



SYLLABUS

BME/OPTI 420/520 Biophotonics

MWF 3-3:50 PM, Zoom

Description of Course

This course will cover the interaction of light with biological material. A particular focus will be the use of photonics in medical diagnostics. The course will include introductory biological concepts such as DNA, proteins, cells, and tissues. In addition, the course will teach the principles and applications of bioimaging, spectroscopy, and biosensors, as well as summarize recently published progress in the field.

Course Prerequisites or Co-requisites

Advanced undergraduates (Junior/Senior) or graduate students in Engineering or Optical Sciences. For Junior/Seniors, BME 330 or OPTI 310 is either a pre- or co-requisite.

Instructor and Contact Information

Judith Su, BSRL 178, 520-621-4240, judy@optics.arizona.edu

Office hours: After class or by appointment

Course Format and Teaching Methods

Lecture only

Course Objectives

The course objectives are (1) to introduce the fundamentals of light-based technologies relevant to biology and medicine to advanced undergraduate and graduate students and (2) to illustrate current applications and future opportunities of biophotonics.

Expected Learning Outcomes, & Relationship to ABET 1-7 Objectives

Upon completing the course, students will be able to

- Have an overall concept of and ability to explain how photonic tools may be used to investigate biological materials (1,3,4)
- Have a basic understanding of and ability to describe what is a cell and other important cellular components (1,3)
- Understand and describe fundamentals of the nature of light and light-matter interaction (1,3)
- Understand and describe different microscopy tools (1,3,6)
- Explain spectroscopy fundamentals (1,3,6)
- Understand and describe optical biosensors, optical tweezers, and microarray technology (1,3,6)

For graduate students, in particular, they will

- Be able to understand and discuss the most recent literature in the field of biophotonics (3,6,7)

- For a range of different biological materials, know and be able to select the best photonic approaches and tools for studying those materials (1,2,3,6,7)
- Be able to carry out a collaborative research project, learn how to form hypotheses, establish aims, write a paper, and present their findings to the class/public (1,2,3,4,5,6,7).

Absence and Class Participation Policy

The UA's policy concerning Class Attendance, Participation, and Administrative Drops is available at: <http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop>

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable, <http://policy.arizona.edu/human-resources/religious-accommodation-policy>.

Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: <https://deanofstudents.arizona.edu/absences>

Makeup Policy for Students Who Register Late

Students who register after the first class should still meet posted deadlines for assignments.

Course Communications

Online communication will be conducted through D2L.

Required Texts or Readings

"Biophotonics: Concepts to Applications," Gerd Keiser, Springer (2016)
Availability: e-book free from Library

Required or Special Materials

None.

Required Extracurricular Activities (if any)

None.

Assignments and Examinations

Homework will be assigned but not graded. There will be a midterm report and final report. In the midterm report students will have the opportunity to design a biophotonic device to address a real world medical issue as suggested by the instructor. These results will be presented to the class. The final report will be to write an NIH style proposal.

Final Examination or Project

The date and time of the final exam is to be determined.

Final Exam Regulations: <https://www.registrar.arizona.edu/courses/final-examination-regulations-and-information>

Final Exam Schedule: <http://www.registrar.arizona.edu/schedules/finals.htm>

Grading Scale and Policies

The grading scale is A: 90-100, B:80-89, C: 70-79, D: 60-69, E: < 60. The thresholds between grades may be lowered by the instructor depending on the final distribution of grades, but will

not be raised. University policy regarding grades and grading systems is available at <http://catalog.arizona.edu/policy/grades-and-grading-system>

ACTIVITIES	PERCENTAGES		DUE DATES
	UNDERGRAD	GRAD	
Class participation	30%	30%	N/A
Project	N/A	10%	3/15/2023
Midterm report	30%	30%	4/12/2023
Final report	40%	30%	5/3/2023

Students taking the graduate course will be given a group project.

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at <http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete> and <http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal> respectively.

Dispute of Grade Policy: All regrade requests must be submitted within one week.

Scheduled Topics/Activities

Topics (subject to change):

- Light sources
- Optical detectors
- Light-tissue interactions
- Microscopy
- Optical probes and biosensors
- Light-tissue interactions
- Optogenetics
- Spectroscopy
- Optical Resonators
- Optical fibers for biophotonics applications

Classroom Behavior Policy

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

Threatening Behavior Policy

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See <http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students>.

Accessibility and Accommodations

At the University of Arizona we strive to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability or pregnancy, you are welcome to let me know so that we can discuss options. You are also encouraged to contact Disability Resources (520-621-3268) to explore reasonable accommodation.

If our class meets at a campus location: Please be aware that the accessible table and chairs in this room should remain available for students who find that standard classroom seating is not usable.

Code of Academic Integrity

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: <http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity>.

The University Libraries have some excellent tips for avoiding plagiarism, available at <http://new.library.arizona.edu/research/citing/plagiarism>.

Selling class notes and/or other course materials to other students or to a third party for resale is not permitted without the instructor's express written consent. Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions. Additionally, students who use D2L or UA e-mail to sell or buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student e-mail addresses. This conduct may also constitute copyright infringement.

UA Nondiscrimination and Anti-harassment Policy

The University is committed to creating and maintaining an environment free of discrimination; see <http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>

Our classroom is a place where everyone is encouraged to express well-formed opinions and their reasons for those opinions. We also want to create a tolerant and open environment where such opinions can be expressed without resorting to bullying or discrimination of others.

Additional Resources for Students

UA Academic policies and procedures are available at <http://catalog.arizona.edu/policies>

Student Assistance and Advocacy information is available at <http://deanofstudents.arizona.edu/student-assistance/students/student-assistance>

Confidentiality of Student Records

<http://www.registrar.arizona.edu/personal-information/family-educational-rights-and-privacy-act-1974-ferpa?topic=ferpa>

Subject to Change Statement

Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.