

## BME 9508A - “Fundamentals of Biomedical Engineering”

### COURSE OUTLINE – Fall 2021

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**CALENDAR  
DESCRIPTION:**

Biomedical Engineering is a broad field of study which involves applying the concepts, knowledge and approaches of Engineering to solve Health Care 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. This is a half course with 12 weeks in the fall term of 2021.

**COURSE  
INFORMATION:**

Instructor: Prof. Emily Lalone  
Room: TEB 361  
Email: emily.lalone@uwo.ca

TA Ms. Elizabeth  
Email: enorman4@uwo.ca

Lectures: Monday 12:30-2:30 pm, Labatt Health Sciences  
Building Room 9

Tutorials: Fridays 1230-2:30 pm, Labatt Health Sciences  
Building Room 9

**PREREQUISITES:**

Fundamentals of Biomedical Engineering is a required course for students who are currently graduate 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 related research area or have permission of the instructor and program. Enrollment is limited to between 20 students.

**TOPICS:**

Key concepts in this course relate to fundamentals of Biomedical Engineering. Strategies are also provided to students with a background in four 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 (short presentation/written short communication/abstracts). All forms of evaluation will allow students to demonstrate their ability to communicate ideas and conclusion clearly.

**Individual Topics:**

1. **BME: what does it mean?**
2. **Wearables**
3. **Biomechanics**
4. **Robotics in Surgery**
5. **Medical Imaging**
6. **Biomaterials-Soft**
7. **Biomaterials-Hard**
8. **Biomedical Signal Processing**
9. **Assistive Technologies**
10. **Bioinformatics and ML for Patient Outcomes**
11. **Physiologic Modeling**

**LEARNING  
OBJECTIVES:**

1. Define the scope of Biomedical Engineering and describe current BME research directions and challenges (*All assessments*).
2. Identify and explain key concepts from both the engineering and biomedical sciences that are directly relevant to student's own research (*Lecture Reflections*).
2. Define what is meant by the term Biomedical Engineering and the roles Biomedical Engineers play in Health Care delivery (*Student Assessment: 3 Quizzes*)
3. Obtain a critical awareness of current problems and/or new insights in the field of Biomedical Engineering (*Student Assessment: Weekly journal club sessions where critically review and evaluate a research paper*).
5. Critically appraise and evaluate scientific literature and state of the art in the field of Biomedical Engineering (*Student Assessment: Weekly journal club sessions where critically review and evaluate a research paper as well as Final Term Presentation*).
6. Gain an understanding of the technical aspects within each topic covered to fully comprehend and to critically evaluate literature available within the field as well as apply knowledge to a broader context (*Student Assessment: Weekly journal club sessions where critically review and evaluate a research paper, weekly homework assignments, Final Term Presentation and Quizzes*).
7. List recent advances in Biomedical Engineering in each topic (*Student Assessment: Weekly homework assignments, journal articles and Final Term Presentation*).
8. Propose what new advances in Engineering that you think will have the greatest impact on clinical care and further Biomedical Engineering Research (*Student Assessment: Final Term Presentation*).

**CONTACT HOURS:** 2 lecture hours, 2 tutorial hours, half course

**TEXT:** No assigned text. Each instructor will provide review journal articles and original research journals each week.

**COURSE  
EVALUATIONS****Participation (15%):**

Participation will be recorded in this class by assigning lecture reflection sheets weekly. If you are not going to be in class for some reason, please let the teaching assistant/instructor know as soon as possible. It is expected that you will complete a minimum of 8 journal club sessions (by attending class and handing in the student reflection at the end of the class). Otherwise, you will receive 0% for participation.

**Quizzes (30%):**

Three one-hour closed-book quizzes (30%) will be given during tutorial periods throughout the term (dates and times to be given in class).

**Homework (30%):** Weekly assignments will be given out to the students. They are due each Monday.

**Lecture Reflection (5%):** Each week the instructor will ask you to reflect on the lecture. These are due each Friday.

**Final Presentation (20%):** Instructor will send out information regarding final presentation/report. This will take place during the final two lectures Nov 29 and Dec 3 (15% FINAL PRESENTATION/5% WRITTEN ABSTRACT).

