Mansoura University	Electrical Eng. Dept.
Faculty of Engineering	1st Year, January 2014
Time allowed : 3 Hours	Electric Circuits(1)

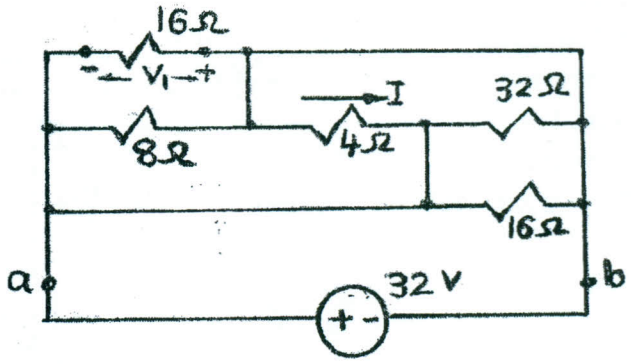
PART (A)

Please Answer all questions (Don't use pencil).

First Question : (8 Marks):

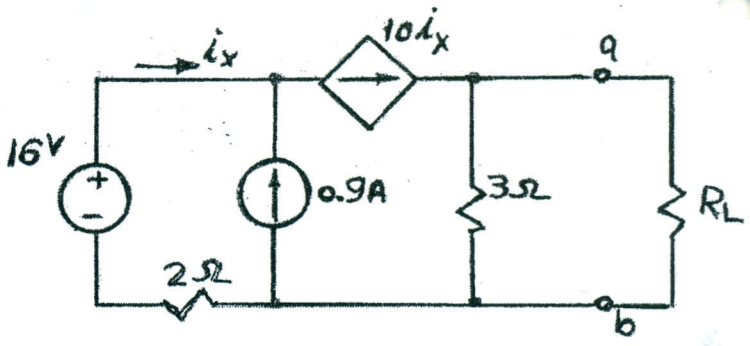
For the shown circuit,

a-determine R_{ab}.
b-calculate V_1.
c-determine the current I.



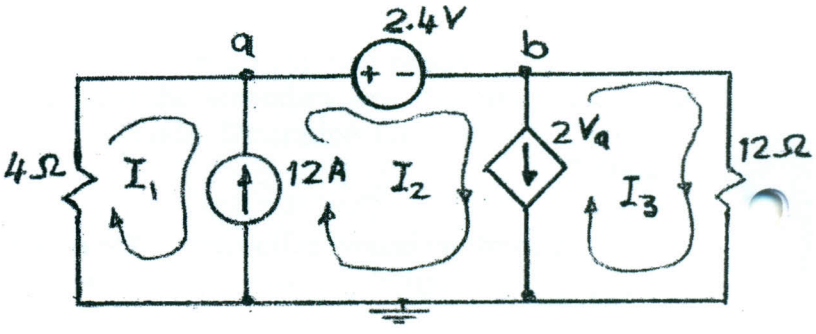
Second Question: (10 Marks):

For the shown circuit, determine the value of resistor "R_L" that consumes maximum power. Determine this maximum power.



Third Question: (14 Marks):

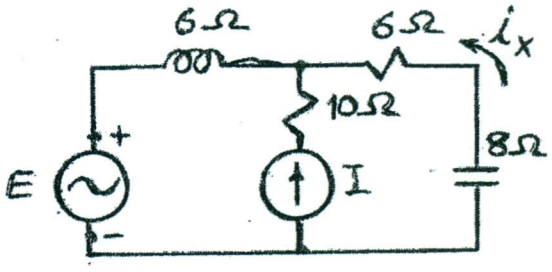
For the shown circuit,
a-write the necessary nodal voltage method equations to determine V_a and V_b.(do not solve the equations).
b- write the necessary mesh-current method equations to determine I_1, I_2, and I_3 .(do not solve the equations).



Fourth Question: (10 Marks):

Using the superposition theorem, determine the value of the current i_x for the shown circuit. Consider,

$E_1=20\angle 30^\circ$, and $I=2\sqrt{2}$ Sin ωt.



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Fifth Question: (8 Marks):

In a certain circuit, if $V_1=3\text{Cos } 4t$, and $V_2=4\text{Sin}(4t+20^\circ)$, find the value of (V_1+V_2). Write the result in time-domain and in phase-domain forms.

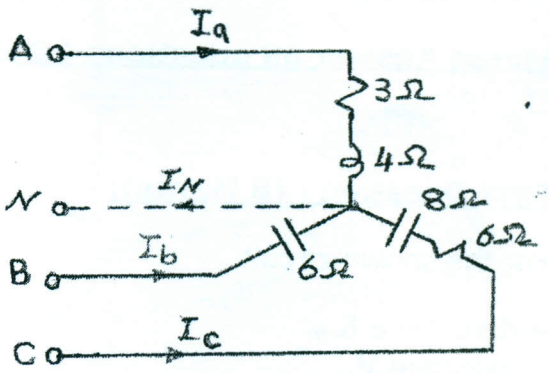
Sixth Question: (10 Marks):

A 3-ph supply with voltage of $V_{ab}=380\ \text{Sin}314t$ V, is supplying the 3-ph load shown in figure. Calculate;

a- The line currents I_a, I_b, and I_c.

b- The neutral current I_N.

c-The total power consumed by the load.



