FORMULAS and CONSTANTS for EXAM II

$e = 1.6 \times 10^{-19}$ C $k = 1/4\pi\varepsilon_o = 9 \times 10^9$ Nm^2/C^2 $\varepsilon_o = 8.85 \times 10^{-12}$ C^2/Nm^2

$\mu_o = 4\pi \times 10^{-7}$ T m/A $c = 3.00 \times 10^8$ m/s 1 Tesla (T) $= 10^4$ Gauss (G)

$m_e = 9 \times 10^{-31}$ kg $m_p = 1.7 \times 10^{-27}$ kg

$I = \Delta q/\Delta t$ $V = IR$ $P = IV = I^2R = V^2/R$

$\overline{P} = (1/2)\, I_o V_o = I_{rms} V_{rms}$ $V_{rms} = V_o/\sqrt{2}$ $I_{rms} = I_o/\sqrt{2}$ $V_{rms} = I_{rms} R$

$F = q_o(v \sin\theta)\, B$ $r = mv/qB$ $F = ILB \sin\theta$

$B_{\text{long wire}} = \mu_o I / 2\pi r$ $B_{\text{center of a circular loop}} = N \mu_o I / 2R$ $B_{\text{solenoid}} = \mu_o\, n\, I$

$\mathcal{E}_{\text{motional}} = v\, b\, \ell$ $\mathcal{E} = -N\dfrac{\Delta\Phi}{\Delta t}$ $\Phi = B\, A \cos\theta$

$\mathcal{E} = -M\dfrac{\Delta I}{\Delta t}$ $\mathcal{E} = -L\dfrac{\Delta I}{\Delta t}$

$\dfrac{V_S}{V_P} = \dfrac{N_S}{N_P}$ $\dfrac{I_S}{I_P} = \dfrac{V_P}{V_S} = \dfrac{N_P}{N_S}$ $V = V_o \sin(2\pi f t)$

$V_{rms} = I_{rms} X_C$ $X_C = \dfrac{1}{2\pi f C}$ $V_{rms} = I_{rms} X_L$ $X_L = 2\pi f L$

$V_{rms} = I_{rms} Z$ $Z = \sqrt{R^2 + (X_L - X_C)^2}$

$\tan\phi = \dfrac{X_L - X_C}{R}$ $\overline{P} = I_{rms} V_{rms} \cos\phi$ $f_o = \dfrac{1}{2\pi\sqrt{LC}}$

$c = \lambda f$ $c = 1/\sqrt{\varepsilon_o \mu_o}$ Energy density in E field $= \dfrac{1}{2}\varepsilon_o E^2$

Energy density in B field $= \dfrac{1}{2\mu_o} B^2$ Total energy density in EM wave $= u_{EM} = \varepsilon_o E^2 = \dfrac{1}{\mu_o} B^2$

$E = cB$ $E_{rms} = \dfrac{1}{\sqrt{2}} E_o$ $B_{rms} = \dfrac{1}{\sqrt{2}} B_o$ Intensity $= S = c\, u_{EM} = c\, \varepsilon_o E^2 = (c/\mu_o) B^2$

Average Intensity $= \overline{S} = c\varepsilon_o E_{rms}^2 = \dfrac{c}{\mu_o} B_{rms}^2$ Average Power $= \overline{P} = \overline{S} A$ $\overline{S} = \overline{S_o} \cos^2\theta$

$\theta_r = \theta_i$ $\dfrac{1}{d_o} + \dfrac{1}{d_i} = \dfrac{1}{f}$ $d_i = \dfrac{f d_o}{d_o - f}$ $m = \dfrac{h_i}{h_o} = -\dfrac{d_i}{d_o}$

$v = c/n$ $n_1 \sin\theta_1 = n_2 \sin\theta_2$ $\sin\theta_c = n_2/n_1$ $(n_1 > n_2)$