Physics 106 Exam 2 Sec. 1, 2 CID#______

You are allowed a pencil and a non-graphing calculator. No scratch paper is allowed.

Make your calculations on the exam itself. When you are confident you have found the correct answer, fill in the appropriate bubble on the scantron sheet.

If English is your second language, you may use a dictionary.

$$\vec{F} = qv \times B$$
$$F = qvB\sin\theta$$
$$F = BIl\sin\theta$$
$$\tau = NBIA\sin\theta$$
$$r = \frac{mv}{qB}$$
$$B = \frac{\mu_0 I}{2\pi r}$$
$$\frac{F_1}{l} = \frac{\mu_0 I_1 I_2}{2\pi d}$$
$$B = \mu_0 nI$$
$$\Phi_B \equiv BA\cos\theta$$
$$\mathcal{E} = -N\frac{\Delta\Phi_B}{\Delta t}$$
$$|\mathcal{E}| = Blv$$
$$\mathcal{E} = NBA\omega\sin\omega t$$
$$\mathcal{E} \equiv -L\frac{\Delta I}{\Delta t}$$
$$L = \frac{N\Phi_B}{I}$$
$$PE_L = \frac{1}{2}LI^2$$
$$I = \frac{\mathcal{E}}{R}\left(1 - e^{-Rt/L}\right)$$
$$\Delta V_{rms} = \frac{\Delta V_{\max}}{\sqrt{2}} = 0.707\, V_{\max}$$

$$X_L = \omega L$$
$$X_C = \frac{1}{\omega C}$$
$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$
$$\phi = \tan^{-1}\left(\frac{X_L - X_C}{R}\right)$$
$$P_{av} = I_{rms}\Delta V_{generator,rms}\cos\phi =$$
$$= I_{rms}V_{R,rms} = I_{rms}{}^2 R = \frac{V_{R,rms}{}^2}{R}$$
$$f_0 = \frac{1}{2\pi\sqrt{LC}}$$
$$I_1V_1 = I_2V_2$$
$$\Delta V_2 = \frac{N_2\Delta V_1}{N_1}$$

Mechanics

$$KE = \frac{1}{2}mv^2$$

Constants, Conversions

$$k_e = \frac{8.99\times10^9\,Nm^2}{C^2}$$
$$\varepsilon_0 = 8.85\times10^{-12}\,C^2/N\cdot m^2$$
$$\mu_0 \equiv 4\pi\times10^{-7}\,T\cdot m/A$$
$$1\,eV = 1.60\times10^{-19}\,C\cdot V = 1.60\times10^{-19}\,J$$
$$1\,kWh = 3.60\times10^6\,J$$

A note about this page: This will be on the exam, as the Sec 2 instructor requested it. But you really only need the formulas on the first sheet.

The RLC Series Circuit

Notation	In English	In math
ΔV_R	Maximum Voltage Across Resistor	$\Delta V_R = I_{\max} R$
ΔV_L	Maximum Voltage Across Inductor	$\Delta V_L = I_{\max} X_L$
ΔV_C	Maximum Voltage Across Capacitor	$\Delta V_C = I_{\max} X_C$
$\Delta V_{\max}$	Maximum Voltage across All Three Elements	$\Delta V_{\max} = I_{\max} Z = I_{\max}\sqrt{R^2 + (X_L - X_C)^2} = \sqrt{\Delta V_R^2 + (\Delta V_L - \Delta V_C)^2} = \sqrt{(I_{\max} R)^2 + (I_{\max} X_L - I_{\max} X_C)^2}$
ΔV_{rms}	rms Voltage	$\Delta V_{rms} = \frac{\Delta V_{\max}}{\sqrt{2}} = 0.707\ V_{\max}$
Δv_R	Instantaneous voltage across resistor	$\Delta v_R = +\Delta V_R \sin \omega t = +I_{\max} R \sin \omega t$
Δv_L	Instantaneous voltage across inductor	$\Delta v_L = \Delta V_L \cos \omega t = +I_{\max} X_L \left(\sin \omega t + \frac{\pi}{2} \right)$
Δv_C	Instantaneous voltage across capacitor	$\Delta v_C = -\Delta V_C \cos \omega t = +I_{\max} X_C \sin\left(\omega t - \frac{\pi}{2} \right)$
Δv	Instantaneous Voltage across All Three Elements	$\Delta v = \Delta v_R + \Delta v_L + \Delta v_C = \Delta V_{\max} \sin \omega t$
$I_{\max}$	Maximum Current	$I_{\max} = \frac{\Delta V_{\max}}{Z} = \frac{\Delta V_{\max}}{\sqrt{R^2 + (X_L - X_C)^2}}$
I_{rms}	rms Current	$I_{rms} = \frac{\Delta V_{rms}}{Z} = \frac{\Delta V_{rms}}{\sqrt{R^2 + (X_L - X_C)^2}}$
ω	Angular frequency	$\omega = 2\pi f = \frac{2\pi}{T}$
ω_0	Resonance frequency	$\omega_0 = \frac{1}{\sqrt{LC}}$
ϕ	Phase Angle between Current and Voltage	$\phi = \tan^{-1}\left(\frac{X_L - X_C}{R} \right)$
X_L	Inductive Reactance	$X_L = \omega L$
X_C	Capacitive Reactance	$X_C = \frac{1}{\omega C}$
Z	Impedance	$Z = \sqrt{R^2 + (X_L - X_C)^2}$