Exam 2 #17

\[ \sum F = 0 = F_g + F_B \]

\[ F_g = F_B \]

\[ mg = I \ell B \]

\[ I = \frac{mg}{\ell B} = 0.49 \text{ A} \]

\[ V = IR = 19.6 \text{ V} \]

\[ E = vB\ell \]

\[ v = \frac{E}{Be} = 1.63 \text{ m/s} \]

#241: \[ V_{rms} = 210 \text{ V} \quad R = 26 \Omega \quad z = 71 \Omega \]

\[ P = P_R = I_R \cdot V_R = I^2 R \]

\[ V = Iz \Rightarrow I = \frac{V}{iz} = 2.96 \text{ A} \]
#19
\[
E = \frac{d\Phi}{dt} = \frac{\Delta \Phi}{\Delta t} \quad \Phi = NBA \cos \Theta
\]
\[
= NA \cos \Theta \frac{\Delta R}{\Delta t}
\]
\[
= (300)(0.2 \times 0.2)(1)\left(\frac{0.4}{2.0}\right)
\]

#32
\[
V_c = I \times X_c
\]
Oscillations - Any back-and-forth behavior

- Voltage, Current, B Field
- Mass on Spring (Simple Harmonic Osc)
- Pendulum
- Guitar string, drum head
- Air molecule in sound wave

All Oscillations have time-related quantities.

- Frequency \( (F) \) in hertz \( (Hz) \) = osc/sec
- Period \( (T) \) in seconds \( (s) \)
- Angular Freq \( (\omega) \) in radians per sec \( (s^{-1}) \)

\[
F = \frac{1}{T} \quad \omega = 2\pi F
\]

Every Oscillation has an oscillating quantity.

- The Amplitude is how far it deviates from its equilibrium.

What Causes Oscillations

- Restoring Force
- Some Energy
- Inertia causing overshooting the equilibrium
Example: Mass on a Spring

\[ F_s = -kx = ma \quad a = \frac{k}{m} x \]

\[ \frac{d^2 x}{dt^2} = -\frac{k}{m} x \]

Solution: \( x = A \sin(\omega t + \phi) \)

Works if \( \omega = \sqrt{\frac{k}{m}} = 2\pi f \)

\[ F = \frac{1}{2\pi} \sqrt{\frac{k}{m}} \quad \text{Bigger = Slower} \]
Pendulum - rock on a string

\[ F = \frac{1}{2\pi} \sqrt{\frac{g}{l}} \]

\[ \text{Torque } \propto \text{-Angle} \]

Ex: Want a period of 2.0 s.
\[ f = 0.5 \text{ Hz} \]
\[ F = \frac{1}{2\pi} \sqrt{\frac{g}{l}} \]
\[ (2\pi f)^2 = \frac{9}{l} \]
\[ L = \frac{9}{(2\pi f)^2} = \frac{9.8}{0.2^2} \]
\[ L = 0.993 \text{ m} \]