EE425 Bioengineering

Instructor: Dr. Yuxin Liu, Associate Professor
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Course Description: The course covers basic concepts of biomedical engineering and their connection with the spectrum of human activity. It serves as an introduction to the fundamental science and engineering on which biomedical engineering is based.

Time & Location: Fall 2019 **Tuesday/Thursday 11:00am – 12:15pm**
Location: **ESB G83**

Office Hours: Tuesday/Thursday 9:30 am to 10:50 am at AERB 243

Prerequisites: None

Course Website: *http://ecampus.wvu.edu*

Textbooks: **1) Class notes and handouts,**
2) Reading material will also be posted to course website or handed out in class
3) Recommended text book: W. Mark Saltzman, "Biomedical Engineering: Bridging Medicine and Technology" Cambridge University Press, 2009, 2015

Course description:

Biomedical engineering is a multidisciplinary field that applies engineering and science principles and methodologies to the analysis of biological and physiological problems. This course aims to provide an introduction to biomedical engineering principles using foundational resources from molecular, cellular biology and physiology, and relating them to various sub-specialties of biomedical engineering from bioinstrumentation to bioimaging, biomechanics, biomaterials, and biomolecular engineering. Further, this course will introduce concrete examples of how applying engineering knowledge could solve problems related to human medicine as well as examples of provide recent examples of technological breakthroughs in the delivery of health care.

Student learning outcomes:

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

1. Explain and discuss what biomedical engineering is
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 cellular and molecular biology, biomaterials and tissue engineering, biomedical device design, biomechanics, or biomedical imaging and signal processing, just to name a few
5. Describe and explain living systems/mechanisms through a systems approach
6. Perform related basic quantitative and qualitative calculations as they apply to the current problems/topics in biomedical engineering
7. Solve problems at the interface of biology, medicine and engineering: Understand the fundamental principles of cell biology, molecular biology, and engineering towards developing biomedical engineering strategies. Apply knowledge of math, engineering and science to identify, formulate, and solve problems in such area
8. Analyze how the development of technology, devices and instrumentation can enhance the quality and precision of health care for disease diagnosis, treatment, and prevention

Course assessment/measures:

Exams: The exams will cover the material presented in the class and the homework as well as any of the suggested readings being assigned by the instructor. No collaboration is allowed during any of the exams or during the final; the exams are closed book. The student is required to bring a calculator and a pen to classes.

Homework: The homework consists of problems and exercises that test student's understanding of the material presented in the class or the assigned reading material. **Homework is due one week after the assignment. Homework turned in after the deadline is 50% off. Homework should be prepared on individual paper sheets (not torn from a notebook). Units must be indicated for all numerical results.**

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:

Middle exam	35%
Final exam	35%
Class participation	5%
Homework	15%
Quiz	10%
Total	100%

Lecture Topics and Schedule: Any changes will be announced in the class.

	Topics	
Introduction	Class policy and Introduction to Bioengineering	Class note and Chapter 1
Part 1 Molecular and Cellular Principles	Biomolecular Principles and DNA	Class note and Chapters 2,3
	Protein and Cell engineering	Class note and Chapter 4, 5
Part 2 Physiological Principles	Cardiovascular Physiology	Class note and Chapter 8
	Renal Physiology	Class note and Chapter 9
	Respiratory Physiology	Class note and Chapter 7
Part 3 Biomedical Engineering	Advanced biotechnology	Class note and Chapter 11
	Biosensor	Class note and Chapter 11
	Drug Delivery	Class note and Chapter 13
	Tissue Engineering	Class note and Chapters 13, 15
	Biomechanics	Class note and Chapter 10
	Bioimaging	Class note and Chapter 12
Guest Lectures	Dr. Cerasela Dinu, Associate Chair of the Biomedical Engineering Program and Professor, Department of Chemical and Biomedical Engineering (Three lectures related to protein and cell biology) Dr.Mark Tseytlin, Assistant Professor from HSC WVU (two lectures related to different imaging technologies)	
Break	Fall Break	Oct. 10, 2019
	Thanksgiving Break	Nov. 23, 2019 – Dec. 01, 2019
Exams A review lecture will be given before the middle and final exam, respectively.	**Middle Exam**	**After the topics of Physiological Principles (Date will be announced later) 11:00am to 12:15pm @ ESB G83**
	Final Exam	**8:00am to 10:00am @ ESB G83 on Thursday (Dec. 19, 2019)**

Attendance Policy:

Attendance is strongly encouraged. Attendance may be recorded at random times throughout the semester. All students are responsible for all materials covered in class as well as all assignments made, due dates and any announcements. Consistent with WVU guidelines, students absent from regular scheduled examinations because of authorized University activities will have the opportunity to take them at an alternate time. Make-up exams for absences due to any other reason will not be given unless you have absence approved before the exams.

Other course policies:

- Material presented in the lecture as well as assigned readings will be included in the exams.
- Students are responsible for gathering all materials presented and all announcements made in lectures. If you have to miss a class for any reason, it is your responsibility to get the information presented in that class.
- 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.

- Your cellular phone should be turned off during class.
- If you are observed texting or using the internet during an exam, you will automatically receive a zero for that exam.
- 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.

WVU Copyright:
All course materials, including lectures, class notes, exams, handouts, presentations, and other materials provided to students for this course are protected intellectual property. As such, the unauthorized purchase or sale of these materials may result in disciplinary sanctions under the Campus Student Code.

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 reminder of the years at WVU and may be required to report your violations on future professional school applications.

The integrity of the classes offered by any academic institution solidifies the foundation of its mission and cannot be sacrificed to expediency, ignorance, or blatant fraud. Therefore, I will 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 West Virginia University Academic Catalog at http://catalog.wvu.edu/undergraduate/coursecreditstermsclassification/#academicintegritytext. 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. Academic dishonesty in this class will result in the following sanction:

- Plagiarism: Student will receive 0% on the assignment
- Cheating on a individual module: Student will receive a grade of F on the paper for the module
- Forgery, misrepresentation, or fraud: F in the course
- 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.

In addition, an Academic Dishonesty Form will be submitted through the department and college offices. Academic dishonesty in the second and following instances may receive more severe sanctions, which can include up to dismissal from an academic program.

Civility in the Classroom:

In this course, you are expected to act in a manner consistent with the behavior expected in the professional workplace. Respect each other, come to class prepared, be supportive of others, be attentive, contribute when appropriate, and be engaged in your learning. Civility is expected and assumed. In order for everyone to have the opportunity to maximize learning, inappropriate or disruptive behavior is prohibited and may result in a request to leave the classroom at a minimum. Examples include, but are not limited to, using cell phones in class, texting in class, excessive tardiness or late arrivals, demanding special treatment, challenges to the instructor's authority, leaving class early, shuffling backpacks and book bags, using offensive language or remarks, chewing gum, wearing caps, prolonged side discussions, playing games in class, sleeping, overt inattentiveness, and using a laptop during class unless instructed to do so.

***Inclusivity Statement*:**

The West Virginia University community is committed to creating and fostering a positive learning and working environment based on open communication, mutual respect, and inclusion. If you are a person with a disability and anticipate needing any type of accommodation in order to participate

in this class, please advise me and make appropriate arrangements with the Office of Accessibility Services (293-6700). For more information on West Virginia University's Diversity, Equity, and Inclusion initiatives, please see http://diversity.wvu.edu.