



**Course Title:** Stem Cell and Tissue Engineering

**Course Code:** BIOT325

**Credit Units:** 03

L	T	P/ S	SW/FW	TOTAL CREDIT UNITS
3	-	-	-	03

**Course Objectives:**

The students will learn breadth and/or depth of the basic knowledge on regenerative medicine applying the thematic studies of stem cell technology and tissue engineering.

**Prerequisite:** Cell Biology, Animal Biotechnology, Human Physiology, Biochemistry

**Student Learning Outcomes:**

- Demonstrate an understanding of the clinical need for stem cell therapy and tissue engineering in regenerative medicine
- Demonstrate knowledge of stem cell sources and their isolation, characterization
- Demonstrate an understanding of the principle of tissue engineering using basic elements (stem cells, growth factors, biomimetic biomaterials and gene therapy) and their use for tissue engineering
- Gauge the need for biomaterials and design, fabrication and used of the biomaterials in vitro, in vivo and clinical application
- Create processes of application in quality control and monitoring: cell-matrix interaction, proteomics, histology and imaging analysis

**Course Contents/Syllabus- Theory:**

	<b>Weightage (%)</b>
<b>Module I</b>	<b>10</b>
<b>Descriptors/Topics: Introduction to tissue engineering: current scope of development; use in therapeutics and in vitro testing</b> Tissue Engineering and Cell-Based Therapies; Tissue Organization and Morphogenesis; Tissue Dynamics; Basic transplantation immunology and wound healing	
<b>Module II</b>	<b>20</b>
<b>Descriptors/Topics: Stem Cell technology</b> Introduction, Hematopoiesis ; Stem Cells and Lineages; ES cells; Pluripotent Stem Cells; Mesenchymal Stem Cells; Cell surface markers; Cell Isolation and Culture; Cell-Matrix & Cell-Cell Interactions; Cell Migration and Mechanics; induced Pluripotent stem cells (iPS)	
<b>Module III</b>	<b>20</b>
<b>Descriptors/Topics: Technical aspects</b> Coordination of cellular fate processes - soluble signals, types of growth factors and chemokines, signaling and integrated responses, soluble growth factor receptors, Growth factor delivery; Cell-extracellular matrix interactions - Binding to the ECM, Modifying the ECM, Malfunctions in ECM signaling; Direct Cell-Cell contact - Cell junctions in tissues, Response to mechanical stimuli; Bioactive factor delivery; Vascularization	
<b>Module IV</b>	<b>20</b>
<b>Descriptors/Topics: Introduction to Biomaterials</b> Classes of materials and their properties; Characterization of materials; Host reactions to biomaterials; Biological and non-biological biomaterials and considerations for the design of artificial organs; Biodegradable polymers and polymer scaffold processing; Microtechnology Tools; Bioreactors for Tissue Engineering, Implantable Devices, 3D Tissue Printing, Biocompatible Materials.	
<b>Module V</b>	<b>30</b>
<b>Descriptors/Topics: Engineered Disease Models</b>	

In vivo cell & tissue engineering case studies: Artificial skin, Artificial blood vessels, Artificial pancreas, Artificial liver, Regeneration of bone, muscle, Nerve engineering	
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**Pedagogy for Course Delivery:**

Lectures: 39

Tutorial: 0

Presentation/ Seminar: 4

Class Test: 2

Total: 45

**Assessment/ Examination Scheme:**

<b>Theory L/T (%)</b>	<b>Lab/Practical/Studio (%)</b>	<b>End Term Examination</b>
<b>100</b>	<b>0</b>	<b>100</b>

**Theory Assessment (L&T):**

<b>Continuous Assessment/Internal Assessment</b>						<b>End Term Examination</b>
<b>Components (Drop down)</b>	<b>Class Test 1</b>	<b>Class Test 2</b>	<b>Home Assignment</b>	<b>Presentation/ Seminar</b>	<b>Attendance</b>	
<b>Weightage (%)</b>	5	10	5	5	5	70

**Text & References:**

- Stem cell and Tissue Engineering, Editors Li, L Heureux and Elisseeff, World Scientific (2011), **ISBN: 9789814317054**
- Stem Cell Engineering : Principles and Application Editors Artmann, Minger and Hescheler , Springer (2011), **ISBN 978-3-642-11865-4**
- Tissue Engineering, Senior Editor Ulrich Martin , Springer (2009), **ISBN: 978-3-642-32618-9**