Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER 2023-2024

Course Handout (Part-II)

Date: 11.08.2023

In addition to part I (General Handout for all courses appended to the Time Table) this portion gives further specific details regarding the course.

Course No. : **BIO F213**
Course Title : **CELL BIOLOGY**
Instructor-in-Charge : **K. N. MOHAN**
Instructors : **Shuvadeep Maity**
Minali Singh

1 **Course description:** Cell Biology (BIO F213) extends the foundations of General Biology for understanding the process at molecular level by which eukaryotic cells carry out common essential functions and their control mechanisms. The topics include types and properties of cells; microscopy; nuclear organization and functions; ribosomes and protein synthesis; membrane structure, function and transport; endomembrane system and its functions; cytoskeleton; cell communication; cell cycle, cell growth and cancer; apoptosis; techniques. These topics will be discussed along with the related experiments and applications of cell biology.

2 **Scope and objectives of the course:** The main objective of this course is to make students thorough in the understanding the molecular basis of essential functions at cellular level as well as in the context of multicellularity. While covering these specific topics in detail, the main objective is to make the students gain appreciation on how fundamental questions in modern biology are experimentally addressed, the current advancements and excitements in the field.

3 **Textbook (TB):** Essential Cell Biology (5th edition) by Bruce Alberts, Karen Hopkin, Alexander Johnson, David Morgan, Martin Raff, Keith Roberts and Peter Walter, W.W. Norton and Co., 2019.

4 **Reference Book (RB):** The Cell: A Molecular Approach (8th edition) by Geoffrey M Cooper, Sinauer/Oxford University Press, 2019.

5 **Course Plan:**

Lecture No.	Learning Objectives	Topics covered	Chapters	
			TB	RB
1-2	**Cells and origins of life**	Origin and evolution of prokaryotic and eukaryotic cells; experimental models.	1	1
3-5	**Studying cells (Basic Methods)**	Cell culture, Microscopy; Cell fractionation.	1	1
6-7	**Organization of the genetic material**	Basic DNA structure; eukaryotic chromosomes and their organization in the interphase nucleus; nucleosomes and	5	

		chromatin structure at 10 nm and higher order levels; regulation of chromosome structure and X-inactivation.		
8-10	**Transmission and maintenance of the genetic material**	DNA replication: Initiation, formation and extension of replication forks; asymmetric DNA synthesis; DNA polymerase, its processivity and proofreading mechanisms; Replication of the chromosome ends. DNA repair: DNA damage; mismatch and recombination-mediated repair.	6	
11-13	**Reading of the genome by cells**	From DNA to RNA: Three types of RNAs and their structures and roles in gene expression; Transcription initiation; processing of the transcripts (capping, splicing and polyadenylation); export of mRNAs into cytoplasm. From RNA to Protein: Translation (initiation, elongation and termination); protein turnover.	7	
14-17	**Control of gene expression**	Differences in proteins underlie the diversity of cells; recapitulating the *lac* operon regulation; eukaryotic transcription factors and their role in gene expression control, coordination of expression of multiple genes by a single transcription factor; combinatorial control and generation of different cell types, essential post-transcriptional regulatory mechanisms.	8	
18-21	**Cell Membrane and transport across cell membranes**	Cell membrane structure, its origins and organization; principles of transmembrane transport; Transporters and channels; passive, co- and active transport mechanisms; membrane potentials and generation of action potentials.	11 & 12	
22-25	**Endomembrane system and intracellular protein transport**	Membrane-bound organelles: the roles of endoplasmic reticulum and Golgi complex in processing and sorting proteins for peroxisomes, lysosomes and cell membranes; endocytosis and exocytosis; protein transport to nucleus, mitochondria and chloroplasts.	15	
26-29	**Cell communications-I**	Extracellular signals and their effects; Cell surface receptors, their categories and mode of action.	16	
30-34	**Cell communications-II**	Cytoskeleton and its role in movement of cells; Microfilaments and cell movements; intermediate filaments and their role, microtubules, intracellular protein transport and positioning of organelles.	17	
35-38	**Cell Division and its control**	Cell cycle checkpoints; Cyclins and CDKs, Specific molecular events in stages of cell cycle, control of cell numbers, size and cell	18	

		death; Meiosis.		
40-42	**Multicellularity**	Extracellular matrix and connective tissue; Cell junctions; Stem cells and tissue renewal; Cancer and its origins.	20	

6 Evaluation Scheme

Component	Duration	Weightage	Date and Time	Nature of the evaluation component
Mid Sem Exam	90 min	20%	09/10 - 9.30 - 11.00AM	Closed Book
Comprehensive Exam	180 min	30%	06/12 FN	Closed Book
Assignments* and quizzes[#] (Multiple)	Variable	15% 35%	Closed Book Open Book *: For assignments, students will be given a topic in advance and asked to write about the topic in a scheduled time in a classroom. Only students present in the lecture hour when the announcement is made are eligible to take the assignment. No other requests will be considered. [#]: All quizzes will be surprise and can be taken either in lecture or tutorial hour.	

7 Chamber Consultation hour:

8 Notices:

9 Make-up policy: Only students with hospitalization or otherwise recommended by campus doctor will be considered. Refer to clause 4.07 in the Academic Regulations booklet.

10 Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Any evidence of plagiarism in case of assignments and copying from other's answers during the quizzes/assignments/exams will be taken seriously and reported to AUGSD for a disciplinary action.

INSTRUCTOR-IN-CHARGE
BIO F213