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FINAL
Examination Paper

(COVER PAGE)

Session : JAN 2012

Programme : DIPLOMA IN ELECTRICAL AND ELECTRONIC ENGINEERING

Course : EEE 1101: BASIC ELECTRICAL TECHNOLOGY

Date of Examination : 5 March 2012

Time : 8a.m. – 10a.m. Reading Time : Nil

Duration : 2 Hours

Special Instructions :

This paper consists of SIX (6) questions. Answer any FOUR (4) questions in the answer booklet provided. All questions carry equal marks.

Materials permitted :

Non-Programmable Scientific Calculator

Materials provided :

Nil

Examiner(s) : Shalyn Lim Sheue Hui

Moderator : Khoo Boo Tap

This paper consists of 10 printed pages, including the cover page.

INTI INTERNATIONAL COLLEGE PENANG

DIPLOMA IN ELECTRONIC AND ELECTRICAL ENGINEERING PROGRAMME (DEEI)

DIPLOMA IN ENGINEERING PROGRAMME

EEE 1101 : BASIC ELECTRICAL TECHNOLOGY
FINAL EXAMINATION : JANUARY 2012 SESSION

Instructions: This paper consists of SIX (6) questions. Answer any FOUR (4) questions in the answer booklet provided. All questions carry equal marks.

Question 1

- (a) List down two conditions for continuous current flow. (2 marks)
- (b) A piece of wire of cross-sectional area 2 mm^2 has a resistance of 300Ω . Find
- (i) the resistance of a wire of the same length and material if the cross-sectional area is 5 mm^2 (2 marks)
 - (ii) the cross-sectional area of a wire of the same length and material of resistance 750Ω . (2 marks)
- (c) With reference to Figure Q1(c), determine
- (i) the currents I , I_3 , I_8 and I_9 . (13 marks)
 - (ii) the voltage V_{ab} (3 marks)
 - (iii) the power dissipated through R_6 and R_8 (3 marks)

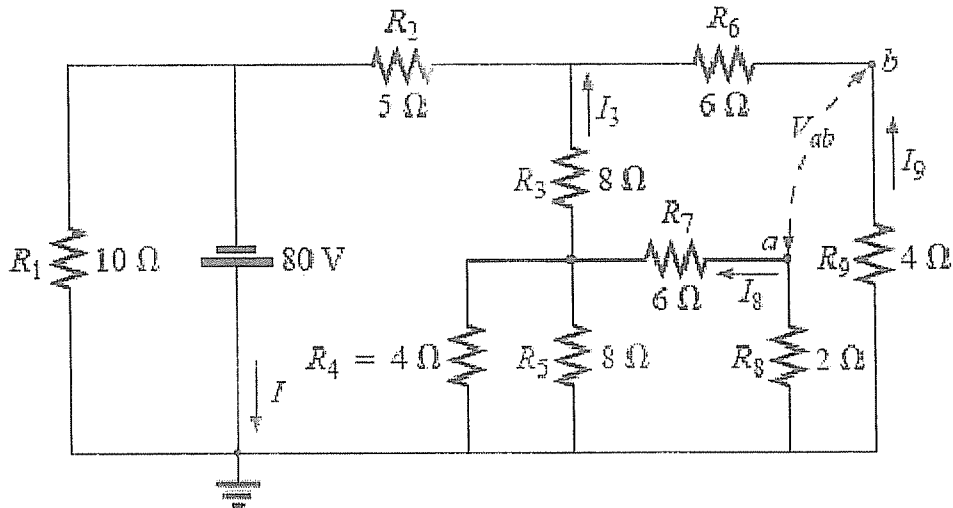


Figure Q1(c)

Question 2

- (a) Using branch-current method, find the current through each resistor for the networks of Figure Q2(a)

(6 marks)

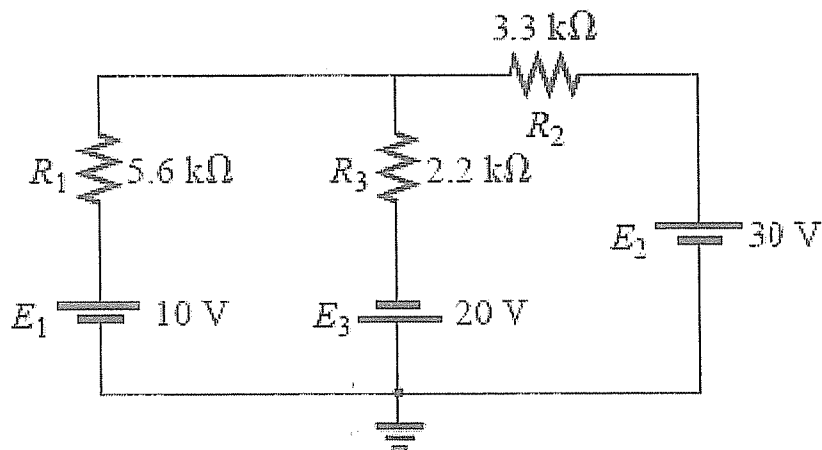


Figure Q2(a)

