PHYSICS 114 – Midterm 2

LIST OF POSSIBLY USEFUL FORMULAS

$\mu_0 = 4\pi \times 10^{-7} T.m/A$

$\varepsilon_0 = 8.85 \times 10^{-12} C^2 / N.m^2$

$e = -1.6 \times 10^{-19} C$

$\vec{\mathbf{F}} = q\vec{\mathbf{v}} \times \vec{\mathbf{B}}$

$r = \dfrac{mv}{qB}$

$\vec{\mathbf{F}} = I\vec{\mathbf{L}} \times \vec{\mathbf{B}}$

$\vec{\boldsymbol{\tau}} = I\vec{\mathbf{A}} \times \vec{\mathbf{B}}$

$\vec{\boldsymbol{\mu}} = I\vec{\mathbf{A}}$

$\dfrac{F_1}{l} = \dfrac{\mu_0 I_1 I_2}{2\pi a}$

$\oint \vec{\mathbf{B}}.d\mathbf{s} = \mu_0 I$

$B = \dfrac{\mu_0 I}{2\pi r}$ for a long, straight wire

$B = \dfrac{\mu_0 I \phi}{4\pi r}$ for a circular arc of wire

$B = \mu_0 nI$ for a solenoid

$B = \dfrac{\mu_0 NI}{2\pi r}$ for a toroid

$\Phi_B = \int \vec{\mathbf{B}}.d\vec{\mathbf{A}}$

$\mathcal{E} = -N \dfrac{d\Phi_B}{dt}$

$\oint \vec{\mathbf{E}}.d\vec{\mathbf{s}} = -\dfrac{d\Phi_B}{dt}$

$\mathcal{E} = -L \dfrac{dI}{dt}$

$L = \dfrac{N\Phi_B}{I}$

$I = \dfrac{\mathcal{E}}{R}\left(1 - e^{-t/\tau}\right)$ where $\tau = \dfrac{L}{R}$

$U_L = \dfrac{1}{2} LI^2$ $\qquad$ $u_B = \dfrac{B^2}{2\mu_0}$

$M_{12} = \dfrac{N_2 \Phi_{12}}{I_1}$

$Q = Q_{\max} \cos \omega t$

$I = -\omega Q_{\max} \sin \omega t$

$\omega = \dfrac{1}{\sqrt{LC}}$

$U_T = U_C + U_L = \dfrac{Q_{\max}{}^2}{2C}$

for a LC Circuit

$X_L = \omega L$

$X_C = \dfrac{1}{\omega C}$

$Z = \sqrt{R^2 + \left(X_L - X_C\right)^2}$

$\phi = \tan^{-1}\left(\dfrac{X_L - X_C}{R}\right)$

$I_{rms} = I_{\max} / \sqrt{2}$

$P_{av} = I_{rms} V_{rms} \cos\phi$

$\omega_0 = \dfrac{1}{\sqrt{LC}}$ and $Q = \dfrac{\omega_0}{\Delta\omega} = \dfrac{\omega_0 L}{R}$

$\Delta V_2 = \dfrac{N_2}{N_1} \Delta V_1$ $\qquad$ and $\qquad$ $R_{eq} = \left(\dfrac{N_1}{N_2}\right)^2 R_L$