SECOND

Birla Institute of Technology & Science, Pilani
Hyderabad Campus

SEMESTER 2021-2022
(Course Handout Part II)

Date: 03-01-2022

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 G542**
Course title **: Advanced Cell and Molecular Biology**
Instructor-in-charge **: PIYUSH KHANDELIA**
Lab Instructors **: Dhansri Krishnamurthy, Murali Krishna Ramgopal, Namita Pandey, Mohammad Mehaboob Subhani Mustafa**

1. Course description:

Eukaryotic cell cycle: restriction point, G1 phase progression, role of cyclins, cancer cell cycles; growth factors and their interaction with receptors: PDGF, EGF, VEGF, FGF, TGF; stress responses: mechanisms molecular biology with special reference to hypoxia; extracelular matrix and adhesion molecules; cytokines: sources, molecular structure, targets and mechanisms of action; apoptosis, caspases and necrosis

This course will provide a flavor of some frontier areas in cell and molecular biology like control of cell division, cell-cell recognition, cellular signaling mechanisms, cytokines and programmed cell death. The topics include: eukaryotic cell cycle - restriction point, G1 phase progression, role of cyclins, cancer cell cycles; growth factors and their interaction with receptors; stress responses: mechanisms and molecular biology with special reference to hypoxia; extracellular matrix and adhesion molecules; cytokines: sources, molecular structure, targets and mechanisms of action; apoptosis, caspases and necrosis.

2. Scope and objective of the course:

After completing this course, students should be able to (i) Understand and appreciate the complexities and intricacies of molecular signaling mechanisms of eukaryotic systems and their impact on development and disease (ii) Design and execute experiments for hypothesis validation independently (iii) Perform basic experiments for cell growth, division, cell death, cytotoxicity etc.

3. Text Books:

T1. Molecular Biology of the Cell (5th edition), Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts and Peter Walter. Garland Publishing Inc., New York and London, 2008.

4. Reference Books:

R1. Molecular Cell Biology (4th edition), Harvey Lodish, Arnold Berk, S Lawrence Zipursky, Paul Matsudaira, David Baltimore, and James Darnell. W.H. Freeman and Company, 2000.

5. Course Plan:

Lecture No.	Learning Objectives	Topics to be covered	Ref* Chap/Sec# (Book)
1	Introduction	Course handout and basic cell and molecular biology	-
2-10	Cell division control in multicellular organisms	Overview of cell cycle, different phases, cell cycle control in eukaryotes, components of cell cycle control system, intracellular control of cell cycle events, role of Rb and p53 in cell	T1: Chapter 17 Pg. 1053-1113

		cycle control	
11-13	Cell cycle and cancer	Cancer as multievolutionary process, cancer critical genes, molecular basis of cancer - cell behavior	T1: Chapter 20 Pg. 1205-1267
14-16	Apoptosis or programmed cell death	Mechanism of cell death with special reference to apoptosis and necrosis, cascade of apoptosis implications	T1: Chapter 18 Pg. 1115-1129 Additional references will be given
17-18	Cell-cell recognition and cell-cell adhesion	Cell junctions and gap junctions, Role of CAMs in cell attachment	T1: Chapter 19 Pg. 1131-1178
19-20	Extracellular Matrix of animals	Components of ECM, role of ECM in bi-directional signaling, integrins	T1: Chapter 19 Pg. 1179-1204
21-31	Signal transduction and cell communication	Mechanisms of signal transduction by cell surface receptor proteins, growth factors and their interaction with receptors in cell proliferation and its regulation	T1: Chapter 15 Pg. 879-964 Additional material will be provided
32-33	Signal transduction pathway by various cytokines	Cytokine sources, molecular structures, JAK STAT pathway	T1: Chapter 15 Pg. 879-964 Additional material will be provided
34-35	Oxygen regulated gene expression and angiogenesis	Hypoxia – pathways and regulation; angiogenesis control	References will be given - Journal articles and reviews
36-37	Signal-mediated transport through nuclear pore complex	Mechanism for the transport of “Cargo” proteins, mechanism for hnRNP protein mediated export of RNA from the nucleus	T1 Chapter 12 Pg. 695-712
38-40	Protein folding and correction of misfolded protein	Mechanism of protein folding in *E. coli* and mammalian systems, Molecular chaperones	References will be given - Journal articles and reviews

Laboratory Component:

Expt. No.	Contents
1	Synchronization of cell cycle in budding yeast
2	Culturing and maintenance of mammalian cells
3	Induction of cell cycle arrest and its study in human cell lines
4	Examining cellular apoptosis using different methods and reagents
5	Transient transfection of mammalian cells
6	Cytokine treatment of mammalian cells
7	Comparative study of normal and transformed cell lines

8	In vitro skeletal myogenesis
9	Confocal Microscopy: Principle and Instrumentation – Demonstration
10	FACS: Principle and Instrumentation – Demonstration

6. Evaluation Scheme:

Evaluation Component	Duration	Weightage (%) (Marks)	Date & Time	Remarks
Mid-semester Exam	90 min	25% (50)	As per Timetable	CB
Lab evaluation (Includes attendance, lab records, quiz and viva)	Variable	20% (40)	continuous evaluation	OB
Assignments/Presentations/Quizzes	Variable	20% (40)	continuous evaluation	OB
Comprehensive Exam	120 min	35% (70)	As per Timetable	CB

7. Chamber consultation hour: Will be announced in the class.

8. Notices: Will be displayed on the Course Management System (CMS).

9. Grading policy: Award of grades will be guided in general by the histogram of marks. Decision on border line cases will be taken based on individual's sincerity, attendance in classes, and the section instructor's assessment of the student. Students missing one or more component of evaluation completely may be given NC.

10. Make-up policy: No make-up will be granted for surprise quizzes and lab components; for mid semester and comprehensive exams, make-up will be given only on medical grounds or with prior permission of the I/C.

11. 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.

INSTRUCTOR-IN-CHARGE
(BIO G542)