Tear-Off Sheet **8.02 MIT April 2000** **Tear-Off Sheet**

Some (possibly useful) Relations for Test 3

You may use these freely unless the problem specifically prescribes a different approach.

$$\mathbf{F} = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2}\hat{\mathbf{r}} \qquad \mathbf{F} = q\mathbf{E} \qquad \oiint \mathbf{E}\cdot d\mathbf{A} = \frac{q_{in}}{\varepsilon_0}$$

$$\varepsilon_0 \cong 9\times 10^{-12}\ \mathrm{C^2\,N^{-1}\,m^{-2}} \qquad \frac{1}{4\pi\varepsilon_0} \cong 9 \times 10^9\ \mathrm{N\,m^2\,C^{-2}} \qquad V(b) - V(a) \equiv -\int_a^b \mathbf{E}\cdot d\mathbf{s}$$

$$C \equiv \frac{Q}{\Delta V} \qquad U_E = \frac{C(\Delta V)^2}{2} = \frac{Q^2}{2C} \qquad u_E = \frac{1}{2}\varepsilon_0\,\mathbf{E}\cdot\mathbf{E} = \frac{1}{2}\varepsilon_0\,|\mathbf{E}|^2$$

$$\mathbf{E} = -\left(\frac{\partial V}{\partial x}\hat{\mathbf{x}} + \frac{\partial V}{\partial y}\hat{\mathbf{y}} + \frac{\partial V}{\partial z}\hat{\mathbf{z}}\right) \qquad \oiint \kappa\mathbf{E}\cdot d\mathbf{A} = \frac{q_{free}}{\varepsilon_0} \qquad \mathbf{F} = q\,(\mathbf{v}\times\mathbf{B})$$

$$d\mathbf{F} = i\,(d\mathbf{s}\times\mathbf{B})\ ;\quad i = dq/dt \qquad |\boldsymbol{\mu}| = N\,i\,A \qquad P = iV = i^2R = V^2/R$$

$$\oint \mathbf{B}\cdot d\mathbf{s} = \mu_0(i_{encl} + i_M) \qquad \mu_0 = 4\pi\times 10^{-7}\ \frac{\mathrm{T\cdot m}}{\mathrm{A}} \qquad \mathbf{E} = \rho\,\mathbf{j}$$

$$R = \rho\, l/A\ ; \quad V = iR \qquad |\mathbf{B}| = \mu_0\, n\, i \qquad \boldsymbol{\tau} = \boldsymbol{\mu}\times\mathbf{B}$$

$$d\mathbf{B} = \frac{\mu_0\, i}{4\pi}\frac{d\mathbf{s}\times\mathbf{r}}{r^3} \qquad \mathcal{E} = -N\frac{d\phi_B}{dt} \qquad L = \frac{N\,\phi}{i}\ ;\quad M_{2,1} = \frac{N_2\,\phi_{2,1}}{i_1}$$

$$\mathcal{E} = -L\frac{di}{dt}\ ;\quad \mathcal{E}_2 = -M\frac{di_1}{dt} \qquad \oiint \mathbf{B}\cdot d\mathbf{A} = 0 \qquad \tau = L/R$$

$$\tau = RC \qquad U_L = \frac{1}{2}L\,i^2 \qquad u_B = \frac{\mathbf{B}\cdot\mathbf{B}}{2\mu_0} = \frac{|\mathbf{B}|^2}{2\mu_0}$$

$$\omega_0 = (LC)^{-1/2} \qquad X_L = \omega L \qquad X_C = \frac{1}{\omega C}$$

$$\mathcal{E} = \mathcal{E}_m \sin\omega t; \quad i = i_m \sin(\omega t - \phi) \qquad i_m = \frac{\mathcal{E}_m}{Z} = \frac{\mathcal{E}_m}{\left[R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2\right]^{1/2}} \qquad \tan\phi = \frac{\omega L - \frac{1}{\omega C}}{R}$$

Special Note: Tutorials will NOT be held on the test date (Weds. Apr. 19).

Recitations WILL be held: important discussion of Displacement Current.