

Physics 108

Introduction to Optics

(Spring, 2016)

- Instructor: Xiangdong Zhu
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<http://www.physics.ucdavis.edu/xdzhu/>
- Lecture: 2:10 PM – 3:00 PM, MWF, 140 Physics Building
- Office hours: Drop-in, Rm. 237 Physics/Geology Building
- Textbook: **Optics Introduction to Optics**, 3rd Edition, Pedrotti's (Prentice Hall, 2007)
Lecture notes on www.physics.ucdavis.edu/xdzhu
- Homework: There are 9 assignments. Each will be posted on Monday on my Web page: www.physics.ucdavis.edu/xdzhu/course2016_Spring.html. The assignment is due on the following Monday at the time of the lecture. The assignments are graded based on the number of problems that are attempted. The solution to an assignment will be posted on the Web page after the assignment is collected.
- Midterm Exam: 2:10 PM – 3:00 PM, **Monday, May 2, 2016**
- Final Exam: 10:30 AM – 12:30 PM, **Saturday, June 4, 2016**
- Grading rules:
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|---------------|-----|
| Homework: | 25% |
| Midterm exam: | 30% |
| Final exam: | 45% |
- References: **Principles of Optics**, Born and Wolf (Pergamon Press)
Introduction of Modern Optics, Grant R. Fowles (Dover Publications)
- Prerequisites: Physics 9 series and Math 21 sequence, preferably Physics 110 series
- 108 Lab: **Lab begins on 4/11/2016 (the third week of instruction)**
Section 01: 3:10 – 5:30 PM, Mondays, 156/156A Roessler
Section 02: 3:10 – 5:30 PM, Wednesdays, 156/156A Roessler
- [1] *Measurement of light mean-free path in highly scattering media*
 - [2] *Michelson interferometer*
 - [3] *Measurement of refractive indices of transparent materials using Brewster angle and critical angle*
- T. A. : Dan Hernandez, 221 Physics Building, hernandez@ms.physics.ucdavis.edu

SCHEDULE:

I. Geometric Optics:

- i. Snell's law of refraction and reflection
- ii. Refraction and reflection at spherical surfaces and Paraxial approximation
Thin lens equation
Mirror equation
Microscope and Telescope
Beyond paraxial approximation: correction with lens systems
- iii. (2×2) -Matrix description for paraxial rays
Thick lens
Lens systems

II. Wave Optics:

- i. Two-beam interference
Young's fringes
Stokes relations
Single reflections from two parallel surfaces
Michelson/Mach-Zender/Sagnac interferometers
- ii. Multiple reflections from two parallel surfaces
Fabry-Perot Interferometer
- iii. Diffraction
Fraunhofer diffraction from a single slit
Fraunhofer diffraction from multiple slits
Reflection gratings and blaze angles (optional)

III. Maxwell's Theory of Optics

- i. Maxwell's equations and boundary conditions
- ii. Snell's law of reflection and refraction (revisit)
- iii. Fresnel equations of reflection and transmission
- iii. Brewster angle
- iv. Critical angle and evanescence wave

IV. Optical Dielectric Constant

- i. Induced dipole moments of electrons
- ii. Optical constants of metals, semiconductors, and insulators
- iii. Optical constants in anisotropic optical media (liquid crystals)
- iv. Optical constant in magnetic/optically active materials

V. Polarized Light and its propagation in anisotropic Media

- i. Polarization of light
- ii. Jones vector representation of polarization
- iii. Jones (2×2) -Matrix representation of polarizing optical components
- ii. Light propagation in uniaxial crystals and double refraction
- iii. Production of polarized light with polarizing optical components
- iv. Optical activity