

The University of Western Ontario
Biomedical Engineering Graduate Program
BME 9508A – Fundamentals of Biomedical Engineering
FALL 2018 COURSE OUTLINE

COURSE DESCRIPTION: Biomedical Engineering is a broad field of study which involves applying the concepts, knowledge and approaches of Engineering to solve health-related problems. The breadth of Biomedical Engineering is significant, but this course provides an introduction and overview of the field of Biomedical Engineering with special emphasis being placed upon transdisciplinary approaches to Biomedical Engineering.

COURSE INSTRUCTOR: Yara Hosein, PhD

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Office hours: Tuesdays, 11:30AM – 12:30PM, ThreeC+ Building, Rm 2405A

PREREQUISITES: Fundamentals of Biomedical Engineering is a required course for students who are currently trainees in the Graduate Program in Biomedical Engineering. High priority is given for students enrolled in this graduate program. Other trainee may enroll at the discretion of the instructor. All participants must have completed an undergraduate degree in a related research area or have permission of the instructor and program. Enrollment is limited to approximately 25 students.

TOPICS:

- Introduction to Biomedical Engineering
- Anatomy and Physiology
- Biomechanics
- Biomaterials
- Tissue Engineering
- Bioinstrumentation and Biosensors
- Biomedical Signal Processing
- Physiologic Modeling
- Medical Imaging
- Biomedical Optics
- Medical Mechatronics

Key concepts in this course relate to fundamentals of Biomedical Engineering. Strategies are provided to students with a background in the four core areas of Biomedical Engineering that are currently being studied at Western University. Special emphasis will be placed on transdisciplinary approaches to Biomedical Engineering, which will be highlighted during student's weekly assignments.

All forms of evaluation will allow students to demonstrate their ability to communicate ideas and conclusions clearly.

LEARNING OBJECTIVES:

1. Define the scope of Biomedical Engineering and the fields Biomedical Engineers work. (*Student Assessment: Midterm and Final Exam*).
2. Define what is meant by the term Biomedical Engineering and the roles Biomedical Engineers play in Health Care delivery. (*Student Assessment: Midterm and Final Exam*).
3. Obtain a critical awareness of current problems and/or new insights in the field of Biomedical Engineering. (*Student Assessment: Weekly journal club sessions involving critical review and evaluation of a research paper*).
4. Critically appraise and evaluate scientific literature in the field of Biomedical Engineering. (*Student Assessment: Weekly journal club sessions involving critical review and evaluation of a research paper*).
5. Gain an understanding of the technical aspects within each Biomedical Engineering topic covered, to fully comprehend and critically evaluate literature available within the field, as well as apply knowledge to a broader context. (*Student Assessment: Weekly journal club sessions involving critical review and evaluation of a research paper*).
6. List recent advances in Biomedical Engineering. (*Student Assessment: Final Term Presentation*).
7. Propose new advances in Engineering, which you think will have the greatest impact on clinical care and further Biomedical Engineering Research. (*Student Assessment: Final Term Presentation*).

COURSE MATERIAL:*Suggested Textbook:*

Introduction to Biomedical Engineering, 2nd Edition 2005, John D. Enderle, Susan M. Blanchard, Joseph D. Bronzino. (**currently available as E-book at Western Libraries (www.lib.uwo.ca), and on reserve at Taylor Library**).

The primary course material will be **based on notes and material presented by instructors at each lecture**. Additional assigned readings will be provided to students through the course website (OWL).

ACADEMIC OFFENSES:

Scholastic offenses are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offense at the following website: www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_grad.pdf

Plagiarism-checking software may be used for all assigned written work to check for textural similarity.

GRADUATE COURSE HEALTH AND WELLNESS:

The following websites are to encourage graduate students to make health and wellness a priority. Please feel free to visit for more information.

Campus Recreation: www.westernmustangs.ca/index.aspx?path=crh&tab=campusrecreationhome

Self-Care; Thriving in Grad School: www.grad.uwo.ca/current_students/living_well/self-care.html

Mental Health Concerns: www.health.uwo.ca/mental_health/

COURSE SCHEDULE:

