COLORADO STATE UNIVERSITY

BIOM/ECE 526 - BIOLOGICAL PHYSICS

INSTRUCTOR INFORMATION

Instructor: Diego Krapf
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Phone: 970-491-4255

COMMUNICATION POLICY: Responses to emails will be provided within 36 hours. Office hours will be held once a week via Zoom. Additional Zoom meeting times can be scheduled with the instructor as needed. Due to the COVID-19 ongoing situation no face-to-face office hours will be conducted this year.

COVID-19 INFORMATION

Please visit the CSU recovery website https://covidrecovery.colostate.edu/ for the latest information about the University's response.

All students in the face-to-face course should fill out a student-specific symptom checker each day before coming to class **(**https://covidrecovery.colostate.edu/daily-symptom-checker/). In addition, please utilize the symptom checker to report symptoms, if you have a positive test, or exposed to a known COVID contact. If you know or believe your have been exposed or are symptomatic, it is important for the health of yourself and others that you report it through this checker. You will not be in trouble or penalized in any way for reporting. If you report symptoms or a positive test, you will receive immediate instructions on what to do and CSU's Public Health Office will be notified. Once notified, that office will contact you and most likely conduct contact tracing, initiate any necessary public health requirements and/or recommendations and notify you if you need to take any steps.

RESIDENT COURSE MEETING TIMES

Tuesdays and Thursdays, 8:00 – 9:15 AM, Scott 229

PREREQUISITES FOR COURSE

MATH 340 or MATH 345; PH 122 or PH 142. You should be familiar with multivariate calculus and should have taken two semesters of physics.

COURSE DESCRIPTION & OBJECTIVES

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 experimental data. Emphasis will be given to modeling biological systems at the nanoscale.

Upon the completion of this course, students will be able to:

1. Model the motion of particles and molecules by diffusion
2. Derive the dynamics of active particles and those of colloids in the presence of an electric field
3. Describe the differences between the effects of an electric field in aqueous solutions vs. in vacuum
4. Explain and estimate Debye lengths
5. Discuss the freely jointed chain and the wormlike chain models of biopolymers
6. Model molecular motors using differential equations
7. Apply the formalism of Master equations to solve enzyme kinetics and two-state systems
8. Discuss the physical mechanism of voltage gated ion channels
9. Use the cable equation to compute the propagation of passive electrical signals
10. Describe action potentials

The topics covered in the course are directly applicable in the following areas

- Biosensors
- Cell biophysics
- Complex systems
- Electrophysiology
- Optical microscopy
- Molecular biophysics
- Nanotechnology
- Neuroscience
- Physical chemistry
- Quantitative biology
- Statistical physics
- Soft condensed matter
- Systems biology

TEXTBOOK / COURSE READINGS

"Biological Physics: Energy, Information, Life" by Philip Nelson, Freeman, 2008

Occasional handouts will also be provided by the instructor.

If you would like additional resources, here are suggested textbooks (not required): "Physical Biology of the Cell" by Phillips, Kondev, and Theriot (Garland Science, 2009). A classic cell biology book that will be useful is "Molecular Biology of the Cell", B. Alberts et. al (Garland Science, 2014).

COURSE MATERIALS & EQUIPMENT

An education MATLAB license will be provided by CSU.

Assignments, handouts, and grades will be posted on Canvas. Check this site regularly.

PARTICIPATION/BEHAVIORAL EXPECTATIONS

For successful completion of the course, it is expected that students spend on average 3 hours/week attending lectures or watching recorded lectures, 8 hours/week solving assignments, 5 hours/week reading the textbook or handouts, and 1 hour/week solving additional problems.

Please review the core rules of netiquette for some guidelines and expectations on how to behave in an online learning environment.

Students in the resident course: I expect students to refrain from using laptops, cell phones and other electronic devices during class. The use of mobile phones (including sending and/or reading text messages) is not accepted during class. 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.

