Physics 108  Modern Optics  (Spring Quarter, 2012)

Instructor: Xiangdong Zhu  
Rm. 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

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/course2012_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 PM, Monday, April 30, 2012

Final Exam: 8:00 AM – 10 AM, Tuesday, June 12, 2012

Grading rules: Homework: 25%  
Midterm exam: 30%  
Final exam: 45%

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 4/16/2012 (the third week of Instruction)  
3:10 – 5:30 PM, Mondays, 156A Roessler Hall

[1] Measurement of light mean-free path in highly scattering media

T.A.: Galina Malovichko
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. $2 \times 2$-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 interferometer and Mach-Zender interferometer
   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 ($2 \times 2$)-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