

Course title: Introduction to Biomedical Engineering

Course Syllabus

Course number: CHE 381
Credit hours: 3
Semester/year: Fall/2013
Meeting days: M, W, F: 2-2.50 p.m.
Room location: 401 ESB
Prerequisites: BIOL 115 or Consent
Instructor: Cerasela Zoica Dinu
Assistant Professor Department of Chemical Engineering
College of Engineering and Mineral Resources
Office location: ESB 445
Office phone #: 304-293-9338
Office hours: T/Th: 10-11 a.m.
E-mail address: cerasela-zoica.dinu@mail.wvu.edu

Course description:

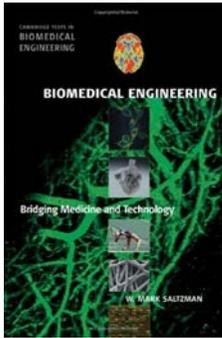
Biomedical engineering is a multidisciplinary field at the interface between engineering and health science. Biomedical engineering applies engineering and science principles and methodologies to the analysis of biological and physiological problems and to the delivery of health care. Biomedical engineering encompasses a range of fields of specialization including bioinstrumentation, bioimaging, biomechanics, biomaterials, and biomolecular engineering. This course aims to provide an introduction to biomedical engineering principles using foundational resources from molecular and cellular biology and physiology, and relating them to various sub-specialties of biomedical engineering. Further, this introductory course will provide concrete examples of applying engineering knowledge to solve problems related to human medicine as well as concrete examples of recent technological breakthroughs. This is an eligible elective course for those pursuing the Biomedical Engineering Certificate. It will be offered every year in the Fall semester.

Student learning outcomes:

Upon successful completion of this course, **Students will be able to:**

1. Explain and discuss what biomedical engineering
2. Explain and discuss what biomedical engineers do in their professional activities
3. Identify similarities and differences between engineering systems and living systems and between engineers and life scientists
4. Discuss and understand fundamental principles used by biomedical engineers in biomechanics, biomedical imaging and signal processing, cellular and molecular biology, biomaterials and tissue engineering, biomedical device design
5. Understand living systems/mechanisms through a systems approach
6. Perform related basic quantitative calculations as they apply to the current problems in biomedical engineering
7. Analyze how the development of technology, devices and instrumentation can enhance the quality and precision of health care for disease diagnosis, treatment, and prevention
8. Increase their proficiency in oral and written communications.

Required text:



Biomedical Engineering: Bridging Medicine and Technology, W. Mark Saltzman, Yale University (Cambridge Texts in Biomedical Engineering), 2009

Required textbooks should be available at the Evansdale Library. Students are encouraged to read outside the assigned class reading; suggested topics will be presented with the class material. Throughout evaluation of the available literature will help with understanding and integrating the material. If you do not read outside the assigned class readings, your grasp of the material will be average.

Course assessment/measures:

1. Tests/Final Exam:

The tests will cover the material presented in the class and the homework of suggested readings. The final exam will cover the entire semesters work. **No collaboration is allowed during any of the tests or final exam.** The two tests and the final exam are closed-book tests for which you are only required to bring a calculator and a pen. The final covers the course material seen during the entire semester (that is, it is a cumulative test). All three tests use the multiple-choice format and the short essay/problem format.

2. Poster Presentation:

Students should select topics related to those presented in the class and present them to the instructor for approval. After the topic approval, students are required to search for an article related to their interested topic using either PubMed website <http://www.ncbi.nlm.nih.gov/sites/entrez?db=PubMed> or Web of Knowledge website http://apps.webofknowledge.com/UA_GeneralSearch_input.do?product=UA&search_mode=GeneralSearch&SID=3A1rP4sJoHk4UC85SYB&preferencesSaved=. **This article should be a research manuscript (no website article or review paper allowed for poster presentation) not older than 5 years (i.e., 2008 the earliest). Students should prepare the poster presentation based on the information and results of the selected paper. Samples for poster presentation are included in the class folder and will be provided by the instructor. Students are not required to print their posters but are required to submit them in their electronic format to the instructor two days prior the student presentation together with the selected paper.** The poster size is 24" x 36" or larger and should be submitted to the instructor two days before the individual student presentation. The poster should list title and the authors of the selected paper, and the presenter's name in the heading. Students will be asked questions related to information presented in their poster, and the final grade will include both poster presentation and students' understanding of the presented materials. Poster presentations should be 10 minutes long with 5 minutes reserved for questions from peers and the professor. The purpose of the poster presentation is to give students an opportunity to evaluate and apply their knowledge and become more proficient in oral and written communication.

