

**BIOMEDE 417: ELECTRICAL BIOPHYSICS**

**COURSE SYLLABUS – FALL 2016**

**LECTURES:** TUESDAY/THURSDAY, 10:00 AM – 12:00 PM, 1024 FXB

**INSTRUCTOR:** Tim Bruns

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NCRC B10-A169

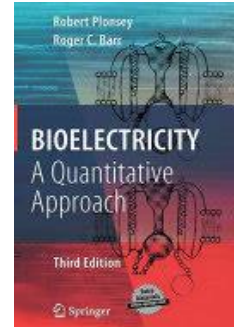
**OFFICE HOURS:** Tu, Th: 12 PM – 1 PM in 2236 Space Research Building (SRB) (or by appointment)

**COURSE DESCRIPTION:** In this class a quantitative approach will be used to introduce students to the fundamentals of bioelectricity. We will cover basic circuit theory for modeling the nervous system and action potential generation and propagation, and continue to electrical stimulation and field potentials. The class format will be primarily didactic lectures although group and in-class exercises discussions may occur. Examination of student understanding will be with homework and in-class quizzes. Student teams will explore an aspect of bioelectricity in a group modeling project, with three class presentations at different progress intervals.

**CANVAS:** This course has a dedicated Canvas website which contains additional information and materials needed for class. The current syllabus will be maintained on the class Canvas page. <https://umich.instructure.com/courses/90163>

**OPTIONAL TEXTBOOK:** Material will be based on Bioelectricity: A Quantitative Approach by Robert Plonsey and Roger Barr. **This book is available online** through the University of Michigan Library access. You can also purchase a hard copy for \$25 at the “buy now” button on the SpringerLink site. There are some errors in the textbook – see the Plonsey & Bar Errors PDF file on Canvas.

<http://mirlyn.lib.umich.edu/Record/005704697>



**GRADING RUBRIC:**

Participation	10%
Assignments	30%
Quizzes	30%
Project	30%

Participation grades are based on:

- *Professionalism* (5%). Students are expected to be on time to class and to not be disruptive to others (e.g. leaving frequently outside of breaks or by creating distractions). If you have a class schedule that may lead to occasional tardiness, talk with Dr. Bruns.
- *Project Feedback* (3%). Thoughtful, constructive criticism of peer project presentations
- *Project Team Peer Evaluations* (2%). Completed at end of semester.

Assignments will be given throughout the semester

- *Homework* (20%): Five total homework assignments will be given, across the semester (4% apiece). Each will be due one week after being assigned. If you wish to dispute any portion of your homework grade, you have one week after it was returned to submit a sheet explaining why you think points should be returned.
- *Readings* (10%): Five readings will be posted to Perusall during the semester (2% apiece). Students will be graded based on providing constructive comments within the Perusall website. These readings will help provide context to course material and may stimulate thoughts for the class project.

Quizzes: Three one-hour in-class quizzes will be given (10% apiece). For each quiz you will be allowed to have a sheet of notes corresponding to the quiz number (i.e. one two-sided sheet for Quiz 1, two two-sided sheets for Quiz 2, three two-sided sheets for Quiz 3). The sheets cannot have flaps or other means of increasing the surface area beyond 8.5" x 11". The note sheets will be submitted with each Quiz, and will be returned after grading. If you wish to dispute any portion of your homework grade, you have one week after it was returned to submit a sheet explaining why you think points should be returned.

Project: The class project is an open-ended opportunity for teams to propose and then execute a computational modeling project investigating a concept related to class material. There will be three milestones: Proposal, Progress Update, and Final Presentation. Project teams will be assigned in the second week of class. Everyone in a team will receive the same grade.

- *Project Proposal* (5%): Teams will submit a 0.5-1 page abstract proposing their project and will give a 1-slide 3-minute class presentation. For each Project Proposal other class members will give constructive feedback on a provided form, in addition to a brief period for questions.
- *Progress Update* (5%): Teams will submit a 2-page report on their Project methods and highlight any preliminary results. In that class period, each team will give a 5-minute presentation on their progress. For each Progress Update other class members will give constructive feedback on a provided form, in addition to a brief period for questions.
- *Final Presentation* (20%): Teams will submit a 10-page paper on their overall project. Content should include Background, Methods, Results, and Discussion. Proposal and Update content can be incorporated into the Final paper. Any generated software should be submitted as an addendum, per details provided close to the end of the semester. References to the scientific literature are expected. During the Final Exam period each team will give a 10-minute presentation on their entire project. Class members will give constructive feedback on a provided form, in addition to a brief period for questions.

Grade Scale: At the minimum, the below scale will be used for assigning class grades.

≥ 97% – 100%	A+	≥ 87% – < 90%	B+	≥ 77% – < 80%	C+
≥ 93% – < 97%	A	≥ 83% – < 87%	B	≥ 73% – < 87%	C
≥ 90% – < 93%	A-	≥ 80% – < 83%	B-	≥ 70% – < 83%	C-

**HONOR CODE:** All students are presumed to be decent and honorable, and all students in the class are bound by the College of Engineering Honor Code. You may not seek to gain an unfair advantage over your fellow students.

- Each student must complete quizzes solely by her or his own efforts. Questions can be asked only of the course instructor. The quiz must be completed within the specified time.
- You may discuss homework assignments with your fellow students, and complete the work with other students in the class, including working in a group around a common table and discussing problems

as you work on them. You must submit individual work that is not a verbatim copy of any other student's work. Do not forget that even when you work in a group, you are individually responsible for the learning that should accompany homework completion.

- All group project work is to be completed only within your own team. You may receive help from the course instructors and you may consult with members of other groups in the course, but you must complete your group's project and write-up on your own.

**BIOMEDE 417 CLASS SCHEDULE****Note: This is tentative and subject to change.** Updated Dec. 13, 2016

Wk	Date	Tuesday (2 hr)	Date	Thursday (2 hr)
1	9/6	Class Introduction Vectors	9/8	Electrical Sources [Homework 1 assigned]
2	9/13	Biopotentials	9/15	[Homework 1 due], [Assign project teams] Biopotentials
3	9/20	Biopotentials Channel Kinetics	9/22	Channel Kinetics, Action Potentials [Homework 2 assigned]
4	9/27	Action Potentials	9/29	[Homework 2 due] Action Potentials; Review for Quiz 1
5	10/4	[Quiz 1]	10/6	Action Potentials
6	10/11	[Project Proposals] Action Potentials	10/13	Action Potentials [Homework 3 assigned]
7	10/18	Fall Break (No Class)	10/20	Signal Propagation
8	10/25	[Homework 3 due] Signal Propagation	10/27	Review Action Potential Modeling [Homework 4 assigned]
9	11/1	Electrical Stimulation	11/3	[Homework 4 due] Review for Quiz 2
10	11/8	[Quiz 2]	11/10	Electrical Stimulation
11	11/15	[Project Day]	11/17	Extracellular Fields
12	11/22	[Project Progress Update] Extracellular Fields	11/24	Thanksgiving (No Class)
13	11/29	Extracellular Fields [Homework 5 assigned]	12/1	Extracellular Fields
14	12/6	Discuss Readings	12/8	[Homework 5 due] Discuss readings; Review for Quiz 3
15	12/13	[Quiz 3]		

Final Project Presentations: Tuesday, December 20: 4-6pm