Dr. T. Arinzeh Fall 2006
9/8/2006 – Vers 2

BME 498-001
ST: Tissue Engineering

The Department of Biomedical Engineering

CLASS HOURS
Wednesday 11:30-12:55pm (Fenster 625)
Friday 2:30-3:55pm (Fenster 625)

OFFICE HOURS (Fenster 614)
Friday 4-5pm (by appointment only)
(973) 596 5269 arinzeh@njit.edu

TEXT
"Tissue Engineering", by Bernhard O. Palsson and Sangeeta N. Bhatia, 2004 Pearson Prentice Hall, ISBN: 0-13-041696-7
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.
"Principles of Tissue Engineering", 2nd Edition. Edited by R. Lanza, R. Langer, J. Vacanti.

COURSE DESCRIPTION
Prerequisites: BME 420, MATH 222
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 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.
- **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*

Week	Topic	Reading Material	Homework Assignment
1	Basics of molecular and cell biology and basic tools	Chapters 1, 2, 9.1, 9.2.1-9.2.3, and handouts	Handout
2	Developmental Biology	Chapter 4, 6.1.1-6.1.2, 6.2.1, 6.3.1, 6.4.1, 7, and handouts	
3	Mathematical Models for Cell Motility and Adhesion (Tranport)	Chapter 9.2.4 and handouts (Chpt 6 – Transport Ref)	Problems 8, 18, and handout
4	Tissue Growth in the Laboratory (Bioreactors)	Chapter 10 and handouts (Chpt. 7.5 – Transport Ref)	Handout
5	Cell and Tissue Mechanics	Chapters 12.1-12.2, 13.1-13.4	
6	Mid-Term (Oct. 18)		
6-8	Biomaterials as Scaffolds for Tissue Growth	Chapter 15, 16, and handouts	Project Assignment
9	Transplantation of Tissues – Immunological Concerns	Ch 18 and 19	
10	Stem Cells as a cell source (ethics and approaches)	Chapter 5 and handouts	Handout
11-13	Design issues for regenerating specific tissues	Handouts	
14	Project Presentations		

***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.

BME 498-001: Learning Outcome Summary

Outcome # 1. Students will understand the fundamental principles of cell biology, molecular biology, and engineering towards developing tissue engineered therapies		
Strategies & Actions	**Program Outcomes**	**Assessment Methods**
Cell biology, molecular biology and engineering with applications are covered in class lectures, homeworks, and project assignments.	A,C,D,E,G,J,K,L,M, O	Tests, homeworks, and project report and presentation are graded.
Outcome # 2. Students will apply knowledge of math, engineering and science to understand the principles of mass transport and biomechanical modeling.		
Strategies & Actions	**Program Outcomes**	**Assessment Methods**
Lectures and discussions cover theoretical models in mass transport and biomechanics and applications in the understandingof tissue formation. Homeworks will challenge students to apply models, derive solutions, and interpret results.	A,C,D,E,G,J,K,L,M, O	Homework assignments
Outcome # 3. Students will learn to work and communicate effectively with peers on multi-disciplinary teams.		
Strategies & Actions	**Program Outcomes**	**Assessment Methods**
Final project report and presentation will be conducted by teams of approximately 3 students. Each team member is expected to participate in the development of problem-solving strategies and assume a specific role in accomplishing the team's goals.	A,C,D,E,G,K,L,O	Project report and presentation (Rubrics for evaluation of presentation)
Outcome # 4. Students will understand professional and ethical responsibility		
Strategies & Actions	**Program Outcomes**	**Assessment Methods**
Lecture and homework will cover regulatory and safety issues surrounding tissue engineering therapies, including ethical issues in the use of stem cells and gene therapy.	F	Homework