BME 302
Intro to Biomedical Engineering: *Foundations in Biomechanics*

The Department of Biomedical Engineering

CLASS HOURS
Tuesday 10:00-12:10pm (Fens 636)
Friday 1:00-3:10pm (Fens 640)

OFFICE HOURS (Fenster 619)
Tuesday 12:10- 1:30pm
Friday 11:00-1:00pm or by appointment
(973) 596 3556 redling@njit.edu

TEXT
Fundamentals of Biomechanics, 2nd Edition, Ozkaya & Nordin
ISBN: 0387982833
Supplemental handouts will be provided as needed.

COURSE DESCRIPTION
Prerequisites: Math 111, Math 112, Phys 111, Phys 121, BME 106. Co-requisite: Math 225.
Course lectures and laboratories will address important issues covering the mechanical fundamentals that are important bases for later learning experiences. This course introduces the students to biomaterials (tissues), biomechanics (forces and motion), bio-fluids and biostatistics, and then integrates them with a final design project on neuromuscular engineering.

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

- **Physiological Applications:** Understand the fundamental principles and physiological applications of biomechanics, biomaterials, bio-fluids, and biostatistics**.** Apply knowledge of math, engineering and science to identify, formulate, and solve problems in these areas.

- **Data Interpretation:** Learn to utilize Matlab software to analyze data. Apply knowledge of math, engineering and science to interpret data. Develop an understanding of and develop the skills necessary to communicate findings and interpretations in an effective laboratory report.

- **Biomechanical Modeling:** Apply knowledge of math, engineering and science to understand the principle of biomechanical modeling. Understand how to apply specific models to solve problems in the areas of biomechanics, biomaterials and bio-fluids.

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

Dr. J Redling Fall 2007

COURSE OUTLINE*

Date	Topic	Material	Class work	Reading/Problem/Studio Assignment**
9/4	Biomechanics – FBD's and Vector analysis	Lecture1 Chapters 1,2	Studio Exercise A	Chapters 1,2 exercises
9/7	Musculoskeletal Lever Systems; Method of Sections	Lecture 2 Chapter 3	Studio Exercise B	Chapter 3 exercises
9/11	Lever systems cont'd; Intro to Statics	Lecture 3 Chapter 3,4	Studio Exercise C / Studio Lab 1	Chapter 4 exercises
9/14	Statics and Intro to Biomechanical Models to determine COG	Lecture 4 Chapter 4,5	Studio Exercise C / Studio Lab 1	Chapter 5 exercises Statistics HW 1 assigned
9/18	COG continued	Modelling handout Chapter 5	Studio Lab 2 and 3	
9/21	Joint & Muscle mechanics; indeterminate systems	Lecture 5 Chapter 5	Studio Lab 2 and 3	Studio Lab 1 due
9/24	BME applications; Intro to Deformable body mechanics	Lecture 6 Chapter 6	Studio Exercise D	Statistics HW 1 due
9/28	Deformable body mechanics (Stress & Strain)	Lecture 7 Chapter 7	Review Exercises	Studio Labs 2 and 3 due Review session on Monday
10/2	Exam 1	Ch 1-5		
10/5	Stress and strain continued	Lecture 8 Chapter 7	Studio Exercise E	Chapter 7 exercises/ Matlab review on Wed
10/9	Multiaxial deformations; Stress transformations	Lecture 9 Chapter 8	Studio Lab 4/ Studio Exercise F	Assign Statistics HW 2
10/12	Mohr's circle; Failure theories	Lecture 10 Chapter 8	Studio Lab 4/ Studio Exercise F	Chapter 8 exercises
10/16	SF, stress concentration; Torsion and bending	Lecture 11 Chapter 8	Studio Exercise G	Statistics HW 2 due
10/19	Viscoelastic models; intro Biological tissue properties	Lecture 12 Chapter 9	Studio Exercise H	Studio Lab 4 due
10/23	Mechanical properties of Biomaterials: Bone	Lecture 13 Chapter 9	Studio Exercise I	Chapter 9 exercises
10/26	Mechanical properties of Biomaterial: Soft tissue	Lecture 14 Chapter 9	Review exercises	Review session on Monday
10/30	Exam 2			
11/2	Fluid statics and pumps; Pouiseuille's law	Handouts	Studio Lab 5/Studio Exercise J	
11/6	Biofluid Mechanics: Laplace's law	Handouts	Studio Lab 5/Studio Exercise J	
11/9	Biofluid Mechanics: Bernouilli's principle	Handouts	Studio Lab 6/Studio Exercise K	Studio Lab 5 due
11/13	Cardiovascular models	Handouts	Studio Lab 7	Studio Lab 6 due
11/16	Cardiovascular fluid mechanics	Handouts	Studio Lab 8	Statistics HW 3 assigned
11/21 *	Muscle Dynamics	Lecture 15	Studio Exercise L	*Wednesday follows Friday schedule; Studio Lab 7 due

