

ECE/BIOM 526

Biological Physics- Syllabus Fall 2019

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Meeting time: TR, 8:00 - 9:15 AM, Scott 231

Course website: Canvas

Office hours: Wednesdays 9:00 AM (tentative)

Text: “Biological Physics: Energy, Information, Life” by P. Nelson, Freeman, 2008
Reading assignments from the textbook or from other materials provided by the instructor will be given every week. It is expected that students come to class after reading the assigned material.

Recommended reading material

1. “Physical Biology of the Cell”, Phillips, Kondev, Theriot (Garland Science, 2009)
This is an excellent biophysics text that covers most of the material of the course in much more detail than Nelson
2. “Molecular Biology of the Cell”, B. Alberts et. al (Garland Science, 2014)
This is a classic cell biology book.

Recommended Math References

1. “Mathematical Methods for Physicists”, G.B. Arfken and H.J. Weber, (Academic Press, 2005);
2. “Mathematical Methods in the Physical Sciences”, M.L. Boas (Wiley, 2005)
Either one of these two reference books provides an excellent resource for vector analysis, coordinate systems, matrices, partial differential equations, special functions, and linear transforms.

Description: This course will introduce the field of biological physics by examining living systems quantitatively. The course is intended to train a broad student audience in mathematical and physical modeling of biological systems. All the topics covered in the syllabus will be rigorously rooted in quantitative experimental data. Emphasis will be given to understanding the techniques and instrumentation used to investigate biological systems at the nanoscale.

Homeworks: Assignments will be posted on Canvas once a week. Each assignment will be due at the start of the class meeting a week from the assignment date. Your first and last name, homework number, and course number must be written in the first page. Your homework must be stapled, and your solutions to the problems must be in the correct order. Your solutions must be clear and you must include how you reach your results. Writing only the final solution is not acceptable. Homework turned in after the due date requires prior approval from the instructor.

Late assignment policy: I expect all assignments to be submitted by their due date and time with the exception of extenuating circumstances. I will not accept assignments submitted over one week after the deadline. If you become ill or the victim of an emergency, please let me know as soon as possible.

Quizzes: Quizzes will be given at the start of class once a week. The quizzes may cover any portion of the material covered in class. You are not allowed to use any electronic device during quizzes (including calculators, smart phones, etc.) and all quizzes are closed book. No make-up quizzes are offered. It is your responsibility to arrive to the classes on time for the quizzes. An excused absence from one quiz will result on your grade being set according to the remaining quizzes. Some quizzes will be individual and others will be done as team work.

Exams: Final and midterm exams are closed book, but you are allowed to bring one hand-written sheet of notes (front and back). You should bring to the exams a calculator, and your handwritten note sheet. The use of cell phone, smart phone, or computer is not allowed.

Topics to be covered:

- Cell components. Length, force and time scales in biophysics. Wk 1
- Brownian motion. Diffusion. Wk 1-2
- Electrophoresis. Nernst-Planck equation. Wk 3
- Transport at low Reynolds numbers. Wk 4
- Entropic forces. Wk 5
- Charged surfaces and their counterion clouds. Electroosmosis. Wk 6-7
- DNA packaging. DNA elasticity. Wk 8-9
- Molecular motors. Wk 10-11
- Membrane potentials. Ion channels. Wk 12
- Nerve impulses. Wk 13-14
- Additional concepts. Wk 15

Week numbers are approximate guidelines only.

Method of evaluation: One midterm: 25%, Final: 35%, Homeworks (8 best homeworks): 30%, Quizzes (8 best): 10%

A+ = 98-100

A = 94-97

A- = 90-93

B+ = 87-89

B = 84-87

B- = 80-83

C+ = 76-79

C = 65-75

D = 50-64

F = 0-49

Attendance policy: Regular attendance in class is mandatory. Notifications regarding material covered in exams, homeworks, etc. will be provided only in class.

Use of mobile devices, laptops, etc. during class: I expect students to refrain from using laptops, cell phones and other electronic devices during class. However I allow you to take notes on your laptop, but you must turn the sound off so that you do not disrupt other students' learning. The use of mobile phones (including sending and/or reading text messages) is not accepted during class.

Recording of Classes: Classroom activities may be recorded by a student for the personal, educational use of that student or for all students presently enrolled in the class only, and may not be further copied, distributed, published or otherwise used for any other purpose without the express written consent of the instructor.

Policy on contacting the instructor: You can contact me at any time via email. All your email correspondence must include “ECE 526 2019” or “BIOM 526 2019” in the title. Note that there are no make-up credits and that questions about the topics to be included in the exam are only answered in class.

Academic Integrity: The course will adhere to the Academic Integrity Policy of the CSU General Catalog (page 7, <http://www.catalog.colostate.edu/FrontPDF/1.6POLICIES1112f.pdf>) and the Student Conduct Code (<http://www.conflictresolution.colostate.edu/conduct-code>).