

Dr. T. Arinzeh  
1/28/2013

Spring 2013

## BME 651 Principles of Tissue Engineering



*The Department of*  
**Biomedical Engineering**

### CLASS HOURS

Monday 11:30-2:25 pm (CKB208)

### OFFICE HOURS (Fenster 614)

Tuesday 10-11:30 am (by appointment only)  
(973) 596 5269 [arinzeh@njit.edu](mailto:arinzeh@njit.edu)

### TEXT

“Principles of Tissue Engineering”, 3rd Edition. Edited by R. Lanza, R. Langer, J. Vacanti, 2007.  
Supplemental handouts will be provided as needed.

### REFERENCES (on reserve at library)

“Essential Cell Biology”, 2nd edition, Alberts et al, 2004.

“Transport Phenomena in Biological Systems”, Truskey, Yuan, and Katz, 2004.

“Tissue Engineering”, by Bernhard O. Palsson and Sangeeta N. Bhatia, 2004.

### COURSE DESCRIPTION

Prerequisites: Differential Equations

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.

### LEARNING OUTCOMES

By the end of the course you should be able to do the following:

- **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.
- **Transport Modeling:** Apply knowledge of math, engineering and science to understand the principles of mass transport modeling. Understand how to apply specific models to solve problems in the areas of cellular and tissue engineering.
- **Work in Multi-disciplinary teams:** Learn to work and communicate effectively with peers on multi-disciplinary teams to attain a common goal.
- **Understand Professional and Ethical Responsibility:** Learn the ethical issues surrounding the use of stem cells and gene therapy in creating tissue engineered therapies.

**COURSE OUTLINE\***

| <b>Week</b> | <b>Topic</b>  | <b>Reading Material</b>                          | <b>Homework Assignment</b> |
|-------------|---|--|----------------------------|
| 1           | Introduction, Basics of molecular and cell biology                              | Chapters 1-5 and handouts                        |                            |
| 2           | Basic Cell Bio Tools, Developmental Biology                                     | Chapters 6-10, 14, 15 and handouts               | Handout                    |
| 3           | Mathematical Models for Cell Motility and Adhesion (Transport)                  | Chapter 18 and handouts (Chpt 6 – Transport Ref) | Handout                    |
| 4-5         | Tissue Growth in the Laboratory (Transport-Bioreactors)                         | Chapters 11 & 12 (Chpt. 7.5 – Transport Ref)     | Handout                    |
| 6           | Cell and Tissue Mechanics   | Chapter 18 and handouts                          |                            |
| 7           | Mid-Term (March 18)   |  |                            |
| 7-8         | Biomaterials as Scaffolds for Tissue Growth                                     | Chapters 19-25 and handouts                      | Project Assignment         |
| 9           | Transplantation of Tissues – Immunological Concerns                             | Chapters 26-29                                   |                            |
| 10          | Stem Cells as a cell source   | Chapters 30-33 and handouts                      | Handout                    |
| 11          | Gene Transfer   | Chapters 34 & 35                                 |                            |
| 12          | Clinical Implementation (including Ethical Issues)                              | Chapter 78 & 86                                  |                            |
| 13-14       | Design Issues for Regenerating Specific Tissues and Final Project Presentations | Handouts   |                            |

**\*The Course Outline may be modified at the discretion of the instructor or in the event of extenuating circumstances. Students will be notified in class of any changes to the Course outline.**

**GRADING**

Mid-Term (25%)  
Project (25%)  
Homework (10%)  
Final Exam (40%)

Homework assignments are due in one week (unless otherwise noted). Late homework assignments will not be accepted.

Attendance is mandatory. No makeup examinations will be administered, unless documented excuse for a missed exam is provided.

NJIT Honor Code will be upheld. Any violations will be brought to the immediate attention of the Dean of Students.

Students will be consulted by the instructor and must agree to any modifications or deviations from the syllabus through the course of the semester.