Today: Review for Exam 3  
HW20, HW18Redo

Tuesday 1pm:  
HW19-20 Redo’s

Wednesday:  
Exam 3  
Equation Sheet

Administrative
- I will grade HW 20 immediately & put it outside my door. Pick it up at your leisure, correct it, and slip it and HW19Redo under my door by Tuesday at 1pm to get them graded.
- I will post HW 19 & 20 solutions on the web at that time.
- Today’s review material is posted; I will add a sample equation sheet to it
- a copy of last year’s test with solutions is posted

Exam 3 Review
Covered:  Ch 20.5, 21, 22, 23
Not:  21.6*, 21.7.2,3**, 21.8, 21.9, 22.6, 22.7, 23.5
*we worked with similar material in lab, but discussed it in terms of forces, not torques
**Yes – straight wire, No – current loop or solenoid.

Format:  
Same as Exam 2 but no longer problems – all worth the same

Must know:
Especially:  Anything that you saw in Lab + Lecture + Homework
Anything the book presents in a beige box
Lab: Principles, Techniques, and Math employed in Lab

Equation Sheet:
- Hand in with test
- No words
- No pictures beyond a triangle for the trig functions, and the symbols for circuit elements
- An equation can appear only once, in a single form
  \[ F = ILB \sin \theta_m \]
  \[ I = \frac{F}{LB \sin \theta_m} \]
  one or the other, not both.

You will hand in your equation sheet with the test.
If I see anything that shouldn’t be there, the pertinent exam questions will receive 0 points.

- You’ll be given the following units and constants

Units

<table>
<thead>
<tr>
<th>Unit</th>
<th>Symbol</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Tesla</td>
<td>( \frac{N}{Amp \cdot m} )</td>
</tr>
<tr>
<td>C</td>
<td>Farad</td>
<td>( \frac{sec}{\Omega} )</td>
</tr>
<tr>
<td>Emf</td>
<td>Volt</td>
<td>( \frac{J}{Coul} )</td>
</tr>
<tr>
<td>I</td>
<td>Amp</td>
<td>( \frac{Amp}{sec} )</td>
</tr>
<tr>
<td>L, M</td>
<td>Henry</td>
<td>( \Omega \cdot s )</td>
</tr>
<tr>
<td>\Phi</td>
<td>Weber</td>
<td>( Tesla \cdot m^2 )</td>
</tr>
</tbody>
</table>

Constants
\( e = 1.60 \times 10^{-19} C, \varepsilon_0 = 8.85 \times 10^{-12} C^2 / (N \cdot m^2), \mu_0 = 4\pi \times 10^{-7} T \cdot m / Amp s \)
Sample equation sheet

Useful Mathematical Relations

\[(\sin(\theta))^2 + (\cos(\theta))^2 = 1, \quad \sin(2\theta) = 2\sin(\theta)\cos(\theta)\]

For small angles: \(\sin(\theta) \approx \theta, \quad \cos(\theta) \approx 1 - \frac{\theta^2}{2}\)

For circles: \(C = 2\pi R, \quad A = \pi R^2\)
For Spheres: \(A = 4\pi R^2, \quad V = \frac{4}{3}\pi R^3\)

If \(Ax^2 + Bx + C = 0\), then \(x = \frac{-B \pm \sqrt{B^2 - 4AC}}{2A}\)

Physical Relations

\[\text{Emf} = \text{emf}_o \sin(2\pi ft) \quad I = I_o \sin(2\pi ft) \quad \langle P \rangle = \frac{1}{2} I_o \Delta V_o = I_{rms} \Delta V_{rms} \quad I_{rms} = \frac{I_o}{\sqrt{2}}\]

\[\text{Emf}_{rms} = \frac{\text{Emf}_o}{\sqrt{2}} \quad \Delta V_{rms} = I_{rms} R \quad \Delta V_o = I_o R \quad F_{\rightarrow q} = qvB\sin\theta \quad F_c = \frac{mv^2}{r}\]

\[r = \frac{mv}{qB} \quad m = \left(\frac{qr^2B^2}{2\Delta V}\right) \quad F = ILB\sin\theta_{IB} \quad B = \frac{\mu_o I}{2\pi r} \quad \text{Emf} = v_{\perp}B_{\perp}L_{\perp}\]

\[\Phi = BA \cos\phi_{BIL} \quad \text{Emf} = (-)N \frac{\Delta \Phi}{\Delta t} \quad \text{emf}_s = (-)M \frac{\Delta I}{\Delta t} \quad \text{emf} = -L \frac{\Delta I}{\Delta t} \quad X_c = \frac{1}{2\pi fC}\]

\[\Delta V_{o, c} = I_{o, c} X_c \quad X_L = 2\pi fL \quad \Delta V_{o, L} = I_{o, L} X_L \quad \text{emf}_o = I_o Z \quad Z = \sqrt{R^2 + (X_L - X_c)^2}\]

\[I_c = I_{o, c} \cos(2\pi ft) \quad I_L = -I_{o, L} \cos(2\pi ft)\]

Units

- \(B\) Tesla = \(\frac{N}{\text{Amp} \cdot \text{m}}\)
- \(\text{Emf}\) Volt = \(\frac{J}{\text{Coul}}\)
- \(I\) Amp = \(\frac{\text{Coul}}{\text{sec}}\)
- \(L, M\) Henry = \(\Omega \cdot \text{s}\)

\(R, Z, X_C, X_L\) Ohm = \(\frac{\text{Volt}}{\text{Amp}} = \frac{J \cdot \text{s}}{\text{Coul}^2}\)

\(C\) Farad = \(\frac{\text{sec}}{\Omega}\)

\(R, Z, X_C, X_L\) Ohm = \(\frac{\text{Volt}}{\text{Amp}} = \frac{J \cdot \text{s}}{\text{Coul}^2}\)

\(\text{Constants}\)

- \(e = 1.60 \times 10^{-19}\) C, \(\varepsilon_o = 8.85 \times 10^{-12}\) \(C^2/(N \cdot \text{m}^2)\), \(\mu_o = 4\pi \times 10^{-7}\) \(T \cdot m / \text{Amp} \cdot \text{s}\)