OPTI 471B Syllabus (Spring 2024)
(Revised on 01/06/2024)

Official website: **http://wp.optics.arizona.edu/opti471b/**
Username: opti471b, Password: s24rm410
Lecture: Friday 1:00PM-1:50PM, In Person

Instructor Information

- Prof. Hong Hua, Rm 741 (west wing)
- Email: hhua@optics.arizona.edu (Preferred method of contact)
- Phone: 520-626-8703
- Office hour (in person or via zoom): Monday 10:00-11:00AM or by appointment.

Zoom Links (passcode: 471B)

- Friday lecture: https://arizona.zoom.us/j/86390371267
- Monday office hour: https://arizona.zoom.us/j/87080599963

TA Information

- Rachel Turner: rachelrturner@arizona.edu Cell: 480-848-9744
  - Session assignments: Monday evening, Tuesday morning, Wednesday afternoon
- Kody Gray: kodygray@arizona.edu Cell: 817-996-2116
  - Session assignments: Monday evening, Tuesday morning, Wednesday afternoon
- TA office hour: Wednesday 11AM-12PM in Lab 454 and also available via zoom: https://arizona.zoom.us/j/86944176049

Course Overview

OPTI471B. Advanced Optics Laboratory (2) II. Gaussian beam optics; Optical element testing; On-axis and Off-axis aberration testing; MTF measurement; Interferometry; Imaging system calibration; Human visual system.

Pre-requisites

- Opti 471A, OPTI 340

Learning Outcomes

Upon completion of this course, students will be able to:

- Apply the optical principles discussed in the junior and senior level optics courses to experimental situations, design and build experimental setups, and observe laboratory phenomena. Examples include but not limited to:
  - Design and build Gaussian beam imaging and expansion systems with parts readily available in the laboratory;
  - Characterize the physical properties of a Gaussian beam;
  - Build test setups to: (1) measure on-axis and off-axis aberrations of lenses; (2) observe diffraction phenomena in the laboratory; and (3) measure modulation transfer functions and distortion of an imaging system;
  - Build interferometric systems to test optical aberrations of lenses or mirrors.
- Effectively assemble and align various optical systems in the laboratory;

    - This lab requires students to assemble their labs themselves to gain hands-on experiences.
- Clearly and accurately summarize and communicate experimental procedures and results through both written reports and video presentations;
- Collaborate as a team with rotating roles (Due to pandemic, there is no more team activities).

Topics to Cover

- Gaussian beams:
    - Beam alignment
    - Propagation and profiling
    - Filtering, expanding, imaging, collimation and propagation
- Optical testing:
    - Radius of curvature testing of optical elements with interferometers
    - Measurement of spherical aberration;
    - Measurement of off-axis aberrations;
    - Measurement of the modulation transfer function
    - Aberration testing with interferometers
- Imaging systems
    - Image acquisition, analysis and processing
    - Imaging system calibration
    - Human visual system

Class/Laboratory Schedule

- One 4-hour lab session per week;
- One 50-minute recitation session per week.

Text & Readings

- No text required
- Selected readings will be assigned. They will be available for downloading through the course website.
- Instructor's lecture notes and lab instructions will be available for downloading through the course website.

Assignments and Grading Policy

The final grade will be based on attendance, pre-lab assignments, video presentations, and quiz.

- Pre-lab assignments (25%)
- Weekly video presentation (30%)
- Quiz (30%)
- Final Lab Report (10%)
- Mandatory attendance (Lecture and lab): 5%

Late Submission Policy

- No late submission is accepted for pre-lab assignments.

Attendance Policy

- Please stay at home if you feel sick or have any of the symptoms of COVID-19.

- Students who need to miss a class, or series of classes, due to illness or the need to quarantine/isolate are responsible for emailing the course instructor, with copy to the Dean of Students, to let them know of the need, as soon as possible. There is no need for a medical excuse to be provided for absence of up to one week (see more below).
- Students who need to miss more than one week of classes in the semester will be required to provide a doctor's note of explanation to the Dean of Students. The Dean of Students Office will communicate the receipt of the note (with expected end date) out to the relevant faculty, and instructors are responsible for determining adjustments or modifications as appropriate.
- Students are responsible for completing any work that they might miss due to illness or the need to quarantine/isolate, including lecture and lab attendance, assignments, tests and exams.
    - Students who miss a lecture or a series of lectures, are required to watch the recorded ZOOM lectures and provide the instructor confirmation or feedback.
    - Students who miss a lab or a series of labs, are required to perform make-up labs during the make-up weeks or other time approved by the instructor or teaching assistants.
- Non-attendance for any reason does not guarantee an automatic extension of due date or rescheduling of examinations.
- Students are responsible for communicating with their instructor via the means of communication established by the instructor, e.g., via D2L, email, etc.

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 accommodations.

Week-by-week lab schedules

Lab Schedule and Lecture Notes

	Schedule	Lecture Notes
Introduction	Week 1	Course introduction
Lab1	Week 3	Kinematic design and Gaussian beam alignment
Lab2	Week 4	Gaussian beam profiling and propagation
Lab3	Week 5	Gaussian beam imaging and filtering
Lab4	Week 6	Optical testing with shear plate interferometer Examples
Lab5	Week 7	Measurement of Spherical Aberration
Lab6	Week 8	Measurement of off-axis aberrations
	Week 9	Spring Break
Lab7	Week 10	Measurement of MTF Matlab program Matlab data example
Lab8	Week 11	Testing optics with shear plate interferometers Wyant's notes on interferogram analysis
Lab8/9	Week 12	Simulated interferometry labs with Zemax, Testing optics with Shack Cube interferometer
Lab 8/9	Week 13	Simulated interferometry labs with Zemax, Testing optics with Shack Cube interferometer
Lab10	Week 14	Imaging system calibration
Lab11	Week 15	Human visual system
Make up	Week 16	Make-up week (Labs 7 through 11) and Quiz
	Week 17	Lab report due

	Lab Sch.	Mon.	Tue.	Wed.	Thur.	Fri.
W1				01/10, Class Begin		01/12, Intro
W2	No lab	01/15, holiday				01/19, Lecture 1
W3	Lab1	01/22				01/26, Lecture 2
W4	Lab2	01/29				02/02, Lecture 3
W5	Lab3	02/05				02/09, Lecture 4
W6	Lab4	02/12				02/16, Lecture 5
W7	Lab5	02/19				02/23, Lecture 6
W8	Lab6	02/26				03/01, Lecture 7
W9	Break	03/04				No lecture
W10	Lab7	03/11				03/15, Lecture 8
W11	Lab8	03/18				03/22, Lecture 9
W12	Lab8/9 Sim lab or Lab 9	03/25				03/29, No lecture
W13	Lab8/9 Sim lab or Lab 9	04/01				04/05, Lecture 10
W14	Lab10	04/08				04/12, Lecture 11
W15	Lab 11	04/15				04/19, Review
W16	Make up	04/22				04/26, Quiz
W17		04/29		05/01 Class End		05/03, Report due
W18	Final Week	05/6				