Date	Time	Room	Activity	Section Topic	Lecturer
Fri Sept 7	1:30-3:30pm	ThreeC+ 1420	Introduction	Introduction to BME	Hosein
Wed Sept 12	4:30-6:30pm		Lecture	Anatomy & Physiology	Hosein
Fri Sept 14	1:30-3:30pm		Journal Club	Anatomy & Physiology	Hosein
Wed Sept 19	Do not come to class		Video	Tissue Engineering	Mequanint
Fri Sept 21	1:30-3:30pm	ThreeC+ 1420	Journal Club	Tissue Engineering	Hosein
Wed Sept 26	4:30-6:30pm		Lecture	Biomechanics	Hosein
Fri Sept 28	1:30-3:30pm		Journal Club	Biomechanics	Hosein
Wed Oct 3	Do not come to class		Video	Bioinstrumentation/Biosensors	Yang
Fri Oct 5	1:30-3:30pm	ThreeC+ 1420	Journal Club	Bioinstrumentation/Biosensors	Yang
Wed Oct 10	4:30-6:30pm		Lecture	Biomaterials	Rizkalla/Wan
Fri Oct 12	1:30-3:30pm		Journal Club	Biomaterials	Rizkalla/Hosein
Wed Oct 17	NO CLASS/ STUDY DAY				
Fri Oct 19	1:30-3:30pm	ThreeC+ 1420	MIDTERM		Hosein
Wed Oct 24	4:30-6:30pm	ThreeC+ 1420	Lecture	Biomedical Signal Processing	Dickey
Fri Oct 26	1:30-3:30pm		Journal Club	Biomedical Signal Processing	Dickey
Wed Oct 31	4:30-6:30pm		Lecture	Physiological Modeling	Lacefield
Fri Nov 2	1:30-3:30pm		Journal Club	Physiological Modeling	Lacefield
Wed Nov 7	4:30-6:30pm		Lecture	Medical Imaging	Drangova
Fri Nov 9	1:30-3:30pm		Journal Club	Medical Imaging	Drangova
Wed Nov 14	4:30-6:30pm		Lecture	Biomedical Optics	Carson
Fri Nov 16	1:30-3:30pm		Journal Club	Biomedical Optics	Carson
Wed Nov 21	4:30-6:30pm		Lecture	Medical Mechatronics	Trejos
Fri Nov 23	1:30-3:30pm		Journal Club	Medical Mechatronics	Trejos
Wed Nov 28	4:30-6:30pm	ThreeC+ 1420	FINAL PRESENTATIONS		
Fri Nov 30	1:30-3:30 pm				
Wed Dec 5	4:30-6:30pm	ThreeC+ 1420	Lecture	BME at Western PIZZA DINNER!	BME Grad Chair

COURSE EVALUATIONS:

Midterm Exam • Anatomy & Physiology • Tissue Engineering • Biomechanics • Bioinstrumentation/Biosensors • Biomaterials	20%
Final Exam • Biomedical Signal Processing • Physiological Modeling • Medical Imaging • Biomedical Optics • Medical Mechatronics	25%
Lecture Reflection (Participation)	5%
Journal Club (Participation)	20%
Final Project; Short Communication & Presentation	30%

Lecture Reflection (5%):

One way of evaluating participation in this class is through weekly assignment of lecture reflection sheets. It is expected that *at least* 8 reflection sheets (out of the 10 lectures) will be completed and submitted to the course instructor at the end of class. If you anticipate absence from a particular class, please let the teaching assistant/instructor know as soon as possible.

For video lecture sessions, reflection sheets are expected to be submitted via OWL by 6:30PM on the Wednesday that the class is scheduled.

Weekly Journal Club Manuscripts (20%):

The second method of evaluating class participation will be the assessment of student contribution to weekly journal clubs. These journal clubs will be facilitated by the assigned lecturer of the week, or your course instructor. Be prepared to critically evaluate and discuss each manuscript during class. Participation is mandatory, and the instructor will grade you on your contribution to the discussion. Resources to aid in the preparation for journal club can be found on OWL.

Final Presentation (30%):This is an independent project (not group work)

The purpose of this assignment is to allow students to demonstrate a critical awareness of current problems and/or new insights, which are at, or informed by, the forefront of each field of study presented in the Fundamentals of Biomedical Engineering course.

The requirement of the final project is *to identify and present on one new insight/technology/research question that is currently a 'hot topic' in the chosen field.*

For example, a 'hot topic' in the field of Biomaterials/Tissue Engineering could be *'The use of 3D Bioprinting for Tissue Engineering'*

Students can review journal articles, conference proceeding papers, scientific presentations, press articles, and editorials *to identify* 'hot topics' in the selected field of study. However, project presentations and short communications should **ONLY** be supported by peer-reviewed sources. Some recommended sources are Annals of Biomedical Engineering, the IEEE Transactions on Biomedical Engineering, the IEEE Engineering in Medicine and Biology Magazine, as well as other medical and biological engineering journals.

For the topic of choice, **prepare a short communication (maximum 2000 words)** that answers the following questions:

1. What is the new insight you are presenting? What is the current research surrounding this new insight?
2. What steps were taken to advance this field of study which led to the recent findings?
3. How do these recent findings affect patients in our healthcare system? Could it change current practice guidelines? Will they change the way health care providers provide care? Will they have an economic impact?

Complementary to your short communication, **prepare an 8-minute oral presentation for the class based on the topic described in your short communication.**

A 2-minute discussion/question period will follow each presentation. It is expected that for each topic, students have sourced the original scientific research articles and have used technical concepts learned in class to critically review and appraise the article(s). Your presentation may use power point slides with the original article figures and/or a poster format for presentation. Reference all figures and data used in your presentation.

This presentation will be graded in class by the instructor and TA. The written short communication will be marked by the class instructor. Please submit a hard copy at the end of your class presentation.