

DEPARTMENT OF BOTANY

CURRICULUM PLAN 2025-2026 (ODD SEMESTER)

Dr. Naghma Parween

B.Sc. (H) Botany

Semester-V

Molecular Biology of the cell:

Theory	Allocation of Lectures	Month wise schedule	Tutorial/Assignment/ Presentation	Reading suggestions
Unit 1: Nucleic acids as carriers of genetic information, Discovery of nucleic acids, Experiments that established nucleic acids (DNA & RNA) as the carrier of genetic information: Griffith's, Hershey & Chase, Avery, McLeod & McCarty, and Fraenkel-Conrat's experiment. Unit 2: Structure and organization of the genetic material: DNA double helix structure (Chargaff's rule; Watson and Crick model); salient features of DNA double helix. Types of DNA: A, B & Z conformations, denaturation and renaturation (only melting profile- T_m), types of RNA (mRNA, rRNA, tRNA, small RNAs). split genes (Phillip Sharp). Unit 3: Central Dogma and Genetic Code Beadle and Tatum's one gene one enzyme hypothesis; The Central Dogma, Genetic code and its salient features, Experiments for deciphering Genetic code (Experiments by Nirenberg & Matthaei, and Har Gobind Khorana). Adaptor hypothesis by Crick Baltimore and Temin's discovery transcription. Unit 4: Replication of DNA ; Delbruck's Dispersive mechanism model; Bloch and Butler's conservative replication model; Meselson and Stahl's semi-conservative replication model; Mechanism - initiation, elongation and termination Enzymes and other proteins involved in DNA replication; General principles – bidirectional, semiconservative and semi-discontinuous replication. (Replisome), RNA priming		August 2025 August 2025 September 2025	Assignment	William S. Klug, Michael R. Cummings, Charlotte A. Spencer, Michael A. Palladino, & Darrell Killian (2019). Concepts of Genetics. Pearson; 12th edition. 2. Watson J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M., Losack, R. (2007). Molecular Biology of the Gene, Pearson Benjamin Cummings, 6th edition. 3. Snustad, D.P. and Simmons, M.J (2019). Principles of Genetics. John Wiley, 7th edition. 4. Russell, P. J. (2010). Genetics- Molecular Approach. Benjamin Cummings, U.S.A. 3rd edition.

(Primase &Primo some); Various modes of DNA replication, including rolling circle, θ (theta) mode of replication, replication of linear dsDNA. Replication of the 5'end of linear chromosome (end-replication problem & Telomerase). Unit 5: Mechanism of Transcription ; Transcription process in prokaryotes (Initiation, Elongation and Termination); structure and function of RNA polymerase enzyme; concept of promoters and transcription factors; comparison between prokaryotic and eukaryotic transcription; concept of post-transcriptional modifications (introduction to eukaryotic mRNA processing: 5' capping; Splicing and alternative splicing; 3' poly A tailing). Unit 6: Mechanism of Translation; Translation in prokaryotes: Initiation, Elongation and Termination; concept of charging of tRNA and role of aminoacyl synthetases; ribosome structure and assembly (prokaryotes and eukaryotes); comparison between prokaryotic and eukaryotic translation; post-translational modifications (phosphorylation, glycosylation). Unit 7: Gene Regulation : Gene regulation in prokaryotes: Operon concept; inducible & repressible systems; regulation of lactose metabolism in E. coli (inducible system, positive & negative control); regulation of tryptophan synthesis (Repression-De-repression and concept of Attenuation) in E. coli. Gene regulation in eukaryotes: concept of gene silencing by DNA methylation and RNA interference. Practical's: 1. Isolation of plasmid and genomic DNA from E. coli and quantification using agarose gel electrophoresis 2. Isolation of genomic DNA from plant samples (at least two different genera / species) using CTAB method and quantification using agarose gel electrophoresis 3. Quantification of unknown DNA by diphenylamine reagent (colorimetry). 4. To estimate the generation time of Escherichia coli (prokaryote) and budding yeast (eukaryote) by spectrophotometric measurement and plotting growth curve as an indirect method to study DNA replication. 5. To study control of replication in budding yeast with the help of specific inhibitors (beta-lactams: -Clavulanic acid,		September 2025 October 2025 October 2025 August 2025 August 2025		Russell, P. J. (2010). I Genetics- A Molecular Approach. Benjamin Cummings,
---	--	---	--	--

