

DSE-5 Cytogenetics, Plant Breeding and Molecular Biology

MM : 100
Time : 3 hrs
L Credit
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Sessional : 30
ESE : 70
Pass Marks : 40

Total Hours: 60

Learning objective:

- To understand the basic knowledge of cell and molecular biology.
- To acquire the basic information about the techniques of molecular biology.
- To acquire information on cell and cell cycle.
- To become familiar with various cell organelles and their functions.
- To acquire an overall knowledge on cell membrane structure, functions and genetic material.
- To become familiar with transcription and regulation of gene expression.

Learning outcomes:

- The students shall be familiar with various tools and techniques used in cell and molecular biology.
- The students shall be able to understand basic Principles of microscopy like light microscopy, phase contrast microscopy; fluorescence microscopy; confocal microscopy.
- The student will be able to understand the electron microscopy like SEM and scanning TEM (STEM); sample Preparation for electron microscopy; X-ray diffraction analysis.
- The student will be able to understand the cell structure and functions, cell theory; prokaryotic and eukaryotic cells.
- The student will be able to take the decisions for carrier point of views in research, industries and academia entrepreneurship etc.

Unit 1: Introduction to Genetics:**(12 Lectures)**

Beginning of genetics; Cell structure and cell division; Early concepts of inheritance, Mendel's laws; Discussion on Mendel's paper, Chromosomal theory of inheritance.

Unit 2: Cell and Cell Cycle:**(8 Lectures)**

The cell theory; prokaryotic and eukaryotic cells; cell size and shape; eukaryotic cell components. Overview of cell cycle, mitosis and meiosis.

Unit 3: Cell Organelles:**(18 Lectures)**

Functions of membranes; models of membrane structure, Mitochondria: structure, and function; symbiont hypothesis; Chloroplast structure and function, Endoplasmic reticulum, Golgi body & Lysosome: structure and role. Peroxisomes and Glyoxisomes: structure, composition, functions. Nucleus: nuclear envelope- structure of nuclear pore complex; chromatin; molecular organization, DNA packaging in eukaryotes, euchromatin and heterochromatin, and nucleolus.

Unit 4: Cell Membrane and Genetic Material:**(12 Lectures)**

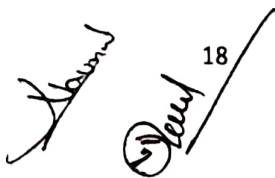
DNA: Miescher to Watson and Crick- historic perspective, Griffith's and Avery's transformation experiments, Hershey-Chase bacteriophage experiment, DNA structure, types of DNA, types of genetic material. DNA replication (prokaryotes and eukaryotes): bidirectional and semi-conservative replication. Types and structure of RNA (mRNA, tRNA, rRNA), RNA polymerases; translation (prokaryotes and eukaryotes), genetic code.

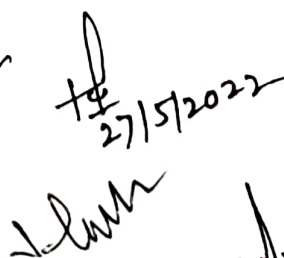
Unit 5: Plant Breeding:**(10 Lectures)**

History of Plant Breeding (Pre and post-Mendelian era); Objectives of plant breeding, characteristics improved by plant breeding; Patterns of Evolution in crop plants- Centers of origin-biodiversity and its significance. Breeding methods in asexually/clonally propagated crops, clonal selection apomixes, clonal selection. Special breeding techniques.

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DSE-1 SEMESTER-V BBO-E551(LAB COURSE-05)

1. To study the prokaryotic cells: (bacteria); viruses; eukaryotic cells with the help of light and electron micrographs.
2. Study of the photomicrographs of cell organelles.
3. To study the structure of plant cell through temporary mounts.
4. To study mitosis and meiosis (temporary mounts and permanent slides).
5. To study the effect of temperature, organic solvent on semi permeable membrane.
6. Demonstration of dialysis of starch and simple sugar.
7. To study plasmolysis and deplasmolysis.
8. To measure the cell size (either length or breadth/diameter) by micrometry.
9. To study the structure of nuclear pore complex with the help of photograph.
10. To study special chromosomes (polytene & lampbrush) either by slides or photographs.
11. To study DNA packaging by micrographs.
12. Preparation of the karyotype and idiogram from given photograph of somatic metaphase chromosome.

Suggested readings:

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.
5. Watson, J. D., Baker T.A., Bell, S. P., Gann, A., Levine, M., and Losick, R., 2008 Molecular Biology of the Gene 6th edition. Cold Spring Harbour Lab. Press, Pearson Pub.
6. Allard RW. 1981. Principles of Plant Breeding. John Wiley & Sons.
7. Chopra VL. 2001. Breeding Field Crops. Oxford & IBH.
8. Chopra VL. 2004. Plant Breeding. Oxford & IBH.
9. Gupta SK. 2005. Practical Plant Breeding. Agribios.
10. Sharma JR. 2001. Principles and Practice of Plant Breeding. Tata McGraw-Hill.
11. P.K. Gupta. BIOTECHNOLOGY AND GENOMICS. Rastogi Publications, 7th Reprint (1st Edition): 2016-2017.
12. P.K. Gupta. Genetics. Published by Rastogi Publications, Meerut.
13. P.K. Gupta Cytogenetics. Published by Rastogi Publications, Meerut.
14. A Textbook Of Basic And Molecular Genetics by Dr. Parihar P (pb) ISBN : 9788188826193.

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