OPTI 512L Syllabus

Updated 6/16/2020

Course Number and Title

OPTI 512L (all sections) – Mathematical Optics Laboratory

Course Description

The Optics 512L laboratory will facilitate your fundamental, mathematical understanding of optics and teach you how to apply your knowledge using computer models and simulations. This course will require a lot of one-on-one quality time with a computer running Matlab. Each week we will cover a new topic class. You will then be required to review the notes and complete the assignment by the following week. The lab writeups for this course need to be clear and understandable but they need not full lab reports with references. Each student must complete their own work. However group discussions of problems is encouraged.

Instructor Information

Matthew A. Kupinski, Professor, Wyant College of Optical Sciences, Program in Applied Mathematics, and Department of Medical Imaging. Office hour to be announced on the course D2L website. Instructor offers two one-hour office hour sessions per week and is available upon request if extra help is needed. Office is room 435 in the west wing of the Meinel building. My office phone is 520.621.2967 and email is mkupinski@optics.arizona.edu .

Learning Outcomes

- Develop expertise in utilizing the discrete Fourier transform to simulate optical systems or solve mathematical problems.
- Develop an understanding of how to propagate scalar fields various distances. This understanding will include the difficulties and common pitfalls associated with implementing propagation methods.
- Develop an understanding of modeling linear systems using both Fourier analysis and singular value decomposition (SVD) as well as how to use these tools to improve image quality.
- Develop the skills necessary to model complex optical imaging systems including the noise.
- Develop an initial understanding of image reconstruction and restoration.

Required Texts and Materials

All notes for this course will be available on the d2l website. There is no required textbook; however, "Foundation of Image Science," H. H. Barrett and K. J. Myers, 2004 is a useful reference for much of the material we cover.

Schedule of Topics and Activities

This course is taught on the whiteboard and supplemented with PowerPoint presentations and in-class demonstrations. The class generally meets once a week for 50 minutes and there are laboratory assignments once a week.

Assessments

Assessment Categories	Percentage of final grade
Lab 1: Introduction to Matlab	8.3%
Lab 2: The Discrete Fourier Transform	8.3%
Lab 3: The Discrete Fourier Transform II	8.3%
Lab 4: Wave Propagation	8.3%
Lab 5: Wave Propagation through an Ideal Lens	8.3%
Lab 6: Image Processing and Deconvolution	8.3%
Lab 7: Singular Value Decomposition (2 weeks)	8.3%
Lab 8: Image Reconstruction	8.3%
Lab 9: The Radon Transformation	8.3%
Lab 10: The Wavelet Transform	8.3%
Lab 11: Introduction to Statistics and Noise	8.3%
Lab 12: Methods of Numerical Integration	8.3%
Total	**100%**

Grading Scale and Policies

Grades are based on whether the student's work demonstrates an understanding of the material:

100 – perfect understanding. No mistakes.

85 – some minor mistakes but generally demonstrated understanding of material.

70 – some conceptual problems.

60 – serious conceptual problems

Below 60 – No demonstrated understanding of the material

Students will be responsible for uploading a single laboratory report each week. Code should also be uploaded as a separate file. For the lab writeup, PDF is the preferred format but word files will also be accepted. This report should contain the necessary code, graphs, and text to show that you understood the problems and the solutions. Please do not just upload your Matlab scripts; a writeup is required. You should label all axes when possible and comment your code so that the TA can accurately grade the assignments. Do not forget to discuss your results for each problem so that we know you understood the problems.

Each lab writeup will count equally towards your grade. There will be no final for this course. Lab due dates will be posted on each lab. Late labs will be penalized 10 points (1 grade)for each week late. Labs must be submitted to the d2l website.

University Policies

All university policies related to a syllabus are available at: https://academicaffairs.arizona.edu/syllabus-policies. By placing this link in your syllabus, you no longer need to have each individual policy includedin your syllabus.

Subject to Change Notice

Information contained in the course syllabus, other than the grade and absence policies, may be subjectto change with reasonable advance notice, as deemed appropriate by the instructor of this course.

Graduate Student Resources (optional)

Please consider including a link to the University of Arizona's Basic Needs Resources page: http://basicneeds.arizona.edu/index.html