Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER 2022-2023
COURSE HANDOUT (PART-II)

Dated: 11-08-2022

In addition to Part I (general handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course No. : **BIO G524**
Course Title : **Animal Cell Culture Technology**
Instructor-In-Charge : **PIYUSH KHANDELIA**
Instructors : **Dhansri Krishnamurthy and Shivasis Mund**

Description : Animal cell and tissue culture from various organisms, types of cell lines, development and maintenance of cell lines, manipulation and applications of cell culture technology for Biotechnological research and therapeutics implication.

1. Course Description: The course will provide a brief overview of how animal cell culture technologies and how it has strengthened the bio-medical research, ranging from basic research to the modern drug discovery. The course will focus on animal cell and tissue culture from various organisms, types of animal cell lines, development and maintenance of animal cells in vitro, manipulation of animal cells in vitro and applications of cell culture technology for biotechnological research and developing therapeutics.

2. Scope and objective of the course: This course will enable students to acquire the necessary theoretical as well as practical knowledge in animal cell and tissue culture technologies. The course will focus on various facets of animal cell culture, like design and layout of the laboratory, aseptic technique, cloning and selection of specific cell types, contamination, cryopreservation, transfection, methods for measuring viability and cytotoxicity, cell culture environment (substrate, gas phase, medium), and the culturing of specific cell types. Recent advances such as 3D culture, robotics and artificial intelligence in animal cell culture etc. will also be covered.

3. Text Book (TB):

1. Freshney, R.I. Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications, Willey-Blackwell Press (6th Ed), 2010 (*BITS library catalog number 591.87 F885 2010*).

4. Reference Book (RB):

1. Asok Mukhopadhyay. Animal Cell Technology. I. K. International Publishing House Pvt. Ltd. 2009 (*BITS library catalog number 591.87 M953 2009*).

5. Course plan:

Lec. No.	Learning objectives	Topics to be covered	Chapter No.
1-2	Introduction	Historical background, Types of culture, Advantages and limitations of tissue culture	1 (TB)
3-6	Biology of cultured cells	Culture environment, Cell Adhesion, Intercellular junctions, Cytoskeleton, ECM,	2 (TB)

		Cell motility	
7-9	Biosafety and lab ethics	Laboratory safety, Risk Assessment, Standard operating procedures, Safety regulations, Bioethics	6 (TB) 6 (RB)
9-11	Laboratory design and equipments	Planning and designing of animal cell culture laboratory, common and specialized equipments, consumables	3, 4, 7 (TB) 6 (RB)
12-13	Aseptic Techniques and Sterilization	Objectives if aseptic techniques, elements of aseptic environment, sterile handling, preparation and sterilization of reagents and materials	5, 10 (TB) 6 (RB)
14-16	Culture media	Defined media and supplements, serum-free medium	8, 9 (TB) 5 (RB)
17-18	Primary culture	Initiation of a primary culture, isolation of tissue, types of primary cell culture	11 (TB) 3, 7 (RB)
19-21	Subculture and cloning	Routine maintenance and sub culturing of cells, authentication and validation of cell lines, cell cloning, isolation of clones	12, 13 (TB)
22-25	Cell line characterization and transformation	Characterizing cells in the culture, transformation, immortalization, tumorigenicity	15, 17 (TB)
26-27	Contamination	Sources of contamination, Types of contamination, Monitoring, disposal and eradication of contamination	18 (TB)
28-29	Cytotoxicity	Markers for cell viability and apoptosis, Viability and cytotoxicity assays	21 (TB) 2, 9 (RB)
30-33	Cell culture of specialized cells and 3D culture	Culture conditions for specific (Differentiated, non differentiated and tumor) cells. Organ, histotypic and organotypic cultures.	22, 23, 24, 25 (TB) 13 (RB)
34-35	Cryopreservation and banking	Rational and principles for cell cryopreservation, Thawing and recovery of frozen cells, Cell banks	19 (TB) 4 (RB)
36-37	Specialized techniques and implications of cell culture	Viable cell separation and quantitation, differentiation, Confocal microscopy, *in situ* hybridization, somatic cell fusion, monoclonals, microcarriers, scale up and automation.	14, 16, 20, 26, 27 (TB) 2, 7, 8, 9 12, 14 (RB)
38-39	Therapeutics implications of cell culture and Bioengineering	Stable gene expression in mammalian cells and methods of DNA transfer, Bioreactors, Tissue engineering	10, 11, 14, 15 (RB)
40	Recent advances in animal cell culture technologies	3D culture, Robotics and artificial intelligence in animal cell culture, Lab grown meat	Reference material will be provided

6. Laboratory plan:

i. Introduction to Animal Cell Culture Laboratory
ii. Introduction to HeLa cells
iii. Preparation of Cell Culture Media

iv. Reviving HeLa cells
v. Sub-Culturing or Passaging of HeLa cells
vi. Trypan Blue Staining and Counting of Viable Cells Using a hemocytometer
vii. Freezing of Cells or Cryopreservation
viii. Reviving cryopreserved cells to check viability
ix. Seeding cells
x. MTT assay to measure cytotoxicity

7. Evaluation scheme:

Component	Duration	Weightage %	Marks	Date and time	Remarks
Midsem Exams	90 mins	25	50	02/11 1.30 - 3.00PM	CB
Laboratory Evaluation	-	20	40	TBA	OB
Assignment/Seminars	-	20	40	TBA	OB
Comprehensive Exams	180 mins	35	70	23/12, FN	CB

8. Chamber consultation hour: To be announced in the class.

9. Notices: All notices will be displayed on the Course Management System (CMS).

10. Grading policy: Students missing one or more component of evaluation completely will be given an NC.

11. Make-up policy: As per the clause 4.07 in the Academic regulations booklet. Make-up will be granted only in case of hospitalization and genuine medical emergency.

12. 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.

Piyush Khandelia
Instructor-in-Charge
BIO G524