3. Homework:

The homework consists of problems and exercises that test your understanding of the material and help you prepare for the in-class exams. Homework is due at the beginning of class on the day specified in class. Homework turned in after the deadline is 50% off. Solutions to the homework will be posted on the class web page shortly after the due date such that homework

that is more than 24 hours late will not be accepted. Homework should be prepared on individual paper sheets (not torn from a notebook) and written with an ink pen or ball pen. Units must be indicated for all numerical results. All derivations must be included with symbols before numbers are “plugged in”.

Grading criteria:

The nominal grading scale is	≥90% A
	≥80% B
	≥70% C
	≥60% D
	<60% F

At the instructor’s discretion, the required values for a given grade may be lowered, but not raised. The final grade for the course will be determined as follows:

Two tests @ 15%	30%
Final Exam	20%
Class Participation	10%
Poster presentation	25%
Homework	15%
<u>Total</u>	<u>100%</u>

*You must be in the audience for all of the projects/presentations. Failure to do so will result in reduction by one full letter on your project/presentation grade.

General about course grading:

If you believe that an error was made in grading your test/exam, you should see me during the office hours. Write a short justification of your claim and attach it to the original graded in question. Place the justification and the graded exam in my mailbox. Your concern will be reviewed and I will respond to you directly during the office hours. Note that for the exam, the entire exam will be re-graded not only the point in question.

Other course policies:

- Material presented in the lecture as well as assigned readings will be included in testing.
- Students are responsible for all material presented and all announcements made in lectures and labs. If you have to miss a lecture or lab for any reason, it is your responsibility to obtain any information missed.
- A portion of the in-class lecture time will be devoted to open courseware and may include visuals, class activities, and assignments in groups related to the topic that is being presented. Note that for students miss any classes, related class materials will not be available online, thus the student will not benefit from the 10% class participation grade as stipulated in grading (see above). You might find questions in tests from such presentations.
- Office hours are meant to correct fundamental conceptual problems not to act as a problem solving session.
- There are no make-up exams and a late assignment means no assignment.
- Any classes canceled due to inclement weather (or for any other reason, such as fire alarms) will be rescheduled. If the fire alarm goes off during an exam, the resolution of the situation is solely at the discretion of the instructor.
- Your cellular phone should be turned off during class. If your cellular phone rings during class, if you are observed texting during class, or if you are observed using the internet during class, your final grade will be reduced by one percentage point, and you will be asked to leave the class and not return on that day. You will still be responsible for all material

covered in class. If you are observed texting or using the internet during an exam, you will automatically receive a zero for that exam.

- Project/presentation assignments that are obviously copied will receive no credit. Credit will be deducted for sloppy work that is hard to follow.

Disability:

If you believe that you have a disability that may affect your performance in this course, it is your responsibility to contact the WVU Office of Disability Services at (304) 293-6700. Written documentation from Disability Services must be provided to me in-person before any accommodations can be granted. If you are authorized for and wish to receive accommodations for an exam, you must notify me at least one week in advance. If you do not arrange accommodations in advance, they will not be given. Any rescheduled exams must be taken during the same calendar week (Monday-Friday) as the original date.

Social justice:

West Virginia University is committed to social justice and fostering a nurturing learning environment based upon open communication, mutual respect, and non-discrimination. Our University does not discriminate on the basis of race, sex, age, disability, veteran status, religion, sexual orientation, color or national origin. Any suggestions as to how to further such a positive and open environment in this class will be appreciated and given serious consideration.