- (b) For the network shown in Figure Q2(b),

- (i) determine the maximum power transfer to R

(6 marks)

- (ii) sketch a curve of power versus R for R equal to ¼, ½, 1 and 1½ the R value obtained in part (i)

(4 marks)

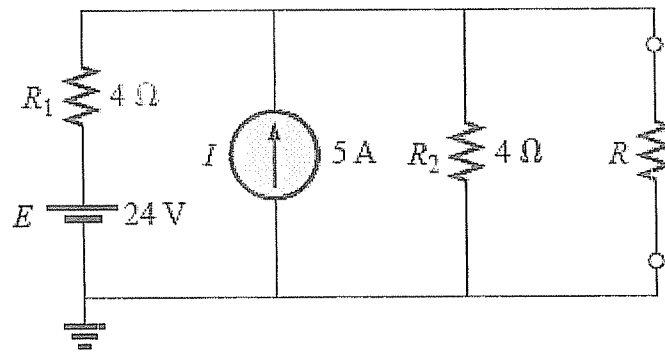


Figure Q2(b)

(c) Calculate the current, I_{R_1} for the network shown in Figure Q2(c).

(9 marks)

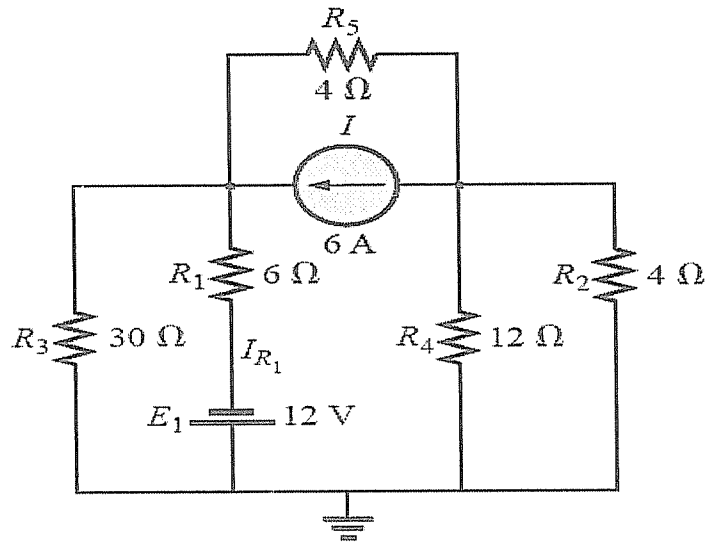


Figure Q2(c)

Question 3

- (a) Two permanent magnets are brought together side to side in Figure Q3(a)(i) and (ii). Sketch the flux distribution lines with correct direction.

(4 marks)



Figure Q3(a) (i)



Figure Q3(a) (ii)

- (b) An iron magnetic core has a uniform cross-sectional area of 5cm^2 and length of 25cm . A coil of 120 turns is wound uniformly over the core. When the current in the coil is 5A , the total flux is 0.6 mWb . Calculate the

- (i) magnetic field strength

(2 marks)

- (ii) relative permeability

(3 marks)

- (c) Find the value of I required to establish a magnetic flux of $\Phi = 0.75 \times 10^{-4}\text{ Wb}$ in the magnetic circuit of Figure Q3(c). Given the magnetizing force of cast steel are 280 At/m .

(8 marks)

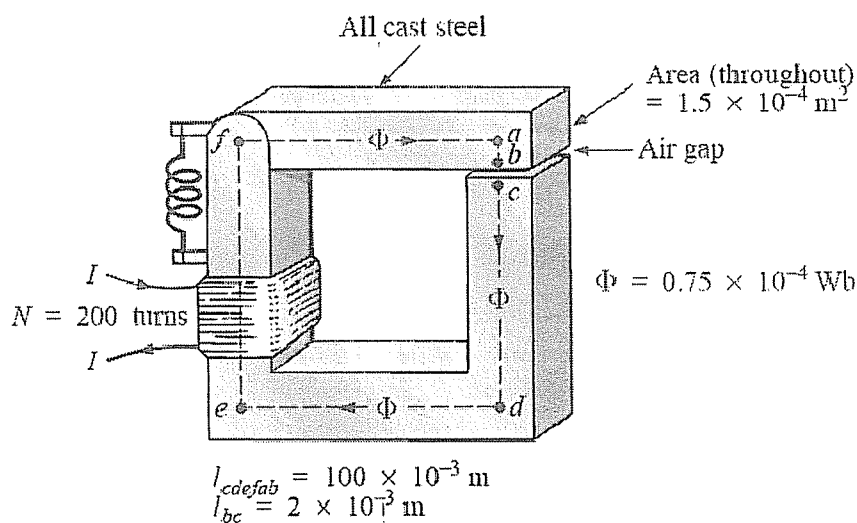


Figure Q3(c)

