Logout Randy Bartels Close your browser to end your session. (http://www.acns.colostate.edu/single-sign-on-using-shibboleth/#1471272725675-5603b487-ebab)

ECE 502- Advanced Fourier Optics

Course Details

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Office Hours: By appointment

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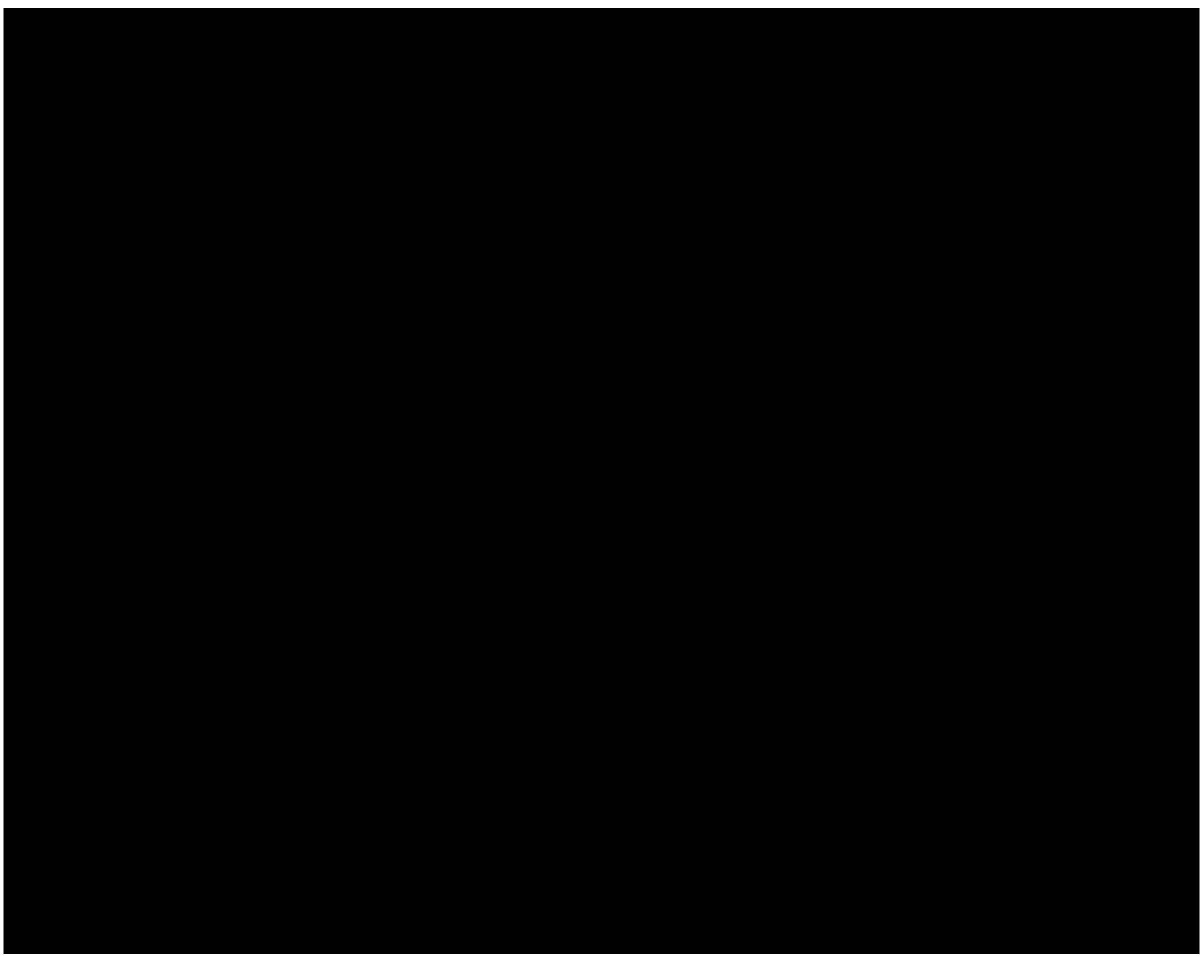
Both the ECE 457 Lectures and the ECE 502 Weekly Lecture

ECE 457 Lecture: 11:00 am - 12:15 pm , Tu/Th Scott 231



Online lecture posted by 5:00 pm

Online lecture posted by 5:00 pm

Course Description

The objective of this course is to provide students with a fundamental background in the Fourier Optics description of light propagation, diffraction, and use in imaging systems and will learn to model diffraction and imaging optical systems. Students will also learn to make use of the forward Fourier Optics models for solving inverse computational imaging problems. Successful students will be able to design and analyze optical imaging and computational imaging systems, as well as design, produce, and implement forward numerical optical models and to computationally invert those models to solve for underlying objects using inverse methods. The students will also learn how these sophisticated computational imaging tools are being used to solve complex problems in diverse fields such as biomedical, industrial, consumer, x-ray science, materials science, and security imaging applications.