**CONSULTATION  
HOURS**

Office Hours: Available upon request.

**ENGLISH:**

In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests and examinations for the improper use of English. Additionally, poorly written work with the exception of final examinations may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.

**ATTENDANCE:**

Any student who, in the opinion of the instructor, is absent too frequently from class will be reported to the Dean (after due warning has been given).

**CHEATING:**

University policy states that cheating, including plagiarism, is a scholastic offense. The commission of a scholastic offence is attended by academic penalties which might include expulsion from the program. If you are caught cheating, there will be no second warning. (see Scholastic Offence Policy in the Western Academic Calendar).

**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:

<http://www.westernmustangs.ca/index.aspx?path=crh&tab=campusrecreationhome>

Faculty of Music:

<http://www.music.uwo.ca/>

Mental Health

Concerns

[http://health.uwo.ca/mental\\_health/](http://health.uwo.ca/mental_health/)

**SCHEDULE:**

FORMAT	DATE	TOPIC	INSTRUCTOR
LECTURE	September 13	INTRO TO BME WEARABLES	LALONE
JOURNAL CLUB	September 17 <i>lecture reflection due</i>	WEARABLES	LALONE
LECTURE	September 20 <i>Homework due</i>	BIOMECHANICS	LALONE
JOURNAL CLUB	September <i>lecture reflection due</i>	BIOMECHANICS	LALONE

LECTURE	September 27 <i>Homework due</i>	ROBOT/SURGERY	FERREIRA
JOURNAL CLUB	October 1 <i>lecture reflection due</i>	ROBOT/SURGERY	FERREIRA
LECTURE	October 4 <i>Homework due</i>	MEDICAL IMAGING	DRANGOVA
QUIZ1: WEARABLES, BIOMECHANICS /ROBOT/SURG	October 8	QUIZ 1	LALONE
JOURNAL CLUB	October 8 <i>lecture reflection due</i>	MEDICAL IMAGING	DRANGOVA
NO CLASS	October 11	Thanksgiving	
ONLINE	October 15	CIHR SEX/GENDER TRAINING	
LECTURE	October 18	HARD BIOMATERIALS	RIZKALLA
JOURNAL CLUB	October 22 <i>lecture reflection due</i>	HARD BIOMATERIALS	RIZKALLA
LECTURE	October 25 <i>Homework due</i>	SOFT BIOMATERIALS	WAN
JOURNAL CLUB	October 29 <i>lecture reflection due</i>	SOFT BIOMATERIALS	WAN
LECTURE	November 1 <i>Homework due</i>	SIGNAL PROCESSING	DICKEY
JOURNAL CLUB	November 5 <i>lecture reflection due</i>	SIGNAL PROCESSING	DICKEY
LECTURE	November 8 <i>Homework due</i>	ASSISTIVE TECHNOLOGY	TREJOS
QUIZ2: MED IMAGING/ HARD AND SOFT BIOMATERIALS	November 12	QUIZ 2	LALONE
JOURNAL CLUB	November 12 <i>lecture reflection due</i>	ASSISTIVE TECHNOLOGY	TREJOS
LECTURE	November 15 <i>Homework due</i>	PHYSIOLOGICAL MODELING	LACEFIELD
JOURNAL CLUB	November 19 <i>lecture reflection due</i>	PHYSIOLOGICAL MODELING	LACEFIELD

LECTURE	November 22 <i>Homework due</i>	BIOINFORMATICS	
JOURNAL CLUB	November 26 <i>lecture reflection due</i>	BIOINFORMATICS	
FINAL PRESENTATION	November 29 <i>Homework due</i>	FINAL PRESENTATIONS	LALONE
FINAL PRESENTATION	December 3- PIZZA DAY	FINAL PRESENTATIONS	LALONE
QUIZ3: SIGNAL PROCESSING/ASSISTIVE DEVICES/PHYSIOLOGICAL MODELING/BIOINFORMATICS	DURING FINAL EXAM PERIOD	QUIZ 3	LALONE