

DEPARTMENT OF MICROBIOLOGY
SEMESTER-IV
B.Sc. (Hons.) Microbiology

DISCIPLINE SPECIFIC CORE COURSE – 10:
ADVANCES IN CELL BIOLOGY

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
MICROB-DSC401: ADVANCES IN CELL BIOLOGY	4	3	0	1	Class XII pass with Biology/ Biotechnology/ Biochemistry	Basic Concepts of Cell Biology

Learning Objectives

The Learning Objectives of this course are as follows:

- The major objective of this course is to introduce the students to the essentials of eukaryotic cell biology.
- The students will gain knowledge about the physical and chemical architecture of cells as well as structural and functional details of different cell organelles.
- They will become familiar with cell cycle events, and mechanisms of cell communication and cell death.
- They will be educated about the hallmarks, etiology and diagnosis of cancers.
- They will be introduced to the cutting edge science of stem cell technology, their production and various applications.

Learning outcomes

The Learning Outcomes of this course are as follows:

- Student will be able to describe the different components of cell signalling pathways used for cell communication.
- Student will be able to recall cell division, mechanisms of cell cycle regulation, and types of cell death.
- Student will be able to evaluate the importance of stem cells and their associated technologies and applications.

- Student will be able to describe the different types of cancers, their causes, characteristics, diagnosis, and treatment modalities.
- Student will be able to analyze DNA by Feulgen staining followed by microscopic observation. Student will be able to analyze the different stages of cell division: mitotic stages by temporary mount and meiosis stages by the permanent mount.
- Student will be able to evaluate chromosome polyploidy by colchicine treatment of plant material followed by staining.

SYLLABUS OF DSC-10

UNIT – I (20 hours)

Cell Signalling: Modes of cell-cell signalling: endocrine, paracrine, autocrine. Signalling molecules: nitric oxide, carbon monoxide, steroid hormones, neurotransmitters, peptide hormones and growth factors. Cell surface receptors and receptor-ligand interactions: G protein-coupled receptors, receptor protein tyrosine kinases, cytokine receptors. Signal transduction: cyclic AMP, cyclic GMP and MAP kinase pathways.

UNIT – II (10 hours)

Cell Cycle and Cell Death: Phases and regulation of eukaryotic cell cycle. Mitosis and meiosis. Types of cell death: necrosis, apoptosis and autophagy, mitophagy. Characteristics and pathways of apoptosis: intrinsic and extrinsic.

UNIT – III (5 hours)

Cell Renewal: Stem cells: characteristics and types: somatic stem cells, embryonic stem cells, induced pluripotent stem cells. Therapeutic applications of stem cells.

UNIT – IV (10 hours)

Cancer biology: Hallmarks of cancer. Causes of cancer: carcinogens, cancer-causing microorganisms. Proto-oncogenes and oncogenes. Tumor suppressor genes. Characteristic features of cancer cells. Types of cancers. Cancer stem cells. Approaches to cancer diagnosis. Currently available cancer treatment modalities (including bone marrow transplantation, immune cell and oncolytic viral therapies).

Practical component

UNIT 1: (20 hours)

Cell division and cytochemical analysis of DNA: Performance of cytochemical staining of DNA by Feulgen stain. Microscopic examination and analysis of the different stages of mitosis through temporary mounts of stained onion root tip. Microscopic examination and analysis of the different stages of meiosis through temporary mounts / permanent slides.

Unit 2: (10 hours)

Chromosome polyploidy and properties of cancer cells: Study of polyploidy in onion root tip by colchicine treatment followed by acetocarmine stain. Identification and

study of properties of different types of cancerous cells through light and electron micrographs.

Essential/recommended readings

Theory:

1. Molecular Cell Biology by H. Lodish, A. Berk, C. Kaiser, M. Krieger, A. Bretscher, H. Ploegh, A. Amon and K.C. Martin. 9th edition. W.H. Freeman, UK. 2021.
2. Essential Cell Biology by B. Alberts, K. Hopkin, A.D. Johnson, D. Morgan, and M. Raff. 5th edition. W.W. Norton & Co, USA. 2019.
3. Karp's Cell and Molecular Biology by G. Karp, J. Iwasa and W. Marshall. 9th edition. Wiley, USA. 2019.
4. The Cell: A Molecular Approach by G.M. Cooper. 8th edition. Sinauer Associates, UK. 2018.
5. The science of stem cells by J.M.W. Slack. 1st edition. John Wiley & Sons. 2018.
6. Cell Biology by T.D. Pollard, W.C. Earnshaw, J. Lippincott-Schwartz and G.T. Johnson. 3rd edition. Elsevier, USA. 2016.
7. Becker's World of the Cell by J. Hardin and G. Bertoni. 9th Edition. Pearson, USA. 2015.
8. Principles of stem cell biology and cancer: future applications and therapeutics by T. Regad, T. Sayers and R. Rees. 1st edition. John Wiley & Sons. 2015.
9. Essentials of stem cell biology edited by R. Lanza and A. Atala. 3rd edition. Academic Press. 2013.
10. Cell and Molecular Biology by E.D.P. De Robertis. 8th edition. Lippincott, Williams and Wilkins, USA. 2006.

Practicals:

1. A Cell Biology Manual by J. Francis. Kendall/Hunt Publishing Co, USA. 2022.
2. Practical Laboratory Manual- Cell Biology by A. Gupta, B.K. Sati. Lambert Academic Publishing, USA. 2019.
3. Cell Biology Practical Manual by R. Gupta, S. Makhija and R. Toteja. Prestige Publishers, India. 2018.
4. Laboratory Manual of Cell Biology by R. Majumdar, R. Sisodia. Prestige Publishers, India. 2018.
5. Essential Cell Biology Vol 1: Cell Structure- A Practical Approach by J. Davey and M. Lord. Oxford University Press, UK. 2003.
6. Essential Cell Biology Vol 2: Cell Function- A Practical Approach by J. Davey and M. Lord. Oxford University Press, UK. 2003.

Suggestive readings

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.