



ECE/BIOM 403 – INTRODUCTION TO OPTICAL METHODS IN BIOMEDICAL ENGINEERING

INSTRUCTOR INFORMATION

Instructor: Diego Krapf

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Communication Policy: Responses to emails will be provided within 48 hours.

COURSE MEETING TIMES

TR 9:30 - 10:45 am, Engineering D 102

Office hours: TBA

PREREQUISITES FOR COURSE

CHEM111, PH142.

COURSE DESCRIPTION & OBJECTIVES

Engineering design principles of optical characterization techniques for biomedical systems, including optical spectroscopy and microscopy of biomolecules and tissues. This course provides students with a fundamental background in modern and classical optics, as well as principles of optical engineering, and provides students with a broad overview of state-of-the-art topics and cutting-edge research in the area of optics and lasers in medicine and biology. Fundamental concepts of optics and laser-tissue interactions will be discussed in order to provide a basis for the understanding of the current technology.

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

1. Describe sources of optical imaging in biomedical systems.
2. Discuss interference and diffraction.
3. Identify the physical principles of optical imaging for histopathology, cell biology, molecular biology, and other applications.
4. Explain optical techniques for technologies such as gene sequencing, pathogen detection, investigation of diseases such as cancer.
5. Identify advances in sensitive molecular detection and super-resolution microscopy.
6. Discuss scattering.



7. Explain different microscopies including confocal, light sheet, structured illumination, and Raman.

TEXTBOOK / COURSE READINGS

Fundamentals of Biomedical Optics by Caroline Boudoux

Blurb -- First Edition, 2017.

<https://www.blurb.com/b/7707867-fundamentals-of-biomedical-optics>

COURSE MATERIALS

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 participating in lectures, 8 hours/week solving assignments, and 5 hours/week reading the textbook or handouts.

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.

COURSE POLICIES

ASSIGNMENTS

There will be a total of eleven assignments during the course. Each assignment will be due at midnight, a week from the posting date. Assignments are submitted in Canvas as a PDF file. Assignments turned in after the due date require prior approval from the instructor.

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 when making drawings.



5. All supporting material to solve a problem such as MATLAB or Mathematica codes should be submitted with the homework.
6. Please be neat and write legibly. If I cannot read it, I 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 solution manual or copy any part of an assignment from another student, including those from previous years.

TEAM QUIZZES

Quizzes will be given during class, once or twice a week. All quizzes will be solved in teams of 3 or 4 students. You are not allowed to use any electronic device during quizzes (including calculators, smart phones, etc.) and all quizzes are closed book. The use of a phone during a quiz will automatically result in a grade of zero in all the quizzes in the semester. An unexcused absence from a quiz is graded as zero. An excused absence from one quiz will result on your grade being set according to the remaining quizzes. It is your responsibility to arrive to the classes on time for the quizzes, the quiz will be graded as a team and only students that arrive on time for the quiz receive a grade.

EXAMS

Throughout the semester there will be two midterm exams and one final exam. You are allowed to bring to the exams any hand-written notes. You should bring to the exam enough blank paper to solve the problems, a calculator, and your notes. The use of a cell phone or computer to help solve the exams is not allowed.



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, in fact, 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 10 days.

ASSIGNMENT	GRADE PERCENTAGE
Written assignments	15 %
Team quizzes	20 %
Midterm exams	40 %
Final exam	25 %
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

Canvas is 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.