Physics 2321. E&M, Light and Optics

Chapters covered in last third of class: 32.1-32.2, 34, 35, 36.1-36.4, 36.10, 37.1-37.5

Sections skipped or de-emphasized:

- Most of 34.3-34.6 were covered very lightly
- 35.6 and 35.7 were covered lightly
- I meant to skip 36.5 - 36.10 but I ended up discussing the magnifier (36.8) and the telescope (36.10).
- 37.3 was lightly covered, 37.6 was skipped.

Equations for Final.

32.1 Self-induced emf: $\varepsilon_L = -L\frac{dI}{dt}$

32.2 Inductance: $L = \frac{N\Phi_B}{I}$

32.3 Inductance: $L = -\frac{\varepsilon_L}{dI/dt}$

Know difference between LR and LC circuits.

Ch.34 Maxwell's Equations:

34.4 $\oint \vec{E} \cdot d\vec{A} = \frac{q}{\epsilon_0}$

34.5 $\oint \vec{B} \cdot d\vec{A} = 0$

34.6 $\oint \vec{E} \cdot d\vec{s} = -\frac{d\Phi_B}{dt}$

34.7 $\oint \vec{B} \cdot d\vec{s} = \mu_0 I + \epsilon_0\mu_0\frac{d\Phi_E}{dt}$

34.17 Speed of light: $c = \frac{1}{\sqrt{\mu_0\epsilon_0}}$

34.20 $c = \lambda f$

34.21 E and B fields in light: $\frac{E}{B} = c$

34.22 Poynting vector: $\vec{S} = \frac{1}{\mu_0}\vec{E} \times \vec{B}$

34.28 Radiation pressure: $P = \frac{S}{c}$ (absorbed), $P = \frac{2S}{c}$ (reflected)

35.1 Energy of a photon: $E = h\nu$

35.2 Law of reflection: $\theta_i = \theta_r$

35.4 Index of refraction: $n = \frac{c}{v}$

35.7 Wavelength in medium with index of refraction n: $\boldsymbol{\lambda_n = \frac{\lambda}{n}}$

35.8 Snell's law: $\boldsymbol{n_1 \sin\theta_1 = n_2 \sin\theta_2}$

35.10 Critical angle for total internal reflection: $\sin\theta_c = \frac{n_2}{n_1}$ (for $n_1 > n_2$)

36.1 Magnification: $M \equiv \frac{h'}{h}$

36.2 Magnification for mirrors (and lenses): $M = -\frac{q}{p}$

36.5 Radius of curvature: $R = 2f$

36.6 Mirror equation (spherical mirrors): $\boldsymbol{\frac{1}{p} + \frac{1}{q} = \frac{1}{f} = \frac{2}{R}}$

Table 36.1 Sign conventions for spherical mirrors

36.8 Spherical refracting surfaces: $\boldsymbol{\frac{n_1}{p} + \frac{n_2}{q} = \frac{n_2 - n_1}{R}}$

Table 36.2 Sign conventions for refracting surfaces

36.15* Lens-makers equation: $\boldsymbol{\frac{1}{f} = (n-1)(\frac{1}{r_1} - \frac{1}{r_2})}$

36.16 Thin lens equation: $\boldsymbol{\frac{1}{p} + \frac{1}{q} = \frac{1}{f}}$

Table 36.3 Sign conventions for thin lenses

36.17 Two thin lenses in contact have net focal length: $\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$

37.1 Path length difference, double slit: $\delta = d\sin\theta$

37.2 Constructive interference by double slit:

$$\boldsymbol{\delta = d \sin \theta_{bright} = m\lambda \quad (m = 0, \pm 1, \pm 2, ...)}$$

37.3 Destructive intereference by double slit:

$$\boldsymbol{d \sin \theta_{dark} = (m + \frac{1}{2})\lambda \quad (m = 0, \pm 1, \pm 2, ...)}$$

37.4 Double slit pattern: the position of P on wall is y above the central maximum, where $\frac{y}{L} = \sin\theta$

37.8 Double slit pattern: phase difference (in radians): $\boldsymbol{\phi = 2\pi \frac{d \sin \theta}{\lambda}}$

37.11 Intensity of double slit pattern: $\boldsymbol{I = I_{max} \cos^2(\frac{\phi}{2})}$

37.14 Wavelength of light in thin film: $\lambda_f = \frac{\lambda}{n_f}$

37.15 Constructive interference by film in air:
$2t = (m + \frac{1}{2})\lambda_f$ where $(m = 0, 1, 2, ...)$

37.17 Destructive interference by film in air:
$2t = m\lambda_f$ where $(m = 0, 1, 2, ...)$

37.– Constructive interference by film on high-n surface:
$2t = m\lambda_f$ where $(m = 0, 1, 2, ...)$

37.– Destructive interference by film on high-n surface:
$2t = (m + \frac{1}{2})\lambda_f$ where $(m = 0, 1, 2, ...)$