WITH MY BEST WISHES

Prof. Dr. Kamal Shebl

Part [2]

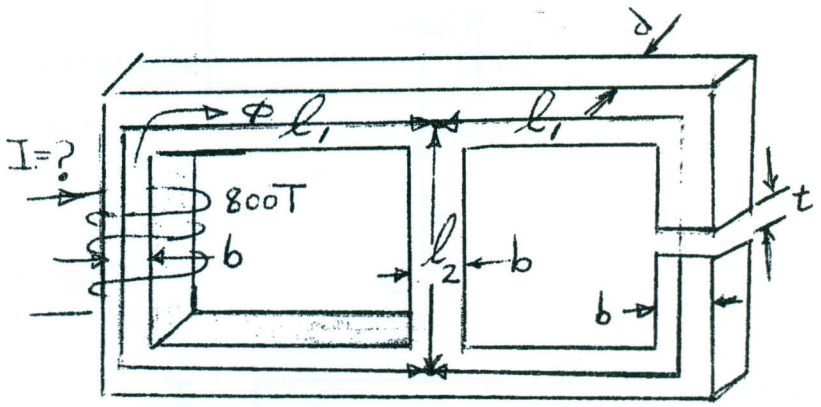
Frist Question:

1-a) Explain the origin of the fringing and leakage flux. ***(4 Marks)***

1-b) Sketch a typical hysteresis loop for a sample of ferromagnetic material and explain its shape, sketch also the typical hysteresis loop for; soft iron, hard steel, and Ferrite. ***(4 Marks)***

1-c) In the magnetic circuit shown in the following Figure, estimate the current, I.

$\Phi = 100\mu W$; $\mu_r = 1000$; $b = 3cm$; $l_1 = 20cm$; $l_2 = 8cm$; $t = 1mm$; $d = 2cm$. ***(12 Marks)***



Second Question:

2-a) Prove, the self-inductance, $L = N\dfrac{\Delta\Phi}{\Delta i} = \dfrac{\mu_o\mu_r N^2 A}{l}$

Mutual inductance, $M = kN_pN_s\mu_o\mu_r\dfrac{A}{l} = K\sqrt{L_1L_2}$

Stored energy in an inductive circuit, $W = \dfrac{B^2 Al}{2\mu_o\mu_r}$ ***(6 Marks)***

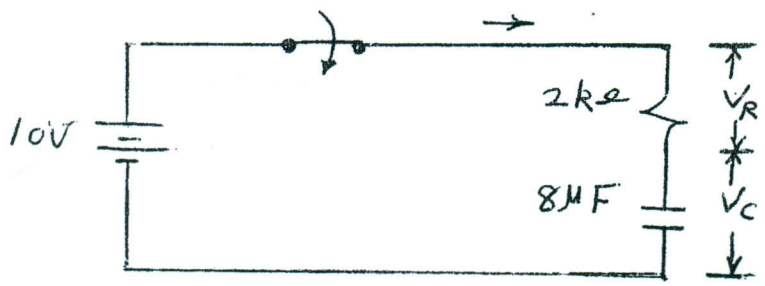
2-b) The dimensions of the magnetic core are; A = 8 cm, l = 20 cm, and relative permeability is 1000. The primary coil has N = 1000 turns, and the secondary coil has 600 turns. If the current is increased from zero to 8A in 0.3 seconds. Determine the emf induced in the secondary coil. ***(7 Marks)***

2-c) A cast steel ring, has A = 2 cm, and l = 12 cm. A 400 – turn coil is wound on the ring. Determine the coil inductance when the current is 1A. (Assume μ_r = 1000). ***(7 Marks)***

Third Question:

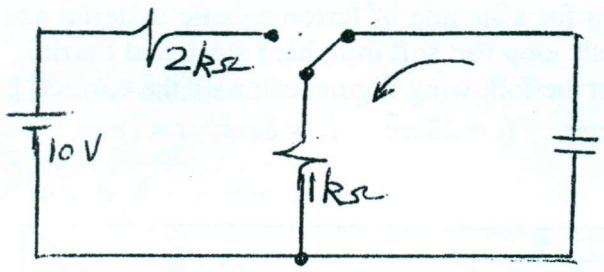
3-a) Prove the following are in seconds; the charging time constant, τ_c - discharging time constant, τ_d - transient time constant in R-L DC circuit. ***(5 Marks)***

3-b) (i) Calculate V_R and V_C at $t = \tau_c$, $t = 3\tau_c$, and $t = 5\tau_c$. ***(5 Marks)***



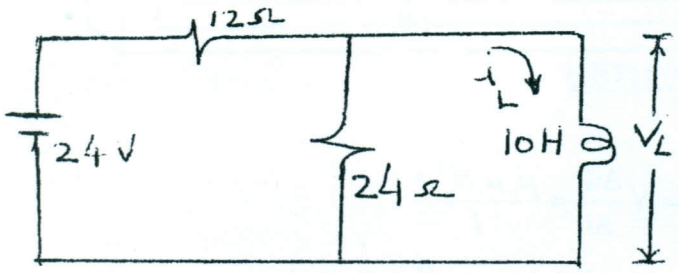
(ii) Calculate V_C, and i_c at $t = \frac{1}{2}\tau_d$, $t = \tau_d$, and $t = 5\tau_d$. (Capacitor was fully charged at t = 0)

(5 Marks)



3-c) In the circuit shown, find;

i_L, and V_L after τ, 3τ, and 5τ. ***(5 Marks)***



Good Luck. Prof. Adel El-Sayes