

MER/BIO 440 ORTHOPEDIC BIOMECHANICS

Instructor: Professor Rapoff; Steinmetz 219; rapoff@union.edu; 388-8384

When & Where: Mondays, Wednesdays & Fridays 9:15 to 10:20 am; Butterfield 106

Office Hours: Generally anytime, or please consult schedule outside my office for official hours.

Course Website: See link at engineering.union.edu/~rapoffa

Prerequisites: MER 214 Strength of Materials

Textbook & Readings: Perhaps a few journal papers and select chapters from the following texts will be distributed:

Cook RD, Young WC. Advanced mechanics of materials. 2 ed. Prentice Hall 1999.

Cowin SC (ed). Bone mechanics. 1/2 ed. CRC Press 1989/2001.

Martin RB, Burr DB, Sharkey NA. Skeletal tissue mechanics. Springer-Verlag 1998.

Vincent JFV. Structural biomaterials. Princeton University Press 1990.

Course Objective: The primary objective of this course is understanding the hierarchical structure and function of bone and other biologic hard tissues, and how their structure and function relates to their mechanical properties, appropriate constitutive models and methods of analysis. Other objectives include the reinforcement and expansion of knowledge in solid mechanics and the introduction to the analysis of skeletal joints, implants and prosthetics.

Homeworks: Several homework problem sets will be assigned throughout the term. Solutions must be completely self-explanatory and of professional quality.

Exams: Two exams will be administered, the first during regularly scheduled lecture time and the second during the final exam period scheduled by the College. All exams may be closed everything; calculators may not even be allowed.

Laboratory Report: A series of laboratory exercises will be conducted using the techniques of micro-computed tomography, light microscopy and microindentation to explore structure-function relationships in bone. Detailed notes should be kept for a report due at the Final Exam. More information will be provided during the term.

Extra Credit: Extra credit problems or quizzes may be assigned or administered during regularly scheduled lecture periods. These points will add directly to the homework points.

Grades: Course grades will be determined using these weights: 25% for homeworks, 25% for each exam (midterm & final) and 25% for laboratory report; and this scale: $\geq 93=A$, $90-92=A-$, $87-89=B+$, $83-86=B$, $80-82=B-$, $77-79=C+$, $73-76=C$, $70-72=C-$, $60-69=D$, and $\leq 59=F$. All grading must be contested prior to the beginning of the lecture period following the period at which the original assignment was returned. These contestations must be accompanied by a brief written explanation of how your solution was incorrectly penalized.

Attendance & Punctuality: Each student will be responsible for knowledge of all scheduling changes and announcements made in class. No prior, late or makeup homeworks, exams, reports, extra credit or contestations will be administered, accepted or allowed without a College approved excuse.

Academic Honesty: Without exception, all assignments must represent the sole work of each individual student. Students may seek from others clarifications of concepts but nothing else. From the Student Handbook: "As a [member of the] Union College [community], [we] hereby dedicate [ourselves] to ... support and uphold the following principles: academic openness in the pursuit of knowledge, academic honesty, awareness of and respect for others' rights - regardless of race, creed, sex, sexual orientation or position, and dignity and pride in [ourselves], [our] actions, and [our] College."

Students with Disabilities: From the Disabled Student Services website: "The Director of Student Support Services provides assistance to students with disabilities ... Students with disabilities who require accommodations must make a formal request by submitting documentation of the disability and accommodations requested." Please present the approved request to the Instructor within the first two weeks of the term, in total confidence and at your discretion.

COURSE OUTLINE

Week	Monday	Topic	Assignments
1	2 April	Mechanics of Materials Review; Generalized Hooke's Law	HW 1
2	9 April	Generalized Hooke's Law	HW 2
3	16 April	Forces in Skeletal Joints	HW 3
4	23 April	Skeletal Biology (Lab)	HW 4
5	30 April	Quantitative Composition (Lab)	HW 5
6	7 May	Midterm Exam Wednesday 9 May 2007	
7	14 May	Mechanical Properties of Bone (Lab)	
8	21 May	Mechanical Properties of Bone	HW 6
9	28 May	Fatigue & Fracture Resistance of Bone (Lab)	HW 7
10	4 June	Mechanical & Evolutionary Adaptation of the Skeleton	
Finals		Final Exam: Wednesday 13 June 8:30 - 10:30 am	Report