Phys 1402 2017-10-26 Lec 16

Exam 2 is Tue 10/31

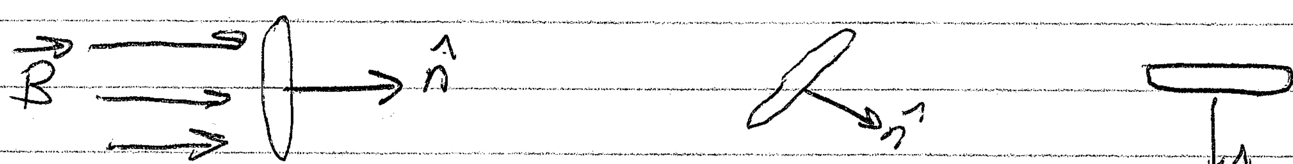
- Exam 2 Review says "University Physics" but that is a typo.

Faraday's Law: $\mathcal{E} = -\frac{\Delta \Phi_B}{\Delta t}$

"Change in Magnetic Flux"

$\Phi_B = NBA \cos\theta$

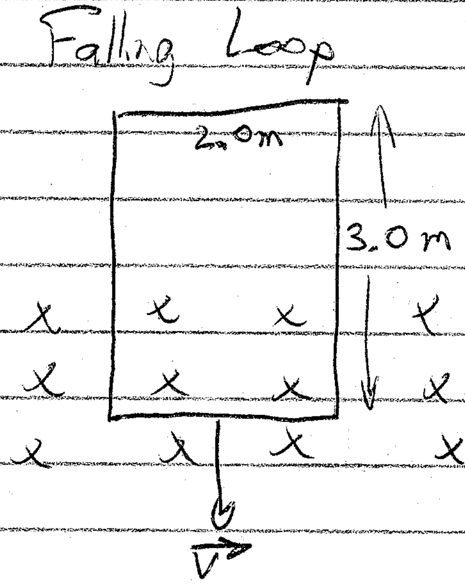
- N: # Loops
- B: magnetic field
- A: size of loop
- $\cos\theta$: orientation



$\hat{n}$ = "normal vector"

$\theta = 0$	$\theta = 45^\circ$	$\theta = 90^\circ$
$\cos\theta = 1$	$\cos\theta = 0.707$	$\cos\theta = 0$

②



B = 6.0 T
m = 0.6 kg
R = 40 Ω

Relevant Equations:

$\mathcal{E} = vBl$

$\mathcal{E} = v(6.0\,T)(2.0\,m)$

$\mathcal{E} = IR$

$\mathcal{E} = I(40\,\Omega)$

$F_B = I l B = F_g = mg$

$I(2.0\,m)(6.0\,T) = (0.6\,kg)(9.8\,N/kg)$

$I = 0.49\,A$

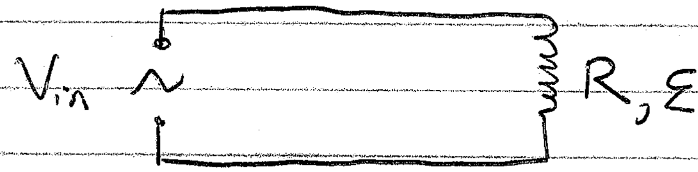
$\mathcal{E} = (0.49\,A)(40\,\Omega)$
$= 19.6\,V$

$(19.6\,V) = v(6.0\,T)(2.0\,m)$

$1.63\,m/s = v$

EMF of a motor: $\mathcal{E} = NBA\,\omega$ (ω ← speed)

<u>Start Motor:</u> $\omega = 0$



$V_{in} = IR$

<u>Running Freely:</u> $\omega = \omega_{max}$

$$V_{in} - \mathcal{E} = IR$$

$\mathcal{E} = NBA\,\omega_{max}$ = Large Value

Small = (Small Current) R

This $\mathcal{E}$ is <u>reducing</u> the current needed.

<u>Under Load</u> $\tau = NBA\,I$

To get large τ, need large I.

$$V_{in} - \mathcal{E} = IR$$

Smaller $\mathcal{E}$ ↑ ← larger

With smaller $\mathcal{E}$, it must be going <u>slower</u>.

(4)

$P_{avg} = 250\ W$
$V_{rms} = 120\ V$

$250W = (120V)\ I_{rms}$
$(2.08A) = I_{rms}$

$V_{max} = 130\ V$ $\quad f = 55\ Hz$

$R = 40\ \Omega$ $\quad V_{rms} = \frac{V_{max}}{\sqrt{2}} = 91.9\ V$

$L = 0.185\ H$ $\quad X_L = 2\pi f L = 63.9\ \Omega$

$C = 65\times10^{-6}\ F$ $\quad X_C = \frac{1}{2\pi f C} = 44.5\ \Omega$

$X = X_L - X_C = 19.4\ \Omega$

$Z = \sqrt{R^2 + X^2} = 44.5\ \Omega$

$(91.9v) = I_{rms}\ Z$

$V_R = I_{rms}\ R$

$V_L = X_L\ I_{rms}$

$V_C = I_{rms}\ X_C$

$V_{b\text{-}d} = I_{rms}\ X$ (L & C between b and d)