OPTI 424A/524A. Optical Systems Engineering (4 units) Spring.
This class provides opportunities for students to learn practical engineering skills for developing optical systems. Students will work in groups on engineering projects and case studies that provide the opportunity to learn systems engineering skills first-hand. Some examples of optical applications that may be covered are imaging, spectroscopy, illumination, adaptive optics, communication, detection, and metrology. These systems will be used to teach fundamentals of systems engineering, optical system design, quantifying performance for optical systems, specification of optical components, and professional engineering skills.

Textbooks:
No textbooks are required. The following are recommended:

- Smith, Warren J. (2007). Modern Optical Engineering, (4th ed.). McGrawHill ISBN: 9780819470966
- Fischer, R., Yoder, P.R., and Tadec-Galeb, B. (2008). Optical System Design. (2nd ed.). McGrawHill. ISBN: 9780071472487

Offered as graduate and undergraduate

Class meets for three 50 min sessions per week with an additional one credit laboratory. The time for the laboratory is a place holder for times that student teams meet. Students are not required to be available during this time, and they should feel free to schedule other classes or activities at that time.

Grading:
Undergraduate

- Case study one: 40%
- Case study two: 60%

Graduate

- Case study one: 20%
- Case study two: 35%
- Case study three: 45%

Learning Objectives:
After completing this course, students should be able to:
OPTI424A and OPTI524A

Evaluate complex optics problems using a range of core optics theories
Formulate a complete set of requirements for a system
Design an optical system capable of solving a reality-based problem
Employ the engineering process to fabricate an optical system
Describe the importance of planning for testing early in a project
Create and manage a schedule
Interpret data to determine whether their design meets the formulated requirements

Communicate the adequacy of a proposed design to a review board of external subject matter experts
Identify some common causes of delay in optical engineering project completion
Develop a series of tests to determine the adequacy of the optical system they have built

OPTI524A

Implement the testing protocol to identify flaws in the optical system they have built.
Propose a solution to design flaws identified based on their interpretation of data
Implement a project management strategy

Topics to be covered:

This course uses a problem based learning model in which real-life case scenarios serve as a focal point for learning. Topics are engaged as their relevancy arises during the process of solving the problems posed. Students can expect to encounter a wide range of topics while working on the optical engineering problems assigned for this course. Below is a list of broad topics and specific exemplars of those topics that are often encountered throughout the course of a semester:

<u>Systems Engineering fundamentals</u>

Defining the statement of the problem
Functional decomposition
Establishing requirements
Systematic design, applied to requirements
Risk management
Quality control, reliability

<u>Optical system design</u>

1st order architecture studies
Creative design
Trade studies
Detailed design and analysis
Tolerancing
Integration and testing

<u>Quantifying system performance</u>

Image quality metrics
Sensitivity
SNR
Spectral resolving power
Error analysis/prediction

<u>Professional skills</u>

Technical writing
Technical presentations

Working as part of a team
Development of proposals
Engineering decision making
Intellectual property
Introduction to project management
Introduction to finance
Career planning

Special Topics

Stray light
Illumination – conservation of etendue
Infrared systems

Possible optical systems used as design projects and case studies

Machine vision
Custom metrology system
Infrared detection
Free space communication
Spectrograph
Adaptive optics

Classroom Behavior

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

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.

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.

Nondiscrimination and Anti-Harassment
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.

Accessibility and Accommodations At the University of Arizona, we strive to make learning experiences as accessible as possible. If you anticipate or experience barriers based on disability or pregnancy, please contact the Disability Resource Center (520-621-3268, https://drc.arizona.edu/) to establish reasonable