Syllabus: Introduction to Biomedical Engineering - BME 4100

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Office Hours: Tuesday 9:15 – 10:30 am, Thursday 9:15 – 10 am, or by Appointment

Course Time: TBA

Course Location: TBA

Text: None. All course materials will be available as handouts or on Blackboard.

TA: TBA

Course Overview
This course is designed to introduce engineering students from engineering and other disciplines to a wide range of topics in biomedical engineering. Fundamental concepts from engineering will be applied to medicine and biology. Examples of current and breakthrough technologies used in biomedical engineering will be described.

Course Outline (tentative)

Week 1, Course Description, Syllabus and Biology Review: A crash course/review on systems, cellular and molecular biology; and an overview of breakthroughs in the field of biomedical engineering

Week 2, Mammalian Physiology: Systems and Whole body considerations. Overview of material and energy balances in mammals and humans; thermoregulation; whole body metabolic measurements; basic anatomy.

Week 3, Physiology and Metabolism: Cellular level - transport through cell membranes; Basic cellular structure; movement of materials into/out of cells; kidneys and artificial kidney design. Fluid aspects - blood and the circulatory system; Blood characteristics; blood flow; blood fractionation, pharmacodynamics. Lecturer: Jeanine Mansour, MS, TA.

Week 4, Neuroengineering: Basics of nerves (focusing on the brain, sensory and motor systems), action potentials; EEG; Neural control and interactions with other physiological systems; physiological modeling.
Week 5, Neuroengineering - Biomedical Sensors & Sensory Systems: “Sensor” aspects: neuroscience and environmental sensing; visual and auditory sensors, overview of other sensory systems; artificial ear. 
*Student presentations begin.*

Week 6, Tissue Engineering: Thursday – Greeshma Mohan, PhD Student, Dept. of Chemical & Biomedical Engineering, USF College of Engineering. 
*Tuesday - Student Presentation.*

Week 7, Tuesday: Guest Lecturer, Dr. Jean Krause, Dept. Communication Sciences & Disorders, USF Behavioral & Community Sci. College: Speech Processing. 
Thursday - Biomechanics: Materials science review; soft tissue composition and biomechanics (including skin, tendons, ligaments, muscles, etc.); soft tissue implants; hard tissue composition; hard tissue implants; prosthetics; 
*Thursday - Student Presentation.*

Week 8, Immunology for Bioengineers: Guest Lecturer, Dr. Ken Ugen, Dept. of Molecular Medicine, USF College of Medicine. 
*No student presentations.*

Week 9, Biomaterials: Material aspects: biomaterials and biocompatibility; Basic biomaterials (ceramics, metals, polymers, etc.) biocompatibility; blood compatible materials 
*Student Presentations.*

Week 10, Tuesday – Mid-Term Exam 
Thursday - Medical Imaging: Radiation Imaging, CT, MRI, and PET 
*No student presentations.*

Week 11, Bioinstrumentation: Amplifiers, Mass spectrometry, 2-D Gels, bio-signals and signal acquisition and averaging, biomedical devices. 
*Student presentations.*

Week 12, Biomedical Images & Bioinformatics: Overview of: biomedical imaging and radiology, bioinformatics, biostatistics; high-throughput investigational and data display techniques; genomics. 
*Student presentations.*

Week 13, Cardiovascular & Respiratory Systems: Guest Lecturer, Dr. Jonathan Reich. Cardiac physiology; EKG; Artificial blood; oxygenation devices. Gas exchange aspects: the respiratory system. 
*No Student presentations: Thursday – Thanksgiving Holiday.*

Week 14, Patents, Clinical Engineering and Drug Delivery: Technology transfer; Health care system aspects: clinical engineering; Overview of clinical engineering and “health care systems”. Novel advances in targeted drug delivery. 
*Student presentations.*
Week 15, Biomedical Optical Engineering: Lasers, Light propagation, Photo thermal therapeutics, Fiber optics and waveguides. Review, Q&A.

Tuesday Student presentation.

Week 16, Final Exam,
The format of the course will be a traditional lecture with a mixture of lecture, power point presentations and handouts. Outside speakers will be brought in to discuss fields that they are expert in. Therefore, the order of topics covered may change according to the scheduling of the outside speakers.

