

Physics 431 - Final Exam (3:00-5:00 pm 12/16/2009)

TIME ALLOTTED: 120 MINUTES

The exam includes topics covered in lectures and labs throughout the semester. Greater emphasis will be placed on the 2nd half of the course. There will be at least two similar problems based on the homework problems.

The exam will consist of problems adding up to 250 pts. Your grade of the final exam will be your score x 0.10.

Topics to be covered

Nature of light: particles and photons, the electromagnetic spectrum, photon energy, momentum, optical force.

Wave properties of light/EM Waves: phase velocity, frequency, irradiance, 1D wave equation, harmonic waves, superposition of waves, complex representation of waves (amplitude and phase), plane waves, spherical waves, polarization, Malus's law.

Geometrical optics: Snell's law, refraction/reflection (application of Fresnel equations), total internal reflection, imaging, lens maker formula, imaging formula, concave mirror imaging, thin lens combination, dispersing prisms.

Optical instrumentation: stops, pupils, windows, microscopes, telescopes, human eyes, eye glasses.

Interference and interferometry: Young's double slit experiment, interference in dielectric films, anti-reflection coatings, Newton's rings, Michelson interferometer and applications.

Diffraction: Fraunhofer v.s. Fresnel diffraction, Fraunhofer diffraction from a single slit, double slits, and multiple slits, square and circular apertures (Sinc functions and Airy patterns), gratings, spatial resolution (Rayleigh's criterion).

Modern optics: Gaussian beam optics, Fiber optics (numerical aperture, single vs multi-mode fibers, dispersion), Basic Fourier optics (including simple Fourier transform, wave properties of a thin lens, and spatial filtering), Basic holography and optical force.