



**IIT Mandi**  
**Proposal for a New Course**

<b>Course number</b>	<b>: BE 507</b>
<b>Course Name</b>	<b>: Tissue Engineering</b>
<b>Credit Distribution</b>	<b>: 3-0-0-3</b>
<b>Intended for</b>	<b>: B.Tech.-M.Tech. Integrated Dual Degree in Bio-Engineering, M. Tech Biotechnology and PhD candidates</b>
<b>Prerequisite</b>	<b>: IC 136 Understanding Biotechnology and its Applications or IC 241 Materials Science for Engineers or Consent of Faculty Member</b>
<b>Mutual Exclusion</b>	<b>: NA</b>

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**1. Preamble:**

The course is designed to introduce **principles of tissue engineering** including the biological, material and engineering aspects. The course will provide a thorough understanding of tissue regeneration using material platforms, their interactions with the surrounding tissue and immune system. The dynamics of cell-extracellular matrix interaction and its effect on tissue regeneration will be covered. The applications of these principles in developing 3D printed/ bioprinted tissues and organs, as well as in vitro disease models that are the forefronts of biomedicine; will be discussed.

**2. Course Modules with quantitative lecture hours:**

**Unit 1: Introduction to Tissue Engineering-**The history and scope of tissue engineering, Challenge in imitating nature, Cells as building blocks, Clinical translation

(4 Hours)

**Unit 2: Cellular differentiation and Tissue Development** -Molecular organization in cells, Cell-matrix interactions, Tissue development

(4 Hours)

**Unit 3: Functional Tissue Engineering-**Matrix as growth factor reservoir, Mechanobiology of matrix, Biosimilar materials as scaffolds

(6 Hours)

**Unit 4: 3D Tissue Culture Techniques-**Animal cell culture, Biomaterials in tissue engineering, Cell interactions with polymers, conventional 3D scaffolds, 3D printing, 3D bioprinting

(8 Hours)

**Unit 5: Transplantation of Engineered Tissues & Disease Models** -Host Immune Response, Immunomodulation, Disease models, applications of disease models

(6 Hours)

**Unit 6: Orthopaedic Tissue Engineering** -Mesenchymal stem cells, Bone ultrastructure and anatomy, Bone tissue engineering, Articular cartilage tissue engineering, Intervertebral disc tissue engineering, Orthopaedic disease models

(8 Hours)

**Unit 7: Ophthalmic Tissue Engineering**-Stem cells in the eye, Corneal replacements, Ophthalmic disease models

(6 Hours)

**Laboratory/practical/tutorial Modules: NA**

**3. Text books:**

1. Robert Lanza, Robert Langer and Joseph Vacanti, **Principles of Tissue Engineering**, Academic press, USA, 2020
2. Bikramjit Basu, **Biomaterials Science and Tissue Engineering: Principles and Methods**, Cambridge University Press, UK, 2017

**4. References:**

1. Bikramjit Basu, **Biomaterials for Musculoskeletal regeneration: Concepts**, Springer Nature, Switzerland, 2017
2. Ravi Birla, **Introduction to tissue engineering: applications and challenges**. John Wiley & Sons, USA, 2014.

**5. Similarity with the existing courses:**

(Similarity content is declared as per the number of lecture hours on similar topics)

S. No.		Course Code	Similarity Content	Approx. % of Content
1.	Biomaterials	BE504	Biomaterials for tissue engineering, Interactions, Immune response	10%

**6. Justification of new course proposal if cumulative similarity content is >30%: NA**