

MODERN OPTICS

Physics 352, Prof. J. Toulouse

Fall 2016

1- MODELS OF LIGHT PROPAGATION

Early models, Fermat's principle, Huygens's principle, laws of reflection and refraction

2- GEOMETRICAL OPTICS

Reflection and refraction at various surfaces, lenses and mirrors, prisms, aberrations, matrix methods, optical ray tracing, optical systems

3- WAVE MOTION

Mathematics of wave motion, superposition of waves, Fourier analysis

4- ELECTROMAGNETISM OF LIGHT PROPAGATION

Fresnel equations, reflectance and transmittance, special angles (critical, Brewster), applications (optical waveguides)

5- POLARIZATION

Different types of polarization, production of polarized light, $\lambda/4$ plates, anisotropic dielectric media, Kerr and Pockel's effects, optical activity, matrix methods

6- INTERFERENCE

Basic formation, wavefront splitting interference (double and multiple beams), amplitude splitting interference, fringe patterns, interferometers

7- DIFFRACTION

Fraunhofer (far field) diffraction (rectangular and circular apertures, slit system gratings), Fresnel (near field) diffraction (Cornu's spiral and the rectangular aperture, Kirchoff's scalar theory and the circular aperture)

8- FOURIER OPTICS

Fourier transforms (one and two-dimensional), phase sensitive imaging (convolution integrals), diffraction revisited, correlation and transfer functions

9- HOLOGRAPHY

Optical recording and reconstruction (multi-slit grating, complex objects)

10- LASERS AND NONLINEAR OPTICS

Instructor: Prof. J.Toulouse
Sherman Fairchild Lab.
Room 208, X 3960
jt02@lehigh.edu

Classes : M-W-F 9:10-10:00 (please be on time)

Text: Optics by Eugene Hecht (**5th edition**)

Other useful texts: Modern Optics by R.Guenther
Optics by M.V. Klein and T.E. Furtak
Optics by K.D. Möller
and, of course, Principles of Optics by Born and Wolf

Grading: Homework 20%
Midterm 25%
Quizzes 20%
Final 35%
Plus class participation 5% (attendance is mandatory thank you)

Accommodations for Students with Disabilities: If you have a disability for which you are or may be requesting accommodations, please contact both your instructor and the Office of Academic Support Services, University Center C212 (610-758-4152) as early as possible in the semester. You must have documentation from the Academic Support Services office before accommodations can be granted.