COURSE POLICIES

ASSIGNMENTS

Assignments will be posted on Canvas once a week. Each assignment will be due on Wednesday at the end of the day, a week from the posting date, unless otherwise stated. Assignments are submitted in Canvas as a PDF file. Only your best 9 out of 12 assignments will count toward your final grade. Homework turned in after the due date requires prior approval from the instructor. The first week of class you will be given an additional assignment before the first traditional homework is posted. This additional assignment consists of reading the syllabus and posting an

introduction of yourself to your classmates. This assignment has 50% the weight of the other assignments.

Assignment guidelines:

1. On the first page in the upper right-hand corner, write your first and last name, homework number, and course number.
2. Your solutions to the problems must be in the correct order.
3. Solutions can be hand-written or typed. Answers should be boxed or highlighted. There should be a logical flow to your homework. Solutions must be clear, and you must include how you reach your results. Writing only the final solution is not acceptable.
4. Use a computer or a ruler when making drawings.
5. All supporting material to solve a problem such as MATLAB or Python codes should be submitted with the homework.
6. Please be neat and write legibly. If the grader can't read it, we will have to assume it is incorrect.
7. Written solutions may be scanned into the computer and submitted as a pdf. Make sure document is readable before submitting. Adobe Scan is a free app that can be used to make a pdf from your smart phone.
8. Students **may not use** a solutions manual or copy any part of an assignment from another student, including those from previous years.

TEAM QUIZZES

All students in the course will sign up into teams of three or four students. To join a group (or see your group afterwards), click the People link to the left, then click the Team Quiz Groups tab, open the groups and you can join your group of choice. For additional information on groups, see How do I join a group as a student?

You will receive quizzes consisting of specific small problems to solve during a period of 48 hours. A single answer is submitted per team and one person within the team will be designated to submit the quiz. The quizzes carry a weight of 10% in your grade. Only your best 9 quizzes count toward the final grade. Each problem will be specific to one lecture and one concept taught. Submissions must consist of a single pdf file that includes, in the top, the names of all the

members of the team. Along with the submission, *each team needs to state how they communicated with their peers* to solve the problem as a team, including the platform used and the time spent during these communications. Examples of possible communication platforms include (but are not limited to these ones):

- Zoom
- Microsoft Teams
- Face-to-face meetings
- Group discussions in Canvas

If possible, include any available documentation of the meeting (screen shot of Zoom meeting, picture of the meeting in person, available written communication, etc.). The same team will be maintained for four weeks and then you will be given the opportunity to sign up for a new team. No make-up quizzes are offered. It is your responsibility to be part of a team in order to be able to submit quizzes.

EXAMS

There will be one midterm and one final exams. Exams are closed book, but you can prepare one hand-written sheet of notes (front and back). You should take to the exams a calculator, and your handwritten note sheet. The use of cell phones is not allowed.

The midterm will be in class for resident students. The final exam will be remote for everybody. Online students will take the final exam using Honorlock. Resident students will take the final exam using Respondus' Lockdown.

Online (remote) exams: Honorlock will proctor your exams this semester. Honorlock is an online proctoring service that allows you to take your exam from the comfort of your home. You **DO NOT** need to create an account, download software or schedule an appointment in advance. To use Honorlock you will need a computer, a working webcam, and a stable Internet connection. To get started, you will need Google Chrome and to download the Honorlock Chrome Extension. You can download the extension at ***www.honorlock.com/extension/install*.**

When you are ready to test, log into the LMS, go to your course, and click on your exam. Clicking **Launch Proctoring** will begin the Honorlock authentication process, where you will take a picture of yourself, show your ID, and complete a scan of your room. Honorlock will be recording your exam session by webcam as well as recording your screen. Honorlock support is available 24/7. If you encounter any issues, you may contact

Honorlock Support by live chat, phone (**844-243-2500**), and/or email (***support@honorlock.com***).

