PHYSICS 2426 Fall 2019
Equation Sheet Exam 4

$\mu_0 = 4\pi \times 10^{-7}$ T·m/A $\quad \epsilon_0 = 8.85 \times 10^{-12}$ C²/N·m² $\quad c = \frac{1}{\sqrt{\epsilon_0 \mu_0}} = 2.99 \times 10^8$ m/s

$\epsilon = K\epsilon_0 \quad \mu = K_m \mu_0 \quad e = 1.602 \times 10^{-19}$ C $\quad m_e = 9.11 \times 10^{-31}$ kg

Maxwell's Equations

Gauss's Law for Electric Fields: $\oint \vec{E} \cdot d\vec{A} = \frac{Q_{\text{encl}}}{\epsilon_0}$

Gauss's Law for Magnetic Fields: $\oint \vec{B} \cdot d\vec{A} = 0$

Faraday's Law: $\oint \vec{E} \cdot d\vec{l} = \varepsilon = -\frac{d\Phi_B}{dt}, \quad \Phi_B \equiv \int \vec{B} \cdot d\vec{A}$

Ampere's Law: $\oint \vec{B} \cdot d\vec{l} = \mu_0 \left(i + \epsilon_0 \frac{d\Phi_E}{dt} \right)_{encl}, \quad \Phi_E \equiv \int \vec{E} \cdot d\vec{A}$

AC Circuits

$X_L = \omega L \quad X_C = \frac{1}{\omega C} \quad i(t) = I\cos(\omega t) \quad v(t) = IZ\cos(\omega t + \phi)$

$Z = \sqrt{R^2 + (X_L - X_C)^2} \quad \tan\varphi = \frac{X_L - X_C}{R} \quad P_{avg} = \frac{1}{2} VI\cos\varphi$

$v_R(t) = IR\cos(\omega t) \quad v_L(t) = IX_L\cos\left(\omega t + \frac{\pi}{2}\right) \quad v_C(t) = IX_C\cos\left(\omega t - \frac{\pi}{2}\right)$

Electromagnetic Waves

$v = \lambda f \quad \omega \equiv 2\pi f \quad k \equiv \frac{2\pi}{\lambda} \quad n \equiv \frac{c}{v} \quad E = cB \quad \vec{S} \equiv \frac{\vec{E} \times \vec{B}}{\mu} \quad I = S_{avg} = \frac{|\vec{S}|}{2}$

$E(x,t) = E\cos(kx \pm \omega t)$

Laws of Reflection and Refraction

$\theta_r = \theta_a \quad n_a \sin\theta_a = n_b \sin\theta_b$

Spherical Mirrors and Thin Lenses

$f_{Mirror} = \frac{R}{2} \quad \frac{1}{f_{Lens}} = (n-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) \quad \frac{1}{s} + \frac{1}{s\prime} = \frac{1}{f} \quad m = -\frac{s\prime}{s}$