Textbook

Introduction to Optical Microscopy

by Jerome Mertz

Cambridge University Press

July 2019

ISBN-10: 1108428304

ISBN-13: 978-1108428309

DOI: https://doi.org/10.1017/9781108552660 (https://doi.org/10.1017/9781108552660)

https://www.cambridge.org/core/books/introduction-to-optical (https://www.cambridge.org/core/books/introduction-to-optical) microscopy/F6C6318C87732519D7E07BA7A03F0B81

Online Resources

Olympus Microscope Resource Center: https://www.olympus-lifescience.com/en/microscope-resource/ (https://www.olympus-lifescience.com/en/microscope-resource/)

Nikon MicroscopyU: https://www.microscopyu.com/ (https://www.microscopyu.com/)

UofA Microscopy Resources: https://microscopy.arizona.edu/learn/microscopy-imaging-resources-www (https://microscopy.arizona.edu/learn/microscopy-imaging-resources-www)

ImageJ: https://imagej.nih.gov/ij/ (https://imagej.nih.gov/ij/)

Molecular Expressions Primer: https://micro.magnet.fsu.edu/primer/ (https://micro.magnet.fsu.edu/primer/)

Royal Microscopical Society: https://www.rms.org.uk/study-read/news-listing-page/online-microscopy-talks-list.html (https://www.rms.org.uk/study-read/news-listing-page/online-microscopy-talks-list.html)

Quantitative Biological Imaging (good lectures): https://www.quantitativebioimaging.com/ (https://www.quantitativebioimaging.com/)

Software

Mathematica is highly recommended for this course.

Assignments and Canvas

I will post all assignments on Canvas, and all assignments must be submitted through Canvas.

All assignments will be submitted as a pdf file and will be prepared either in Mathematica, LaTex, or a similar program so that all responses are typeset. All code used for calculation must be submitted in the pdf.

It is expected that you will use the following format for submitting all assignments:

LAST.FIRST.ASSIGNMENT.pdf For example: Bartels.Randy.HW01.pdf

Homework Policy

The homework is an essential part of the course. You should attempt all problems yourself, but feel free to argue with your colleagues about them. (Simply copying each other's solutions is, however, counterproductive for all parties and is not acceptable.

A few of the problems will be numerical, not involving heavy computation, but more in the way of modeling pulse propagation through various dispersive elements, so you will need to use your modeling pulse propagation through various dispersive elements, so you will need to use your favorite math package (e.g., Mathcad, Maple, Matlab, Mathematica, IDL, etc.).

To clarify, a homework solution MUST include a full explanation of how the problem is set up, the motivation of steps in the analysis, and an interpretation of the results. The entire point of homework is to explore and think about the material presented in the class AND to be able to communicate your findings. The ability to communicate scientific ideas is of critical importance. Moreover, the emphasis of homework is to analyze each physical situation, interpret that analysis, and communicate the meaning. As a result, the emphasis is NOT on algebraic manipulations.

You are encouraged to use Mathematica (and to a MUCH lesser extent other mathematical tools) to write up your solution. All solutions MUST be in a highly simplified form that YOU interpret correctly. Remember: each homework solution should be a short story that includes a reproduction of appropriate diagrams and may require plots of the final solutions you find to explain behaviors.

Homework Formatting Requirements

All homework assignments must be submitted in narrative form. Consider each answer a short essay or paper. In all instances, you should provide a quick background and motivation in the context of Optical Microscopy and then develop your answer to the questions while explaining each step. Below are notes on writing and formatting requirements:

These notes are adapted from Stephen Boyd et al.: **https://web.stanford.edu/class/ee364b/latex_templates/template_notes.pdf (https://web.stanford.edu/class/ee364b/latex_templates/template_notes.pdf)**

You will likely find that when you write out a detailed explanation on a question, you will find that there are gaps in your understanding and thought process. The process of writing out a full explanation will help you clarify your thought and understanding.

John von Neumann once said, “There’s no sense in being precise when you don’t even know what you’re talking about,” and Niels Bohr wrote, “Never express yourself more clearly than you can think.” Keep these in mind.

Write in good english: Always write good English, even when the subject that you are discussion contains mathematics. This includes correct grammar, word choice, punctuation, spelling, phrasing, and common sense. A classic on this topic, only slightly dated, is Strunk and White [1].

Keep the reader in mind: Perhaps the most important principle of good writing is to keep the reader in mind: What do they know so far? What do they expect next and why? Do they have sufficient motivation for stated results? As part of this, make sure you know what level of reader you are writing for and stay consistent with that level. If the reader is expected to know microscopy, do not keep defining standard concepts like numerical aperture (you will know this well before the end of the course if you don't already know about this)!

Write to allow skipping over formulas: Many readers will first read through the paper ignoring or skipping all but the simplest formulas. Your sentences and overall report should flow smoothly, and make sense, when all but the simplest formulas are replaced by “blah” or a similar placeholder. As a related point, do not simply display a list of formulas or equations in a row; tie the concepts together with a running commentary.

Online Course Details

All lectures will be available online and simultaneous participation will be available with Zoom.

Late Policy

You are expected to manage your schedule and meet all assigned deadlines. Items turned in within 24 hours after a deadline will receive a 25% penalty. Items turned in 24-48 hours late will receive a 50% penalty. Items submitted more than 48 hours late will not be accepted. Any exceptions must be approved in advance. Late submission is not allowed for the final exam.

Honor Pledge

For all work in this course, it is assumed that the following statement is true: I will not give, receive, or use any unauthorized assistance. The exception is that students my discuss approaches and clarifications regarding homework problems. In fact, this is highly encouraged and you may learn a lot from your peers and from helping your peers.

Professionalism and Academic integrity

This course will adhere to the CSU Academic Integrity Policy as found on the Student' Responsibilities page of the **CSU General Catalog (http://catalog.colostate.edu/general-catalog/policies/students-responsibilities/#academic-integrity)** and in the **Student Conduct Code. (https://resolutioncenter.colostate.edu/wp-content/uploads/sites/32/2018/08/Student-Conduct-Code-v2018.pdf)**

For more details on academic integrity, please read **Practicing Academic Integrity. (http://learning.colostate.edu/integrity/index.cfm)**

At a minimum, violations will result in a grading penalty in this course and a report to the Office of Student Resolution Center.

References

[1] W. Strunk and E. White. The Elements of Style. Macmillan, 1957.

Course Summary:

Date	Details