GRADING POLICY

CSU does not use grades of C-, D+, or D-.

Grade	Range
A+	100% to 97%
A	<97% to 93%
A-	<93% to 90%
B+	<90% to 87%
B	<87% to 83%
B-	<83% to 80%
C+	<80% to 76%
C	<76% to 65%
D	<65% to 55%
F	<55% to 0.0%

As a student enrolled in this course, one of your responsibilities is to submit course work by the due dates listed in Canvas. With that said, I take my role as your instructor very seriously and I care about how well you do in this course and that you have a satisfying, rewarding experience. To that end, it is my commitment to you to respond individually to the work you submit in this class and to return your work in a timely manner. Weekly assignments will be returned within 7 days and exams will be returned within 12 days.

ASSIGNMENT	GRADE PERCENTAGE
Homework assignments (9 best)	30 %
Team Quizzes	10 %
Midterm	25 %
Final Exam	35 %
Total:	**100 %**

*Keep a copy of all work created for the course, including work submitted through Canvas course learning management system.

CANVAS INFORMATION, TECHNICAL SUPPORT, & MATLAB ACCESS

Canvas is the where course content, grades, and communication will reside for this course.

- Login: canvas.colostate.edu
- Support: info.canvas.colostate.edu
- For passwords or any other computer-related technical support, contact the Central IT Technical Support Help Desk.
  - (970) 491-7276
  - help@colostate.edu

The Technical Requirements page identifies the browsers, operating systems, and plugins that work best with Canvas. If you are new to Canvas quickly review the Canvas Student Orientation materials.

You can access Matlab on your home computer by going to this link: https://www.engr.colostate.edu/ets/matlab/ . This is probably the easiest option. If you prefer, you can alternatively access the Engineering Virtual Classroom by going to this link: https://www.engr.colostate.edu/ets/virtual-classroom/ where Matlab is already installed

Academic Integrity & CSU Honor Pledge

This course will adhere to the CSU Academic Integrity/Misconduct policy as found in the General Catalog and the Student Conduct Code.

Academic integrity lies at the core of our common goal: to create an intellectually honest and rigorous community. Because academic integrity, and the personal and social integrity of which academic integrity is an integral part, is so central to our mission as students, teachers, scholars, and citizens, I will ask that you affirm the CSU Honor Pledge as part of completing your work in this course.

Further information about Academic Integrity is available at CSU's Academic Integrity - Student Resources.

Universal Design for Learning/Accommodation of Needs

I am committed to the principle of universal learning. This means that our classroom, our virtual spaces, our practices, and our interactions be as inclusive as possible. Mutual respect, civility, and the ability to listen and observe others carefully are crucial to universal learning.

If you are a student who will need accommodations in this class, please contact me to discuss your individual needs. Any accommodation must be discussed in a timely manner. A verifying memo from The Student Disability Center may be required before any accommodation is provided.

The Student Disability Center (SDC) has the authority to verify and confirm the eligibility of students with disabilities for the majority of accommodations. While some accommodations may be provided by other departments, a student is not automatically eligible for those accommodations unless their disability can be verified and the need for the accommodation confirmed, either through SDC or through acceptable means defined by the particular department. Faculty and staff may consult with the SDC staff whenever there is doubt as to the appropriateness of an accommodative request by a student with a disability.

The goal of SDC is to normalize disability as part of the culture of diversity at Colorado State University. The characteristic of having a disability simply provides the basis of the support that is available to students. The goal is to ensure students with disabilities have the opportunity to be as successful as they have the capability to be.

Support and services are offered to student with functional limitations due to visual, hearing, learning, or mobility disabilities as well as to students who have specific physical or mental health conditions due to epilepsy, diabetes, asthma, AIDS, psychiatric diagnoses, etc. Students who are temporarily disabled are also eligible for support and assistance.

