# OPTI 415

## Optical Specifications, fabrication and testing

Syllabus



Wyant College of Optical Sciences

# Syllabus OPTI 415

https://wp.optics.arizona.edu/jsasian/opti-415/


**Instructor:**
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**Course goals:**
To acquire skills in the specification and testing of optical systems, and have understanding of the optical fabrication process

**Schedule:**
TTH, 11:00 AM-12:15 PM

**Homework:**
Approximately 8 Homeworks
PDF Files: OPTI 415 your name.
Less than 5 MB
60% of total grade

**Software**
Zemax OpticsStudio

**Exams:**
Two
40% of total grade

**Grade**:
A > 90%
B > 80%
C > 70%

**HW grace period:**
One week after due date by 5 PM.
Then HWs will not be
accepted.
Last HW is due the last day of classes
and has no grace period.

**Each HW must have:**
I verify that this HW is all my work
Your signature.





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# Learning Outcomes

- To understand and specify optical specifications
- To understand optical fabrication methods
- To understand and test optical systems and components
- To be familiar and use optics terminology

# Recommended Books

- Schwiegerling J. Optical Specification, Fabrication and Testing. (SPIE, Bellingham, WA, 2014)
- Malacara D. Optical Shop Testing, 3rd ed. (Wiley, New Jersey, 2007).
- Smith W. Modern Optical Engineering, 4th ed. (Mcgraw-Hill, New York, 2008)
- H. H. Karov, *Fabrication methods for precision optics*, Wiley, New York, pp 520-525, 2004.
- Prism and lens Making, F. Twyman
- Optical Production Technology, D. Horne.

# Topics

**1. Review of first order optics**

- First order optics
- Terminology
- Focus
- Depth of focus
- Field of view
- Symmetry
- Basic lens configurations
- Lens layout
- Index of refraction and interpolation
- Field of view and speed; 35 mm format
- Sensor formats; h=f tan
- Cardinal points
- Model of optical system

**2. Review of aberrations**

- Optical path
- Wavefront deformation
- Aberration function
- Seidel sums
- Transverse ray aberrations
- Spot diagrams
- Aplanatic
- Achromatic doublet
- Basic lens systems
- Etendue
- Thermal changes
- Breaking axial symmetry
- Zernike Polynomials

# Topics

**3. Image quality**

- Imaging
- Metrics
- Laser beam quality
- Coupling light into a fiber

**4. Aspheric surfaces**

- Spheres
- Conics
- Cylinders and toroids
- Polynomials
- Freeforms
- Axicons
- User defined
- Spherical aberration correction
- Gaussian to flat top
- Variations on the Cassegrain theme
- Eye astigmatism
- Central coma

# Topics

**5. Optical testing**

- Measuring of lens parameters
- Testing a flat
- Testing a spherical mirror
- Testing a conic mirror
- Knife edge
- Wire test
- Ronchi test
- Hartman test
- Shack-Hartman
- Interferometry
- Profilometry
- Null testing, null correctors

**6. Optical fabrication**

- Tolerances
- Tolerancing
- Methods

**7. Optical alignment**

**8. Optical specifications and standards**

- ISO Specs and drawings

# Previous Topics

https://wp.optics.arizona.edu/visualopticslab/wp-content/uploads/sites/52/2022/01/Opti-415-Overview-1.pdf

**Outline**

# Previous Topics

***Academic Integrity***

*According to the Arizona Code of Academic Integrity (http://dos.web.arizona.edu/uapolicies/cai2.html), "Integrity is expected of every student in all academic work. The guiding principle of academic integrity is that a student's submitted work must be the student's own." Unless otherwise noted by the instructor, work for all assignments in this course must be conducted independently by each student. CO-AUTHORED WORK OF ANY KIND IS UNACCEPTABLE. Misappropriation of exams before or after they are given will be considered academics misconduct.*

*Misconduct of any kind will be prosecuted and may result in any or all of the following:*
** Reduction of grade*
** Failing grade*
** Referral to the Dean of Students for consideration of additional penalty, i.e. notation on a student's transcript re. academic integrity violation, etc.*

***Students with a Learning Disability***

*If a student is registered with the Disability Resource Center, he/she must submit appropriate documentation to the instructor if he/she is requesting reasonable accommodations. (http://drc.arizona.edu/instructor/syllabus-statement.shtml).*

# Classroom Behavior Policy

**Recommended language:**
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.).
**Additional recommendations depending on instructor preferences:**
Students are asked to refrain from disruptive conversations with people sitting around them during lecture. Students observed engaging in disruptive activity will be asked to cease this behavior. Those who continue to disrupt the class will be asked to leave lecture or discussion and may be reported to the Dean of Students.
**Alternate language for those who want to restrict computers and laptops to an area of the classroom:**
Some learning styles are best served by using personal electronics, such as laptops and iPads. These devices can be distracting to other learners. Therefore, students who prefer to use electronic devices for note-taking during lecture should use one side of the classroom.
**Alternate recommended language for those who do not wish to permit laptops in the classroom:**
The use of personal electronics such as laptops, iPads, and other such mobile devices is distracting to the other students and the instructor. Their use can degrade the learning environment. Therefore, students are not permitted to use these devices during the class period.

# University-wide Policies

Links to UA policies are provided here"
https://academicaffairs.arizona.edu/syllabus-policies:

- Absence and Class Participation Policies
- Threatening Behavior Policy
- Accessibility and Accommodations Policy
- Code of Academic Integrity
- Nondiscrimination and Anti-Harassment Policy
- Subject to Change Statement