University of California, Santa Cruz
Electrical Engineering Department
EE-293, Winter 2018

Optics and Microscopy

Instructor: **Prof. Sara** Abrahamsson
Office: BE-257B
Office Hours: Wednesday 10am-noon and by appointment (email sara@ucsc.edu)

Course Description:

- Students should after taking this course understand the basic principles of geometrical optics and how the eye, a camera and a microscope works. Students should understand how Numerical Aperture / F# determines resolution and depth of field in an image. Students should understand how a digital sensor works and how digital imaging data is represented. Students should have a general understanding of how biological specimens can be imaged with visible light, and the limitations of live imaging in microscopy. Students should also get an understanding of how light travels through materials, refraction, reflection and diffraction, how lenses refract light, and how images are formed and digitally represented.

- This course is spearheading a focus on Optics in the EE department. The course will provide a prerequisite to popular courses offered in the department in the field of Adaptive Optics and Signal Processing in imaging. The course will also provide deeper understanding in general signals and systems by providing visual input that is intuitively easy to access. The course will is designed to pair well with EE264 Image Processing and Reconstruction, that will be offered in the 2018 Spring Quarter.

References will be handed out in class in PDF format.

There is no official course textbook, but useful and recommended additional references are:
- Optics (Hecht)
- Introduction to Fourier Optics (Goodman)
- Principles of Optics (Born and Wolf)

If you want to take a look at these, they are available in Prof. Sara's personal library in her office.

Homework:
Homework will be assigned and collected during class sessions, and will generally follow a weekly sequence; we will work through the solutions on the date of collection; they will not be posted to our class website.

Material will consist of problems from our text, supplementary and extra credit problems. To receive full credit, your work must be well organized, written at a college level and show

evidence of thoughtful attention to the problem itself. The homework questions are designed to be very similar to the questions on the exams. Grading will follow as described below.

A Complete and thoughtful solutions; numerical correctness is not the sole criterion, conceptual correctness is. Excellent college level writing.

B Thoughtful solutions displaying clear evidence of attention to each problem but some conceptual errors present.

C Numerically correct result(s) without evidence of conceptual understanding or thoughtful solution.

D Sloppy, incomplete or poorly presented problem set.

... to each of the above, + or - as appropriate...

Examinations There will be one midterm exam and a comprehensive final exam.

Unless otherwise stated, Conceptual = 40%; Math = 40% and Exposition=20%.
A uniformly distributed mapping will be employed to equate percentages to letter grades:
A+ >= 95; A >= 85; A- >=80; B+ >=75; B >=60; B - >=55; C+ >=50; C >=35; C - >=30;
D+ >=25; D >=10; D - >= 5

Grading Letter grades will be assigned for all work. Averaging will follow the usual 4.0 point scale to determine a final grade-point and associated letter grade. Category weightings are as follows:

Homework 30%
Midterm Exam 20%
Project Presentation 20%, passing this presentation is required to pass the class.
Final Exam 30% passing this test is required to pass the class.
For students who have selected grade pass/no pass: Passing grade will be **B and higher** (not B-)

Academic Integrity:
The student-instructor relationship is based on imputed trust. Violations of this trust by deceptively offering the work of others as your own, cheating on examinations etc. will result in formal charges of academic dishonesty being brought against you.

This is a new class at UCSC. Please, help out by reaching out to the instructor at any time if you have input, questions, comments, feedback on the level, content, etc. of the course.