

TISSUE ENGINEERING AND BIOMATERIALS SCIENCE (IBT-920) Credit Hrs 3 (3-0)

1. Educational Objectives

- a. Provide a broad and balanced curriculum in Tissue engineering and Biomaterials Science in order to equip students with the necessary knowledge, skills and understanding to pursue successful careers in both industry and research environments.
- b. Provide teaching environment in which postgraduates can interact with academic staff through advanced course units and project work.
- c. Oral and written communication, group work and IT skills.
- d. Provide students with effective academic support and enable all students to achieve their full potential.
- e. Monitor and enhance educational provision to ensure that it remains relevant to current development in research and industry in Pakistan.

Course Outcomes:

2. At the end of the subject, students will be able to:
 - a. Apply engineering principles to analyze and predict specific cell physiological behaviors.
 - b. Integrate fundamental knowledge from cell and molecular biology, physiology, and biomechanics to comprehend recently published approaches to tissue engineering.
 - c. Ability to understand Stem Cell Bioengineering processes and its applications to Tissue Engineering and Regenerative Medicine.
 - d. Insight on biomaterial properties and integration of biomaterials on engineered tissues.
 - e. Ability to tailor biomaterials for Tissue Engineering and Drug Delivery applications.
 - f. Ability to integrate the knowledge on biomaterial fundamentals and Cell & Tissue Biology towards the development of Biomedical Applications.

- g. Understand the most recent developments in biomaterials and tissue engineering.
- h. Use, through case studies, the appropriate techniques and right strategies in the successful development of new biomaterials for medical applications.

3. **Course Contents:**

- a. Introduction to Tissue engineering
- b. Introduction to Biomaterials Science
- c. Materials in the living world today – Classes of Biomaterials
- d. Anatomy and physiology of the human body
- e. Tissue interactions/Tissue response to materials (cell-material interaction)
- f. Structure and design of materials – Innovative Biomaterials for tissue engineering applications:
 - (1) Soft tissue replacement e.g. skin, connective tissues, heart, nerves
 - (2) Hard tissue replacement e.g. bone, cartilage, tendon
- g. Transplantation – organ transplant and replacement
- h. Design I Project – Bioengineering innovation and design
- i. Nanomaterials for Tissue engineering e.g. nanotubes, nanoparticles and nanowires
- j. Importance of Tissue engineered products in Industry
- k. Future of Biomaterials Science and nanotechnology

Recommended Books:

- 1. Principles of tissue engineering - Lanza, R. P., Langer, Robert S., Vacanti, Joseph, 2007

2. Biomaterials, medical devices, and tissue engineering: an integrated approach - Silver, Frederick H., 1994
3. Materials Science and Engineering an Introduction, William D Callister, Jr., 6th,or 7th or 8th Edition
4. Biomaterials science: an introduction to materials in medicine - Ratner, B. D., Society for Biomaterials, 2004