Any student who is enrolled at CSU, and who self-identifies with SDC as having a disability, is eligible for support from SDC. Specific accommodations are determined individually for each student and must be supported by appropriate documentation and/or evaluation of needs consistent with a particular type of disability. SDC reserves the right to ask for any appropriate documentation of disability in order to determine a student's eligibility for accommodations as well as in support for specific accommodative requests. The accommodative process begins once a student meets with an accommodations specialist in the SDC.

THIRD-PARTY TOOLS/PRIVACY

Please note that this course may require you to use third-party tools (tools outside of the Canvas learning management system), such as Skype and others. Some of these tools may collect and share information about their users. Because your privacy is important, you are encouraged to consult the privacy policies for any third-party tools in this course so that you are aware of how your personal information is collected, used and shared.

COPYRIGHTED COURSE MATERIALS

Please do not share material from this course in online, print, or other media. Course material is the property of the instructor who developed the course. Materials authored by third parties and

used in the course are also subject to copyright protections. Posting course materials on external sites (commercial or not) violates both copyright law and the CSU Student Conduct Code. Students who share course content without the instructor's express permission, including with online sites that post materials to sell to other students, could face appropriate disciplinary or legal action.

Undocumented Student Support

Any CSU student who faces challenges or hardships due to their legal status in the United States and believes that it may impact their academic performance in this course is encouraged to visit Student Support Services for Undocumented, DACA & ASSET for resources and support. Additionally, only if you feel comfortable, please notify your professor so they may pass along any additional resources they may possess.

Title IX/Interpersonal Violence

For the full statement regarding role and responsibilities about reporting harassment, sexual harassment, sexual misconduct, domestic violence, dating violence, stalking, and the retaliation policy please go to: Title IX – Sexual Assault, Sexual Violence, Sexual Harassment.

If you feel that your rights have been compromised at CSU, several resources are available to assist:

- Student Resolution Center, 200 Lory Student Center, 491-7165
- Office of Equal Opportunity, 101 Student Services, 491-5836

A note about interpersonal violence: If you or someone you know has experienced sexual assault, relationship violence and/or stalking, know that you are not alone. As instructors, we are required by law to notify university officials about disclosures related to interpersonal violence. Confidential victim advocates are available 24 hours a day, 365 days a year to provide support related to the emotional, physical, physiological and legal aftermath of interpersonal violence. Contact the Victim Assistance Team at: 970-492-4242.

Religious Observances

CSU does not discriminate on the basis of religion. Reasonable accommodation should be made to allow individuals to observe their established religious holidays. Students seeking an exemption from attending class or completing assigned course work for a religious holiday will

need to fill out the Religious Accommodation Request Form and turn it in to the Division of Student Affairs, located on the second level of the Administration building.

Once turned in, the Division of Student Affairs will review the request and contact the student accordingly. If approved, the student will receive a memo from the Dean of Students to give to their professor or course instructor.

Students are asked to turn in the request forms as soon as the conflict is noticed. Similarly, unanticipated conflicts requiring a religious observance, such as a death in the family, can also be reviewed.

CSU Principles of Community

Inclusion: We create and nurture inclusive environments and welcome, value and affirm all members of our community, including their various identities, skills, ideas, talents and contributions.

Integrity: We are accountable for our actions and will act ethically and honestly in all our interactions.

Respect: We honor the inherent dignity of all people within an environment where we are committed to freedom of expression, critical discourse, and the advancement of knowledge.

Service: We are responsible, individually and collectively, to give of our time, talents, and resources to promote the well-being of each other and the development of our local, regional, and global communities.

Social Justice: We have the right to be treated and the responsibility to treat others with fairness and equity, the duty to challenge prejudice, and to uphold the laws, policies and procedures that promote justice in all respects.

Diversity and Inclusion

The Mission, Vision, and Focus webpage of the Vice President for Diversity includes a comprehensive statement of CSU's commitment to diversity and inclusion.