

## OPTI 636 Syllabus

Updated 5/21/2020

### Course Number and Title

OPTI 636 (all sections) – Noise in Imaging Systems

### Course Description

OPTI 636 focusses on the development of mathematical tools for describing stochastic processes in optical detectors and complex imaging systems; understanding the effect of image processing and reconstruction algorithms on image noise; and the development of a quantitative approach to assessing and optimizing image quality. This course is a companion to OPTI 637, Principles of Image Science, but neither is a prerequisite to the other.

### 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](mailto:mkupinski@optics.arizona.edu).

### Learning Outcomes

- An understanding of sources of noise in imaging detectors and imaging systems.
- An understanding of signal-detection and estimation theory and how the concepts fit into measures of image quality.
- A detailed understanding of random variables, vectors, and stochastic processes and how they are used to model noise in imaging systems.
- A detailed understanding of photon-counting statistics and how they impact noise in all imaging systems.
- A detailed understanding of the concepts of observers and observer performance as a metric for image quality.
- An overview understanding of the types of noise the can degrade an image across the electromagnetic spectrum.

### Required Texts and Materials

"Foundation of Image Science," H. H. Barrett and K. J. Myers, 2004. We cover Appendix C, and Chapters 8, 11, 12, 13, and 14 in this book. There is an online version of this book. Either the print or online version will suffice.

### Schedule of Topics and Activities

This course is taught on the whiteboard and supplemented with PowerPoint presentations. The class generally meets twice a week and there are homework assignments once every other week.

### Assessments

Assessment Categories	Percentage of final grade
Homework (approx. 5)	40%
Final Project Proposal (1 page written)	10%
Final Project Presentation	20%
Final Project Writeup	30%
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

### 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 included in your syllabus.

### Subject to Change Notice

Information contained in the course syllabus, other than the grade and absence policies, may be subject to 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>