

		Mechanism of multi substrate reaction – Ping Pong, Bi-Bi mechanism.		
43	Session 43	(d) Regulation of enzyme activity: Allosteric effect, control proteins, reversible covalent modification, (e) proteolytic activation. Enzyme inhibition – reversible and irreversible inhibition, competitive, non-competitive, uncompetitive inhibition, dixon plot. (f) Cofactors and coenzymes: Essential ions, Coenzymes; structure and role of metabolite coenzymes – ATP; structure and role of vitamin derived coenzymes – NAD+, NADP+, FAD, FMN, TPP, PLP, (g) Biotin. Isozymes.	Presentation/Chalk and Board	
44	Session 44			
45	Session 45			
46	Session 46			
47	Session 47			
48	Session 48			
49	Session 49	Functions of nucleotides, nucleotide biosynthesis by de novo pathways and salvage pathways.	Presentation/Chalk and Board	
50	Session 50			
51	Session 51			
52	Session 52	Classification, biosynthesis, and functions of terpenoids, alkaloids, phenolics, flavonoids, coumarins.	Presentation/Chalk and Board	
53	Session 53			
54	Session 54			
55	Session 55			
PRACTICALS				
56	Session 56	1.Workout problems related to linkage, crossing over and gene mapping, human pedigree analysis. 2. Workout problems in population genetics - gene and genotype frequency, Hardy Wienberg equilibrium.	Chalk and Board	
57	Session 57			
58	Session 58			
59	Session 59			
60	Session 60		Laboratory/Demonstration	

61	Session 61	1. Preparation of buffers of various strength and pH. 2. Differentiating sugars based on osazone formation. 3. Quantitative estimation of reducing sugar using Dinitro salicylic acid (DNS) or Anthrone. 4. Separation and analysis of lipids and amino acids by TLC. 5. Quantitative estimation of protein by Lowry's method. 6. Preparation of molal, molar, normal and percentage solutions and their dilutions. 7. Estimation of purity of DNA (By DNA protein ratio). 8. Estimation of catalase activity. 9. Isolation and assay of amylase enzyme from germinating Pea seeds/appropriate plant material.		
62	Session 62			
63	Session 63			
64	Session 64			
65	Session 65			
66	Session 66			
67	Session 67			