

GANPAT UNIVERSITY									
FACULTY OF ENGINEERING & TECHNOLOGY									
Programme	Bachelor of Technology				Branch/Spec.	Biomedical Engineering			
Semester	VII				Version	2.0.0.0			
Effective from Academic Year	2017-18			Effective for the batch Admitted in	July 2017				
Subject code	2BM704		Subject Name		Advanced Bio-Material and Tissue Engineering				
Teaching scheme					Examination scheme (Marks)				
(Per week)	Lecture(DT)		Practical(Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	3	-	1	-	4	Theory	40	60	100
Hours	3	-	2	-	5	Practical	25	25	50
Pre-requisites: Good Knowledge of Human Tissues and basic chemistry.									
<p><b>Learning Outcome:</b> The educational objectives of the course are to educate students to attain the following:</p> <ul style="list-style-type: none"> <li>• Understanding basic principles of tissue engineering, scope and application</li> <li>• Knowledge of stem cells and its types</li> <li>• Aware about instruments used in these techniques</li> <li>• Understanding process of cell growth, differentiation and interactions with tissue.</li> <li>• Know about materials of scaffold</li> </ul>									
Theory syllabus									
Unit	Content								Hrs.
1	<b>INTRODUCTION:</b> Tissue engineering and its fundamentals, Motivation behind tissue engineering, Basic working components of Tissue engineering, Cell sources in tissue engineering, Stem cells: Its types , classification and predominant lineages, Tissue organisation and cell types.								8
2	<b>CELLULAR INTERACTION IN TISSUE ENGINEERING:</b> Tissue organisation and cell types, Dynamic states of Tissue, Cell differentiation, Cell migration, Cell division, cell death or apoptosis, Coordination of cellular-fate processes: soluble signals, Cell-Extracellular Matrix Interactions, Direct cell-cell contact, Cell sorting by FACS.								9
3	<b>SCAFFOLD MATERIALS IN TISSUE ENGINEERING:</b> Natural scaffolds in Tissue engineering, <b>Biomaterials used in Tissue engineering namely: Medically relevant polymers</b> - Its basic structure, physical properties, interaction with tissues, application; <b>Hydrogels</b> - Its basic structure, physical properties, interaction with tissues, application; <b>Biodegradable polymers</b> - Its basic chemistry, chemical bonds, and degradation behaviour, Advanced biomaterial for stents, drug eluting compounds.								8
4	<b>BIOREACTORS AND SCAFFOLD FABRICATION TECHNIQUES:</b> Design requirements of Bio-reactors, Types of Bioreactors: rotating wall, spinner flask, Direct perfusion, Hollow fiber, Compression type. Basic fabrication Techniques: Solvent-casting and particulate-leaching, Gas foaming, Freeze-drying, Melt molding, Sintering, Electro spinning, Rapid prototyping (RP) – CAD/CAM Techniques.								12
5	<b>APPLICATIONS OF TISSUE ENGINEERING:</b> Tissue engineering used for development of Skin, cartilage, development of IPS cells from skin cells, application of IPS cells, induced pluripotent stem cell-derived cardiovascular progenitor cells, clinical trials for Liver Tissue Engineering, Artificial pancreas.								8
Practical content: <b>Term Work and Practical shall be based on the above syllabus.</b>									
Text Books:									
1	Principles of Tissue Engineering by Robert Lanza, Robert Langer and Joseph Vacanti Pub.: Academic Press								
2	Scaffolding in Tissue Engineering by Peter X. Ma, Jennifer Elisseeff, Pub.: by CRC Press								
Reference Books									
1	Tissue Engineering by Bernhard O. Palsson and Sangeeta N. Bhatia, Pub.: Prentice Hall								
2	The Biomedical Engineering Handbook-Volume II (2nd Edition) – by Joseph D. Bronzino, CRC/IEEE Press, 2000.								
3	Buddy Ratner et al. (eds), Biomaterials Science 2nd Edition, Elsevier								