

Test Information for Test 3:

Formulas to memorize:

Inductors

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

Impedance

$$\mathcal{P} = I \Delta V$$

$$\langle \mathcal{P} \rangle = I_{\text{rms}}^2 R$$

$$I_{\text{max}} = \Delta V_{\text{max}} / Z$$

Frequency & wavelength

$$\omega = 2\pi f$$

$$f = 1/T$$

$$k\lambda = 2\pi$$

Power & Pressure

Absorption:

$$\mathcal{P} = \langle S \rangle \sigma$$

$$F = P\sigma$$

Reflection:

$$F = 2P\sigma$$

Speed of Light

$$\omega/k = f\lambda = v = c/n$$

$$c = 3.00 \times 10^8 \text{ m/s}$$

Transformers

$$\frac{\Delta V_1}{N_1} = \frac{\Delta V_2}{N_2}$$

$$I_1 \Delta V_1 = I_2 \Delta V_2$$

Reflection & Refraction

$$\theta_i = \theta_r$$

$$n_1 \sin \theta_i = n_2 \sin \theta_r$$

Formulas to know how to use, but you need not memorize:

Constant

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

LC Circuits

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

$$Q = Q_0 \cos(\omega t)$$

RL Circuits

$$\tau = L/R$$

$$I = I_0 e^{-t/\tau}$$

$$I = \frac{\mathcal{E}}{R} (1 - e^{-t/\tau})$$

AC Circuits

$$\Delta V = \Delta V_{\text{max}} \sin(\omega t)$$

$$I = I_{\text{max}} \sin(\omega t - \phi)$$

EM waves

$$E_0 = cB_0$$

$$\mathbf{S} = \frac{1}{\mu_0} (\mathbf{E} \times \mathbf{B})$$

$$\langle S \rangle = cB_0^2 / 2\mu_0$$

$$P = \langle S \rangle / c$$

Impedance

$$X_C = 1/C\omega, \quad X_L = L\omega$$

$$Z^2 = R^2 + (X_L - X_C)^2$$

$$\phi = \tan^{-1} [(X_L - X_C)/R]$$

$$\omega_0 = 1/\sqrt{LC}$$

RLC Circuits

$$\omega = \sqrt{\frac{1}{LC} - \frac{R^2}{4L^2}}$$

$$Q = Q_0 e^{-Rt/2L} \cos(\omega t)$$

RMS values

$$\Delta V_{\text{rms}} = \frac{\Delta V_{\text{max}}}{\sqrt{2}}$$

$$I_{\text{rms}} = \frac{I_{\text{max}}}{\sqrt{2}}$$

Other things to know:

- Inductors oppose changes in current, capacitors in voltage
- What type of current gets through a capacitor? Through an inductor?
- How are \mathbf{E} , \mathbf{B} , and the direction of a wave related?
- How does the power absorbed and pressure change if the target is partly reflecting/transparent/absorbing?
- The order of the seven types of electromagnetic radiation
- The order of at least six visible colors (ROYGBV)
- That when you are in vacuum or air, $n = 1$; for other materials, $n > 1$

Material for test 2:

Chapter 32	Inductance
Chapter 33	AC Circuits
Chapter 34	Electromagnetic Waves
Chapter 35	Reflection and Refraction

Organization of the Test:

Part I: Multiple Choice [20 points]

For each question, choose the best answer (2 points each)

[questions 1-10]

Part II: Short answer [20 points]

Choose **two** of the following questions and give a short answer (1-3 sentences) (10 points each).

[questions 11-13]

Part III: Calculation: [60 points]

Choose **three** of the following four questions and perform the indicated calculations (20 points each)

[questions 14-17]