GUJARAT TECHNOLOGICAL UNIVERSITY

BIO-MEDICAL ENGINEERING (03)
INTRODUCTION TO TISSUE ENGINEERING
SUBJECT CODE: 2160309
B.E. 6th SEMESTER

Type of course: Core

Prerequisite: Human anatomy and physiology, cell biology, biomaterials and implants

Rationale: The course will cover the application of engineering principles, combined with molecular cell biology, to develop fundamental understanding of property function relationships in cells and tissues.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks				Practical Marks		
L	T	P	C	ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Introduction to tissue engineering, Biochemical influence on cell function, Interaction between cells and their environment.	6	13
2	Cell growth and differentiation: The cell cycle, stem cell and cell differentiation, agents that regulate cell growth and differentiation.	6	13
3	Cell adhesion: Mechanics of cell adhesion, cell junctions, cell adhesion receptors, extracellular matrix, cell adhesion and intracellular signaling.	5	11
4	Cell migration: Overview of cell migration. Cell aggregation and cell sorting overview	4	9
5	Cells micro mechanisms for regeneration and repair stem cells, Biomaterials in tissue engineering, Tissue culture, Bioreactors and bimolecular production, Immunity and surface reaction	5	11
6	Skin tissue engineering, Bone and cartilage tissue engineering, Cardiac tissue engineering, Valve tissue engineering, Vascular tissue engineering, neural tissue engineering, visceral tissue engineering	4	9
7	Organ and tissue transplantation, Scaffold design and fabrication	4	9
8.	Case studies in tissue engineering: Tissue engineered cartilage, tissue engineered skin, Tissue engineering approaches to nerve regeneration.	5	11

Suggested Specification table with marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15%	30%	30%	15%	10%	**0**

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:
1. Tissue engineering: Principles for the design of replacement organs and tissues, W. Mark Saltzman
2. The molecular and cellular biology of wound repair. Clark, Plenum Press
3. Biomaterials Science. Ratner, Hoffman, Schoen, Academic Press.
4. Frontiers of tissue engineering. Patricks, Mikos, McIntire, Pergamon Press.
5. Principles of Tissue engineering. Lenza, Langer, vacanti, Academic Press.
6. Bernhard O. Palsson and Sangeeta N. Bhatia, *Tissue Engineering*, Prentice Hall, 2003
7. Clemens van Blitterswijk *et al.*, *Tissue Engineering*, Academic Press Series in Biomedical Engineering, 2008

Course Outcome:
After learning the course the students should be able to:
1. Understand fundamental concepts in tissue engineering
2. Will be able to do critical evaluation of scientific literature and scientific and engineering research and development in this field.

List of Experiments: (Outlines)

1. To overview tissue engineering and its applications.
2. To study different agents that regulate cell growth and differentiation.
3. To study phenomena of cell migration.
4. To study different biomaterials used in tissue engineering.
5. Overview of organ and tissue transplantation.
6. Finding protocols of animal tissue culture.
7. Case study: Tissue engineered cartilage.
8. Case study: Tissue engineered skin.

Active Learning Assignments: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding of theory and practical work. The faculty will assign topics from which students can grasp knowledge about current scenario of the Diagnostic Instrumentation. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.