Ceftazidime, Piperacillin, Ceftriaxone etc) and studying budding frequency. 6. To study control of transcription in Escherichia coli with the help of prokaryotic (Rifampicin) and eukaryotic (Actinomycin-D) transcription inhibitors and plotting growth curve. 7. To study control of translation in Escherichia coli with the help of prokaryotic (Kanamycin / Streptomycin) inhibitors using an IPTG- inducible system. 8. To understand the regulation of lactose (lac) operon (positive & negative regulation). B. Sc. (Programme) Life Science, Botany DSC-for LS-III Semester Paper: Plant Cell and Developmental Biology Theory: Unit 1. Introduction to Plant Cell: structure and function : Structure of plant cell, Structure and functions of cell organelles: cell wall (Primary and secondary wall), nucleus, chloroplast, mitochondria, dictyosomes, endoplasmic reticulum. Unit 2. Polarity in plant growth 6 hours Growth through primary meristems, and secondary meristems (discuss briefly), Organization of shoot apex (Tunica-Corpus theory, Waiting meristem theory) and root apex (Körper-Kappe theory). Unit 3. Differentiation of tissues: vegetative organs 7 hours Structure and functions of tissues (simple and complex), Structure of stem, root, and leaf (dicot and monocot), Brief mentioning of anomalous secondary growth in stem of Salvadora/Bignonia and Dracaena, Epidermal system: classification of stomata (Metcalfe and Chalk), trichomes. Unit 4. Differentiation of tissues: reproductive organs 6 hours Flower development (ABCDE model), Anther and its wall layers (ontogeny not to be included), microsporogenesis and microgametogenesis, pollen wall (intine, exine), male germ unit; Ovule: General structure, megasporogenesis (monosporic, bisporic, tetrachoric) and mega gametogenesis		September 2025 October 2025 August 2025		
--	--	--	--	--

(only Polygonum type), ultrastructure and significance of female germ. Unit 5: Unit 5. Pollination and Fertilization Pollination types (Self and Cross; agencies of pollination not to be included); Pollen-pistil interactions with brief overview of incompatibility, pollen tube pathway, pollen tube entry into ovule and embryo sac (porogamy, misogamy and chalazogamy); double fertilization. Unit 6. Development of Embryo and Seed Endosperm structure (Free nuclear, Cellular and Helobial type, one example of each) and functions; development of embryo from zygote in monocot and dicot; establishment of apical, basal and radial organisation; development of seed (general account only). Practical: 1. To study cytoplasmic streaming in Hydrilla. 2. a. Study of cell organelles through electron micrographs – nucleus, mitochondria, chloroplast, mitochondria, dictyosomes, endoplasmic reticulum b. Study of cell organelles (through permanent slides/photographs)– nucleus (Feulgen/acetocarmine staining); mitochondria (Janus green B staining); cell wall (PAS staining). 3. Study of plant cells: types of stomata (through peel mounts), trichomes, sclerenchyma, xylem (through maceration). 4. Study of shoot apical meristem and root apical meristem, parenchyma, collenchyma, phloem, laticifers through permanent slides/micrographs. 5. Study organs structure through temporary preparations- a. Transverse section of dicot stem- Helianthus/Cicer, stem with secondary growth – Helianthus/Cicer etc., Transverse section of monocot stem - Zea mays b. Transverse section of dicot root: primary and with secondary growth- Cicer/Vigna etc., monocot root - Zea mays c. Vertical section of dicot and monocot leaf 6. Study anomalous secondary growth through permanent slides/photomicrographs: Salvadoria/ Bignonia, Dracaena		August 2025 September 2025 August 2025 August 2025		
---	--	--	--	--

7. Study reproductive structures through photographs/ micrographs/permanent slides/specimens: a. Transverse section of anther with wall layers, secretory and amoeboid tapetum b. Microsporogenesis through micrographs of transverse section anther c. Pollen exine patterns (any four types) d. Types of ovule, associated structure (obturator, aril, caruncle) e. Mature Polygonum type of embryo sac and ultrastructure of egg apparatus 8. Study of pollen viability (TTC/FDA). 9. Calculation of percent pollen germination in any one medium through sitting drop culture/ Hanging drop culture. 10. Dissection of embryo/endosperm from developing seeds. Plant tissue culture Practical's: 1. To study the equipment used in tissue culture: autoclave and laminar air flow chamber. 2. Preparation of Murashige & Skoog's (MS) medium. 3. Demonstration of sterilization and inoculation methods using leaf and nodal explants of tobacco, carrot, Datura, Brassica, etc. (any two). 4. Study of anther, embryo and endosperm culture (demonstration/photographs).. 5. Study of micropropagation, somatic embryogenesis & artificial seeds (demonstration/photographs). 6. Isolation of protoplasts (demonstration/photographs). 7. Visit to a plant tissue culture laboratory facility/ Industry and submission of report.		August 2025 September 2025 November 2025 August 2025 September 2025		
--	--	--	--	--

		October 2025		
		November 2025		