Week 10 :

score calculation to get (.25) from HW

1. Every HW atleast 50% completed / attendance of excercise class : 10/HW or 10/day of attendance
2. Need atleast 40% aggregate.

Total = (#1) + ($\sum_i$ HW$_i$ scores) + (small constant offset) + (midterm?) + ???

small constant offset is percentage rounding offset

3. Total should be atleast 40% ± 5% => i.e atleast 37.5%

Note: (#1) = {Number of HW you completed in sufficient quantity of atleast 50% or Number of days the course - excercise was attended} X10

I will send you your personalized score card after last HW and indicate if you got (.25) extra.

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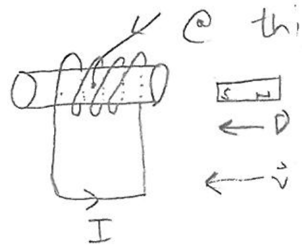
micro teaching : Look @ this week's micro teaching PDF on moodle.

HW 10

1. Lenz Law: "Emf induced such that it opposes the flux change"

$$\Phi = \int \vec{B} \cdot d\vec{a}$$

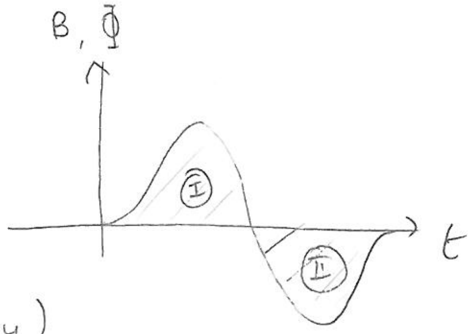
a.



Tasks:

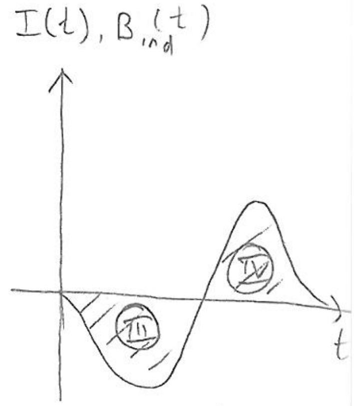
(i) plot $\vec{B}_z(t)$?

same as $\Phi(t)$



Note: (I) = (II) (Cons. of Energy)

(ii) Now plot the $I(t) \longrightarrow B_{ind}(t)$?



III → − I
IV → − II
} This is Lenz Law Statement

2. Faraday's Law:

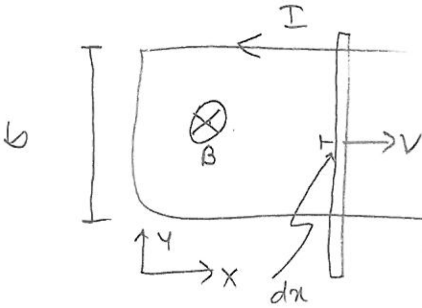
$$\vec{\nabla} \times \vec{E} = -\frac{\partial \vec{B}}{\partial t} \iff \oint_L E \cdot dl = -\int_S \frac{\partial B}{\partial t} \cdot d\vec{a}$$

$$V_{Emf} = -\frac{\partial}{\partial t} \int_S B \cdot d\vec{a}$$

$$= -\frac{\partial \Phi_B}{\partial t}$$

a. $\mathcal{E}_{emf} = -\frac{d\Phi_B}{dt} = \frac{\int \vec{B}\cdot d\vec{a}}{dt} = V$ This has direction

Task: (i) Is $\int B \cdot d\vec{a}$ changing with time

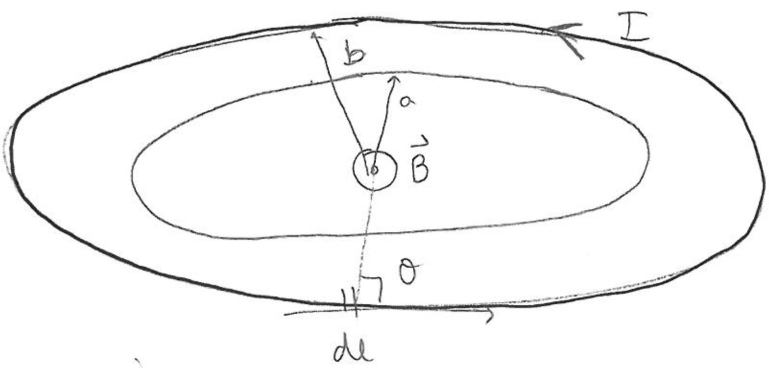


Notice $|d\vec{a}| = b\,dx$

(ii) Indicate direction of I ?

(iii) Calc. $\mathcal{E}mf = -\frac{d\Phi}{dt}$? $= -Bbv$

3.



Assume the ring is conductor

Task:

(i) which direction would 'I' go when $\vec{B}$ is turned off ?

