Physics 108 Introduction to Optics (Spring, 2018)

Instructor: Xiangdong Zhu, 237 Physics Building
(530) 752-4689; xdzhu@physics.ucdavis.edu
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 (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/course2018_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, April 30, 2018**

Final Exam: 3:30 PM – 5:30 PM, **Monday, June 11, 2018**

Grading rules:

Homework	20%
Midterm exam	30%
Final exam	50%

Lecture TA: Teresa Hamill, 506 Physics Building, hamill@ms.physics.ucdavis.edu

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 4/16/2018 (the third week of Instruction)**

Section 01:	3:10 – 5:30 PM,	Mondays,	156/156A Roessler Hall
Section 02:	3:10 – 5:30 PM,	Fridays,	156/156A Roessler Hall

[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*

108 Lab TA : Rui Xiao, 96 Physics Building, xiao@ms.physics.ucdavis.edu

SCHEDULE:

I. Geometric Optics:

i. Snell's law of refraction and reflection and critical angle
ii. Refraction and reflection at spherical surfaces and Paraxial approximation
Thin lens equation
Mirror equation
Microscope and Telescope and Resolutions
Beyond paraxial approximation: correction with lens systems

II. Wave Optics:

i. Two-beam interference
Young's double slits
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