DISCIPLINE SPECIFIC ELECTIVES (DSE-6): Cell Growth and Regulation
Zoo-DSE-6

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	Department offering the course
		Lecture	Tutorial	Practical/ Practice			
Cell Growth and Regulation Zoo-DSE- 6	04	03	Nil	01	Passed Class XII with Biology/ Biotechnology	Basic knowledge of Cell Biology	Zoology

Learning Objectives

The learning objectives of this course are as follows:

- to enable students to learn biological phenomenon at cellular level
- to develop an understanding of cell function and its regulatory mechanisms.
- to understand cell division, cell cycle and its regulation, growth factors, survival factors; cell cycle control systems and checkpoints.
- to provide in-depth knowledge on various experimental skills and histo-pathological studies used in clinical and research laboratories
- to acquire knowledge in the areas of cellular malfunctioning causing serious health conditions such as autoimmune disorders, cancers etc.

Learning Outcomes

By studying this course, students will be able to:

- appreciate the diverse cellular processes, cell signaling, and cellular interactions.
- Know more about the defects in cellular functioning and molecular mechanisms that can lead to diseases and disturb the homeostasis of the body.
- to elucidate the roles of cell signalling in gene regulation
- appreciate differences in normal and cancer cell, apoptosis vs. necrosis; cell death and cell renewal
- observe stem cells and their applications in therapeutic cloning and regenerative medicine.
- Know the fundamentals of targeted cancer therapies and molecular approaches to cancer treatment.

SYLLABUS OF DSE- 2

UNIT 1: Cell division, Cell Cycle, and its Regulation **10 hrs**

A brief study of stages and events during mitosis and meiosis; overview of cell cycle; mitogens, growth factors, and survival factors; cell cycle control system: components and mechanisms; cell cycle checkpoints.

UNIT- 2: Cell Signaling **7 hrs**

Types of cell-cell signaling, signaling molecules, and cell receptors; components of a generalized signaling pathway; examples of two pathways: GPCR/ cAMP/ PKA/ CREB/ target gene and a nuclear receptor pathway (to elucidate roles in gene regulation).

UNIT 3: Gene Regulation **9 hrs**

Concepts of positive and negative gene regulation; principles of eukaryotic transcriptional regulation of genes; concepts of activators, repressors, silencers, and enhancers.

UNIT- 4: Cell Death and Cell Renewal **9 hrs**

Apoptosis *vs*. necrosis; intrinsic and extrinsic pathways of programmed cell death; stem cells and maintenance of adult tissues; cells in culture and cell lines; embryonic and induced pluripotent stem cells and their applications in therapeutic cloning and regenerative medicine.

UNIT 5: Cancer Biology **10 hrs**

Hallmarks of a cancer cell; types and causes of cancer; oncogenes and tumour suppressor genes; tumor viruses; correlation of cell signaling, gene regulation, cell cycle control, and cell death in cancer development (any one example); targeted cancer therapies/molecular approaches to cancer treatment.

Practical **(30 hrs)**

(Laboratory periods: 15 classes of 2 hours each)

1. Principles of Microscopy.
2. Preparation of a temporary slide of onion root tip to study various stages of mitosis.
3. Study of various stages of meiosis through permanent slides.
4. Cell culture techniques: preparation of media, seeding, thawing and maintenance of cell culture, trypsinization and cryopreservation
5. Measurement of cell growth: Direct count by Trypan blue and Indirect count by Spectrophotometer.
6. Calculation of Doubling Time based on given data.
7. Assessment of metabolic activity by MTT.
8. Study of monolayer (in Roux Bottle, Roller bottle, Plastic film, Optical culture system, Bread Bed reactors, Heterogenous reactors). Suspensions (stirred bioreactors, continuous flow cultures, air lift fermenter) and immobilized cultures.

9. Project related to topics covered in theory/ project report based on visit to labs/institutions/industry etc.

Essential/recommended readings

1. Karp, G. (2010) Cell and Molecular Biology: Concepts and Experiments. 6th edition. John Wiley & Sons. Inc.
2. Cooper, G.M. and Hausman, R.E. (2009) The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.

Suggested readings

1. Alberts et. al., (2008) Molecular Biology of the Cell, Garland Science, Taylor & Francis Group, New York, USA.

2. Lodish et. al., (2007) Molecular Cell Biology, W.H. Freeman and Company, New York, USA

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