Grading and Related Matters
1) There will be multiple, short quizzes throughout the semester, generally at the start of each Tuesday class, but may be given at any time during class meetings. The quiz will cover the material from the previous week lectures.
2) Each week a reading assignment will be posted on Blackboard. Some questions on the weekly quiz will require knowledge of the reading assignment.
3) There will be 1 mid-term test during the semester.
4) There will also be a comprehensive final exam that is compulsory. No test grades or quiz grades can/will be dropped. The final will be given during finals week as dictated by the USF schedule.
5) Homework: Each week a short, written homework assignment will be given out, due at the start of the next week’s Thursday class. You may work together, but must fill in the final answers yourself.
6) By the end of the semester, each group of 2-3 students will give a 10-minute Power Point Presentation (about 10 slides), critiquing a biomedical engineering journal article of choice. Prof. Frisina will assign groups of 2-3 students, and schedule several of these presentations each week. 2 weeks or more, before your presentation is scheduled, your student group should meet, and you must e-mail or meet with Prof. Frisina, listing 3 or more possible articles to choose for your presentation. If you would like to meet with Prof. Frisina, the meeting should be setup beforehand via an e-mail appointment. Approval of your final choice by Prof. Frisina should be obtained 2 weeks prior to your presentation.

Final grades will be based on the following:
15% Quizzes, 15% Homework, 15% oral presentation/class participation, 25% Mid-Term Exam, 30% Final exam

Grading Scale: 97+ A+; 94 to 96 A; 90 to 93 A-; 87 to 89 B+; 84 to 86 B; 80 to 83 B-;
77 to 79 C+; 74 to 76 C; 70 to 73 C-; 67 to 69 D+; 64 to 66 D; 60 to 63 D-; 59 and below F

Course Objectives and Goals
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1. Students will understand the basics of systems biology, prokaryotic and eukaryotic cell biology, and molecular bioengineering concepts.

2. Students will have knowledge of the basic moral/ethical issues that face biomedical engineers.

3. Students will know the basic anatomical and physiologic features of the mammalian and human body.

4. Students will understand the basics of biomechanical motion and motor systems.

5. Students will have knowledge of biomaterials and their basic uses.

6. Students will have an understanding of tissue engineering and its role in the future of medicine/bioengineering.

7. Students will have an understanding of neuroengineering, biomedical sensors and instrumentation.

8. Students will be familiar with medical imaging, including the ultrasound, X-ray, CT, MRI, and PET imaging techniques; as well as bio-optics.

9. Students will have a general understanding of patents and technology transfer.

10. Students will gain a basic appreciation for cardiovascular, renal and respiratory systems and physiology.

Academic Dishonesty Policy
Academic dishonesty policy of USF will be followed in this class. Therefore, plagiarizing, or cheating during any test, quiz, or the final exam will result in a grade of 0 (zero) for the particular work, including the possibility of a FF grade. This zero or FF will be used to in the computation of your final grade for this course as prescribed by the University of South Florida academic dishonesty policy. As an example, if the test answers or project of two students appear to have been copied, both will receive zeros on that assignment, at a minimum, and an FF grade at a maximum. Full details can about the “Procedures for Alleged Academic Dishonesty or Disruption of the Academic Process”. Can be found at http://www.ugs.usf.edu/catalogs/0708/adadap.htm.

University Closure Policy
In the event of an emergency, it may be necessary for USF to suspend normal operations. During this time, USF may opt to continue delivery of instruction through methods that include but are not limited to: Blackboard, Elluminate, Skype, and email messaging and/or an alternate schedule. It’s the responsibility of the student to monitor Blackboard site for each class for course specific communication, and the main USF, College, and department websites, emails, and MoBull messages for important general information.
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**Attendance and Make Up Work**
Other than the first class meeting, no attendance will be taken. Missed quizzes and tests can only be made up for documented emergencies or on medical grounds. To be excused on medical grounds, a medical certificate/documentation is required. Any other extenuating circumstance requires proper documentation. If you anticipate missing class due to religious observances or because you are attending a professional or research conference, please inform Prof. Frisina by the second class meeting of the occasion and date by sending him an e-mail and link about this event.

The use of cell phones and headphones are forbidden in class, as well as excessive eating or other non-course related activities. Students engaged in activities unrelated to the lecture and/or that disturb their fellow students will be asked to leave the classroom.

**Re-grading:** Request for re-grading a test, homework assignment, or quiz must be submitted to the instructor (or TA) within one class meeting of the work being handed back. No questions will be entertained after this time.

**Submitting Assignments:** Students should monitor Blackboard regularly, to obtain weekly Announcements, Class Lectures, Homework Assignments, Reading Assignments and Exam Study Guides. Assignments should be turned in to the instructor at the start of the class the assignment is due, or slid under the instructors office door (ENC 3504) prior to the start of the class. No assignments will be accepted by e-mail, digital drop box, the instructor’s departmental mailbox, or by any other mechanism. Late assignments will not be accepted. If you cannot come to class, give your assignment to Prof. Frisina or the TA prior to the start of the class that the assignment is due.

**Students with a disability:** Students in need of academic accommodations for a disability may consult with the office of Students with Disabilities Services to arrange appropriate accommodations. Students are required to give reasonable notice prior to requesting an accommodation. If approved, contact the instructor and provide a memorandum from the Office of Academic Support and Accommodations for Students with Disabilities (ASASD).