Academic integrity:

Student-teacher relationships are built on trust. For example, students must trust that teachers have made appropriate decisions about the structure and content of the courses they teach, and teachers must trust that the assignments that students turn in are their own. Acts that violate this trust undermine the educational process. The integrity of the classes offered by West Virginia University solidifies the foundation of its mission and cannot be sacrificed to expediency, ignorance, or blatant fraud. Therefore, I enforce rigorous standards of academic integrity in all aspects and assignments of this course. For the detailed policy of West Virginia University regarding the definitions of acts considered to fall under academic dishonesty and possible ensuing sanctions, please see the Student Conduct Code http://studentlife.wvu.edu/office_of_student_conduct/student_conduct_code. Should you have any questions about possibly improper research citations or references, or any other activity that may be interpreted as an attempt at academic dishonesty, please see me *before* the assignment is due to discuss the matter. The WVU Handbook of Student Rights and Responsibilities define various forms of Academic Dishonesty and you should make yourself familiar with these. It is possible that you will work with other class members to complete your assignments. All submitted work must be your original work and must be clearly indicate with whom you have collaborated. If you have any question concerning this policy before submitting an assignment, please ask for clarification. All matters of academic integrity are to be brought to my attention immediately. Value for honesty, integrity, self-discipline, respect, responsibility, punctuality, dependability, courtesy, cooperation, consideration, and teamwork would be emphasized as an integral part of this class learning. A grade of zero will be given on the first assignment where a violation is detected. All cases of academic misconduct will be submitted to the Office of Student Conduct; if you are found guilty of academic misconduct you will be on academic integrity probation for the remainder of the years at WVU and may be required to report your violations on future professional school applications.

Examples of cheating:

- It is cheating to give another student access to your directory and your account for copying any of the homework assignments. Your campus account is for your use alone.

Approximate Course Calendar

This is a tentative schedule and subject to change depending upon the progress of the class.

Date	Tentative Class
08/19	What is biomedical engineering
08/21	Biomolecular principles: atoms, molecules, macromolecules
08/23	Nucleic acids/ Gene
08/26	DNA technology and biomedical applications
08/28	Molecular dogma of biology
08/30	RNA technology
09/02	Labor Day
09/04	Proteins/ Enzymes
09/06	Clinical applications of proteins and enzyme
09/11	Cellular structure and function
09/13	Cell-cell interactions and signaling
09/16	Cell growth/differentiation/proliferation/apoptosis/death (I)
09/18	Cell growth/differentiation/proliferation/apoptosis/death (II)
09/20	Cell culture technologies and biomedical engineering
09/23	Test
09/25	Fundamentals of signaling in biological systems and implications for biomedical engineering
09/27	Engineering principles in biomedicine
09/30	Engineering balances
10/02	Circulatory systems
10/04	Removal of molecules from the body
10/07	Instruments in medical practices and research laboratories
10/09	The newest applications of research and technology for the development of the next generation of lab devices
10/11	Mechanical properties of materials
10/14	University Holiday
10/16	Mechanical properties of the cell/ Practical Example
10/18	Mechanical properties of the tissues and organs
10/21	Biomaterials
10/23	Biohybrid artificial organs
10/25	Bioimaging Image processing and analysis Lab demonstration
10/28	Drug delivery
10/30	Tissue engineering
11/01	Nanobiotechnology for biomedical engineering
11/04	AIChE: No class
11/06	Guest lecture
11/08	Test
11/11	Engineering and immunity
11/13	Biomedical engineering and cancer
11/15	Systems biology and biomedical engineering/ Biotechnologies for biomedical engineers

11/18	Student Presentations
11/20	Student Presentations
11/22	Student Presentations
11/25	Thanksgiving recess
11/27	Thanksgiving recess
11/29	Thanksgiving recess
12/02	Student Presentations
12/04	Student Presentations
12/06	Student Presentations
12/09	Last Day of Classes: Course Review
12/16	Final 8:00-10:00 a.m.