NJIT | DEPARTMENT OF BIOMEDICAL ENGINEERING

BME 430 – Fundamentals of Tissue Engineering

3 Credits, 3 Contact hours
Instructor: Jonathan Grasman, Ph.D.

No Textbook(s)/Materials Required: Supplemental handouts will be provided as needed.

REFERENCES **(on reserve at library)**
"Tissue Engineering", by Bernhard O. Palsson and Sangeeta N. Bhatia, 2004 Pearson Prentice Hall, ISBN: 0-13-041696-7
"Essential Cell Biology", 4th edition, Alberts et al., 2013
"Transport Phenomena in Biological Systems", 2nd edition, Truskey, Yuan, and Katz, 2009.
"Principles of Tissue Engineering", 4th Edition. Edited by R. Lanza, R. Langer, J. Vacanti, 2013.

Description:
This course is an introduction to the field of tissue engineering. It is rapidly emerging as a therapeutic approach to treating damaged or diseased tissues in the biotechnology industry. In essence, new and functional living tissue can be fabricated by delivering cells, scaffolds, DNA, proteins, and/or protein fragments at surgery. This course will cover the advances in the fields of cell biology, molecular biology, material science and their relationship towards developing novel "tissue engineered" therapies.

Prerequisites:
BME 420, Math 222
This is a required course for the Biomaterials and Tissue Engineering Track.

Course Learning Outcomes (CLOs):
By the end of the course, you should be able to do the following:

1. **Solve Problems at the Interface of Biology and Engineering:** Understand the fundamental principles of cell biology, molecular biology, and engineering towards developing tissue engineered therapies. Apply knowledge of math, engineering and science to identify, formulate, and solve problems in this area.

2. **Transport and Biomechanical Modeling:** Apply knowledge of math, engineering and science to understand the principles of mass transport and biomechanical modeling. Understand how to apply specific models to solve problems in the areas of cellular and tissue engineering.

3. **Work in Multi-disciplinary Teams:** Learn to work and communicate effectively with peers on multi-disciplinary teams to attain a common goal.

4. **Understand Professional and Ethical Responsibility:** Learn the ethical issues surrounding the use of stem cells and gene therapy in creating tissue engineered therapies.

Student Outcomes:

Student outcome 1 – an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
Related CLO – 1

Student outcome 5 – an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
Related CLO - 3

Student outcome 4 – an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
Related CLO – 4

Program Specific Criteria:

B- the capability to apply advanced mathematics (including differential equations and statistics) to solve the problems at the interface of engineering and biology
Related CLO - 2

C - the capability to apply advanced science and engineering to solve the problems at the interface of engineering and biology
Related CLO - 2

Course Topics: Basics of molecular and cell biology, biology tools, developmental biology, mathematical models for cell motility and adhesion, bioreactor design, biomaterials as scaffolds for tissue growth, immunology, stem cells, design issue for specific tissue types/applications.