Revised 8/30/07

11/26	Muscle Dynamics	Handouts		Statistics HW 3 due; Statistics HW 4 assigned
11/30	Hexapod Materials/Design	Handouts	Studio Lab 9 Hexapod Design	Studio Lab 8 due
12/4	Hexapod Design	Handouts	Studio Lab 9 cont'd	
12/7	Hexapod Design/Presentations	Handouts	Hexapod Presentations	Statistics HW 4 due
12/11	Final Review	Handouts	Hexapod Labs due#	Studio Lab 9 (Hexapod) report due#
TBA	Final Exam			

***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 and schedule of studio sessions.**

****Studio Exercises not completed in class are due at the next class meeting.**

GRADING
Studio Exercises (including Lab reports): 30%
Exam 1: 15%
Exam 2 : 15%
Group quizzes: 10%
Final Exam 30%

Attendance is mandatory. Failure to attend class regularly will result in a failing grade.
No makeup examinations will be administered. If a valid, documented excuse for a missed exam is provided, the weight of the Final Exam will increase to compensate for the missed grade.

STUDIO Exercises/LABS
BME 302 uses a ***studio-learning*** approach, an alternative to the conventional lecture, recitation, laboratory format. This approach to learning is challenge-driven; it is designed to promote greater opportunity for developing your problem-solving abilities and critical thinking skills. Each class meeting integrates lectures and laboratories into a "studio session". In general, each session will begin with a mini-lecture, followed by a studio exercise or lab. Studio sessions are challenge-driven and require that you are fully engaged in the learning process. Unlike more traditional class formats, the goal is not to "deliver" knowledge to you in class; you will be the one building your own body of knowledge. In these exercises, you will be working in small teams with no more than three (3) members. As an active contributor to your team, you are expected to generate and share ideas, test the team's ideas (i.e. conduct research), and share your findings with other teams (i.e. teaching is the best way to learn!).

Since you are expected to generate ideas within your team, it is critical that you read all relevant material PRIOR to class. This will promote more effective research and increase your understanding of the material covered in the studio session. Some studio sessions will require completion of a **Studio Exercise.**; **each student is expected to submit** an exercise at the end of the session. Other sessions will involve a **Studio Lab** and will require submission of a **Group Laboratory Report** prepared outside of class.

Guidelines for Studio Laboratory Reports

Written lab reports must be submitted one-week after the studio session, unless otherwise specified[#]. Please note: *reports that are submitted without evidence of participation in the studio exercise will be considered plagiarism* and will result in dismissal from the course. You cannot copy the experimental results of others and claim credit. Throughout the semester, each team member will be expected to design the initial solution, laboratory exercise coordinator (the person who coordinates the team for the laboratory exercise), take measurements, interpret the data, validate the results, and write the lab report in the laboratory notebook. The responsibilities of the team members will be different for each studio exercise, e.g., each group member must have the opportunity to write the lab report, to construct the initial design, etc.

Laboratory format:

- **Title Page:** Studio Lab title, team member names, team member roles, date submitted.
  Team roles may include:
  - initial solution designer
  - laboratory coordinator
  - measurement taker
  - data interpreter
  - results validation person
  - lab report writer

- **Abstract (1 paragraph)**
  State the purpose/main concept of the lab and its importance. Summarize findings.

- **Methods**
  Brief description of the lab procedure in your own words. Include the reasoning for each step and suggestions for improvement.

- **Results**
  Presentation of your data
  Interpretation (meaning) of your data
  Use tables, graphs and other means to achieve the points above.

- **Discussion**
  Relate and state your data to the purpose/main concept of the lab.
  State how your data support or reject the purpose of this lab.
  Be clear and precise of your interpretation. Quality of your work is better than quantity.

- **Conclusion**
  Summary of the main point drawn from the discussion (DO NOT COPY and PASTE) in one or two sentences.

Honor Code Violations/Disruptive Behavior: NJIT has a zero-tolerance policy regarding cheating of any kind and student behavior that is disruptive to a learning environment. Any incidents will be immediately reported to the Dean of Students. In the cases the Honor Code violations are detected, the punishments range from a minimum of failure in the course plus disciplinary probation up to expulsion from NJIT with notations on students' permanent record. Avoid situations where honorable behavior could be misinterpreted. No eating or drinking is allowed in class. Cellular phones must be turned off during the class hours.