PHYSICS 2426 Fall 2019
Equation Sheet Final Exam

Constants

$m_e = 9.11 \times 10^{-31}$ kg $\quad$ $e = 1.602 \times 10^{-19}$ C $\quad$ $q_e = -e$

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

Newtonian Mechanics and Gravity

$\sum \vec{F} = m\vec{a}$ $\quad$ $F_g = -mg$ $\quad$ $K = \frac{1}{2}mv^2$ $\quad$ $U_g = mgy$ $\quad$ $a_{cent} = \frac{v^2}{r}$

Maxwell's Equations

$\oint \vec{E} \cdot d\vec{A} = \frac{Q_{\text{encl}}}{\epsilon_0}$ (Gauss' Law)

$\oint \vec{B} \cdot d\vec{A} = 0$ (Gauss' Law for Magnetism)

$\oint \vec{E} \cdot d\vec{l} = \varepsilon = -\frac{d\Phi_B}{dt}$ (Faraday's Law of Induction)

$\oint \vec{B} \cdot d\vec{l} = \mu_0 \left(i + \epsilon_0 \frac{d\Phi_E}{dt}\right)_{\text{encl}}$ (Ampere's Law)

Electric Fields, Forces, Electric Potential and Electric Potential Energy

$\vec{E}_{\text{pt}} = \frac{1}{4\pi\epsilon_0}\frac{q}{r^2}\hat{r}$ $\quad$ $\vec{r} \equiv \vec{r}_f - \vec{r}_s$ $\quad$ $\vec{F}_E = q_0\vec{E}$

$V_{\text{pt}} = \frac{1}{4\pi\epsilon_0}\frac{q}{r}$ $\quad$ $U_{el} = q_0 V$ $\quad$ $V_a - V_b \equiv -\int_b^a \vec{E} \cdot d\vec{l}$ $\quad$ $\vec{E} = -\frac{dV}{dr}\hat{r}$

Magnetic Fields and Forces

$\vec{F}_B = q\vec{v} \times \vec{B}$ $\quad$ $B_{long\ wire} = \frac{\mu_0 I}{2\pi r}$ $\quad$ $B_{solenoid} = \mu_0 n I$

DC Circuits

$R \equiv \frac{\rho L}{A}$ $V = IR$ $P = IV$

$\sum(\text{currents in}) = \sum(\text{currents out})$ $\sum(\text{voltages around a complete loop}) = 0$

Resistors in Series: $R_{eq} = R_1 + R_2 + R_3 + \cdots$ Resistors in Parallel: $\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \cdots$

Electromagnetic Waves

$E(x,t) = E\cos(kx \pm \omega t)$ $E = cB$ $v = \lambda f$ $\omega \equiv 2\pi f$ $k \equiv \frac{2\pi}{\lambda}$

$\vec{S} = \frac{\vec{E}\times\vec{B}}{\mu_0}$ $I = S_{avg} = \frac{|\vec{S}|}{2}$

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

Geometric Optics

$f_{mirror} = \frac{R}{2}$ $\frac{1}{f_{lens}} = (n-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ $\frac{1}{s} + \frac{1}{s'} = \frac{1}{f}$ $m \equiv \frac{y'}{y} = -\frac{s'}{s}$

Wave Interference

$\Delta r = m\lambda$ $\Delta r = \left(m + \frac{1}{2}\right)\lambda$ $\Delta r \approx d\sin\theta$ when $d \ll$ distance to observation point