Physics 2140 Exam 4 Outline

Wave Optics

- What is a wave?
- Wavefronts
- Wavelength, frequency, speed
- Electromagnetic waves: what do they look like?
- Polarization
- Polarizers
- What does wavelength of EM wave indicate?
- What does frequency of EM wave indicate?
- Identify types of EM waves
- Young's Two-Slit Interference
- Constructive and Destructive Interference
- Diffraction Grating: what is it, what pattern does it make
- Find d for a diffraction grating
- Single-slit diffraction
- What does diffraction pattern look like?
- When diffraction and two-slit interference occur together, identify the effects of each
- Diffraction through a circular opening (what is a?)
- Rayleigh Criterion
- Maximum resolution (angular or linear)
- Index of refraction
- What stays the same when light slows down: λ or f?
- Thin film interference: when does constructive or destructive interference occur?

Equations
(make sure you know what these letters mean!)

$$v = f\lambda$$
$$d \sin\theta = n\lambda$$
$$d \sin\theta = \left(n + \frac{1}{2}\right)\lambda$$
$$y_n = n\lambda L/d$$
$$\Delta y = \lambda L/d$$
$$y_p = p\lambda L/a$$
$$\sin\theta_p = p\lambda/a$$
$$\theta p \approx p\lambda/a$$
$$y_p = p\lambda L/a$$
$$\theta_p \approx 1.22p\lambda/a$$
$$y_p \approx 1.22p\lambda L/a$$
$$s_{min} = 1.22\lambda L/a$$
$$\theta_{min} = 1.22\lambda/a$$
$$v = c/n$$
$$\lambda' = \lambda_{air}/n$$
$$2t = \left(m + \frac{1}{2}\right)\frac{\lambda_{air}}{n}$$
$$\theta_r = \theta_i$$
$$n_i \sin\theta_i = n_t \sin\theta_t$$
$$\theta_c = \sin^{-1}(n_t/n_i)$$
$$M \equiv h_i/h_o = -d_i/d_o$$
$$1/f = (1/d_o) + (1/d_i)$$

Ray Optics

- What is a ray?
- absorption, reflection, transmission
- Specular vs Diffuse Reflection
- Interface vs normal
- Angles are measured from the normal
- What is refraction?
- When light slows down, the ray bends towards the normal
- When light speeds up, the ray bends away from the normal
- Snell's Law
- Total Internal Reflection
- Critical angle for TIR
- How we see: diverging rays
- Images, and how to find them
- Images created by flat mirrors
- Images of underwater objects
- Virtual vs real images
- Lenses vs Mirrors
- Thin Spherical Devices
- Convex vs concave
- Converging vs diverging devices
- Focal points of lenses and mirrors
- Focal length (how does this measure strength?)
- Ray Tracing
- Magnification
- Lens Equation
- Sign conventions for d_o, d_i, and f