(ii) $\mathcal{E}mf = ? = \pi a^2 \cdot \frac{dB}{dt}$ $\left(= \oint_C \vec{E}\cdot d\vec{l}\right.$

(iii) $\vec{E}$? indicate direction: (Always along current)

$$d\tau = \vec{r} \times d\vec{F}$$

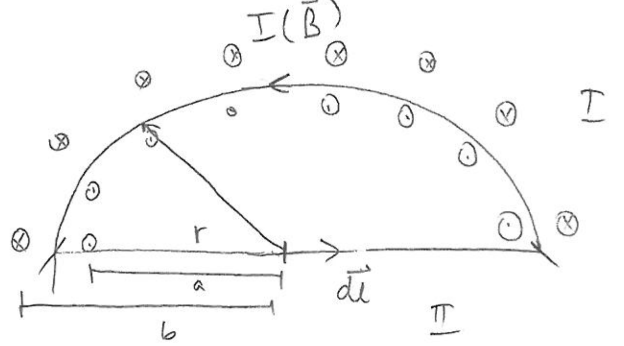
$$= \vec{r} \times dq \cdot \vec{E} = b \cdot \lambda d\vec{l} \cdot \vec{E} \cdot \sin\theta$$

$$\tau = \int d\tau = \int b \cdot \lambda d\vec{l} \cdot \vec{E} \cdot \sin\theta$$

(iii) what is $\sin\theta$? $(= \pi/2)$

(i) $\tau = \int b\lambda \, \vec{E} \cdot d\vec{l} = b\lambda \int \vec{E} \cdot d\vec{l} = ?$

4.



Ampere's Law: $\int \vec{B} \cdot d\vec{l} = \mu_0 \vec{J} = \mu_0 (N \cdot I)$

a. Task:

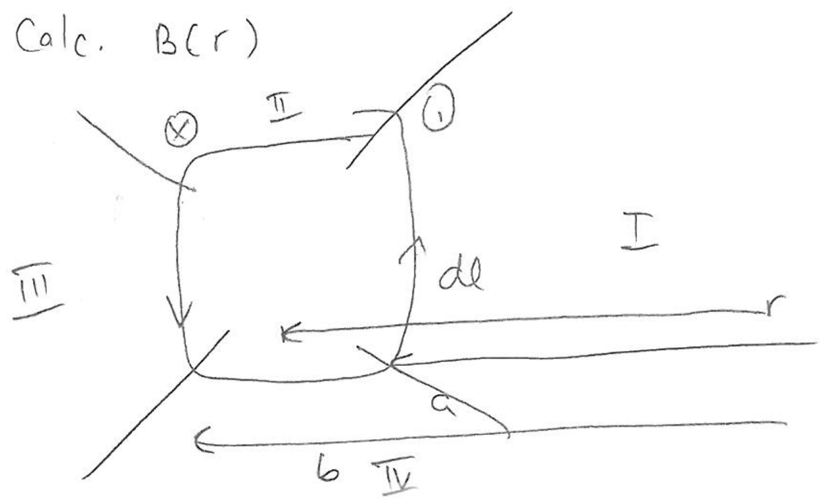
(i) Indicate direction of $\vec{B}$ in I, II?

(ii) $\oint_C \vec{B} \cdot d\vec{l} = \int B_I \cdot dl_I + \int B_{II} \cdot dl_{II} = ?$

$\mu_0 N \cdot I = B \cdot 2\pi r$ 0

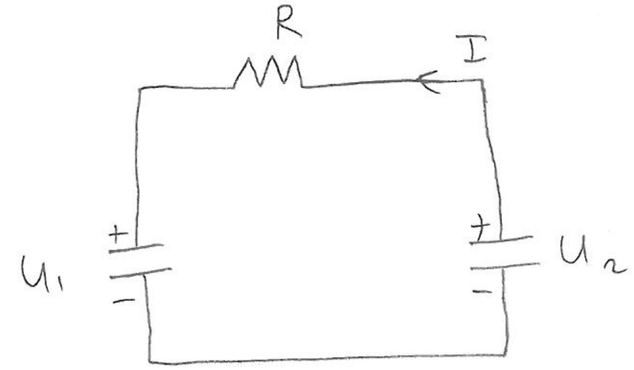
Calc. $B(r)$

b.



B. $\Phi = ? = LI\ ? \quad \propto I$

5.



a. Task.

(i) write Kirchoff's Loop Rule for ↑

$$\left(U_2 - I(t)R - U_1 = 0 \right)$$

Note: @ $t=0 \Rightarrow U_2(0) = \frac{Q_2^0}{C_2}$; $U_1(0) = \frac{Q_1^0}{C_1}$

& $I = -\dot{Q}_1 = \dot{Q}_2$

@ $t = \infty \Rightarrow I(t) = 0$

(ii) write Everything in terms of Q_i

$$\partial \left(\frac{Q_2}{C_2} - I(t)R - \frac{Q_1}{C_1} \right) = 0$$

$$\frac{I}{C_2} - \dot{I}R - \frac{I}{C_1} = 0 \Rightarrow \text{Solve } I.$$

b. Note $V_L = L\frac{dI}{dt}$

just replace $I(t)R \rightarrow L\frac{dI}{dt} = L\dot{I}$

Solve for I.