- (d) Two coils A and B are kept in parallel planes such that 70% of the flux produced by coil A links with coil B. Coil A has 10 000 turns, coil B has 12 000 turns. A current of 4A in coil A produces a flux of 0.04 mWb while a current of 4A in coil B produces a flux of 0.08 mWb. Calculate
- (i) the inductance of L_A and L_B . (3 marks)
 - (ii) the mutual inductance (3 marks)
 - (iii) the coupling coefficient (2 marks)

Question 4

- (a) For the network of Figure Q4(a),
- (i) Determine the mathematical expressions for the current i_L and the voltage v_L when the switch is closed. (3 marks)
 - (ii) Repeat part (i) if the switch is opened at $t = 1$ ms. (5 marks)

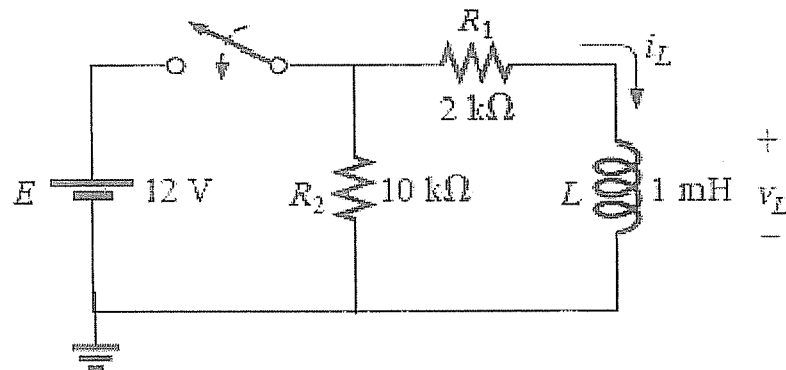


Figure Q4(a)

- (b) For the circuit shown in Figure Q4(b), determine
- (i) the charge drawn from the supply (3 marks)
 - (ii) the charge on the $8 \mu\text{F}$ capacitor (2 marks)
 - (iii) the potential difference across the $3 \mu\text{F}$ capacitor. (3 marks)

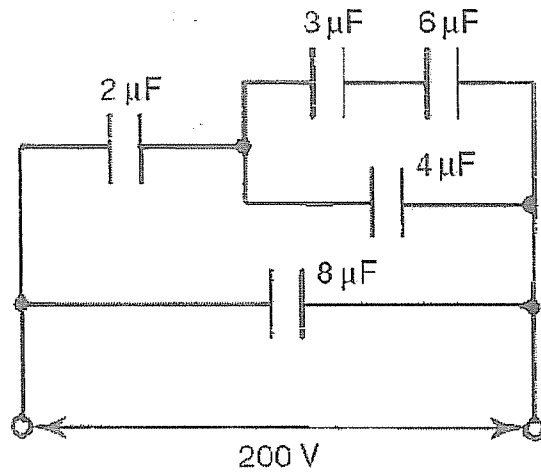


Figure Q4(b)

(c) Given the RC circuit shown in Figure Q4(c),

- (i) find the mathematical expressions for the transient behavior of the voltage v_C and the current i_C following the closing of the switch. (6 marks)
- (ii) sketch the waveform of v_C and i_C in the duration of 5τ . (3 marks)

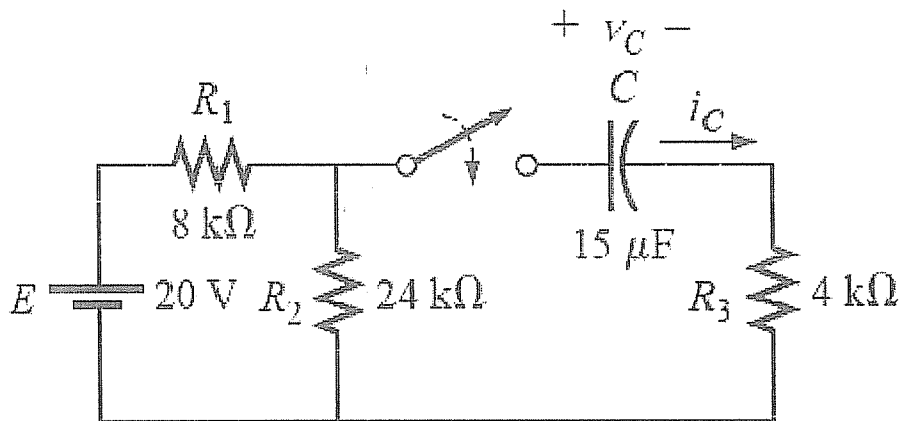


Figure Q4(c)

Question 5

- (a) What is the phase relationship between the sinusoidal waveforms $i = 15 \sin(\omega t + 60^\circ)$ A and $v = 10 \sin(\omega t - 20^\circ)$ V? State whether this is a capacitive or inductive network. (3 marks)

- (b) Find the **sinusoidal expression** for the applied voltage e_{in} for the network in Figure Q5(b). Given the voltages across each element as below.

$$V_a = 60 \sin(\omega t + 30^\circ) \text{ V}$$

$$V_b = 30 \sin(\omega t - 30^\circ) \text{ V}$$

$$V_c = 40 \sin(\omega t + 120^\circ) \text{ V}$$

(3 marks)

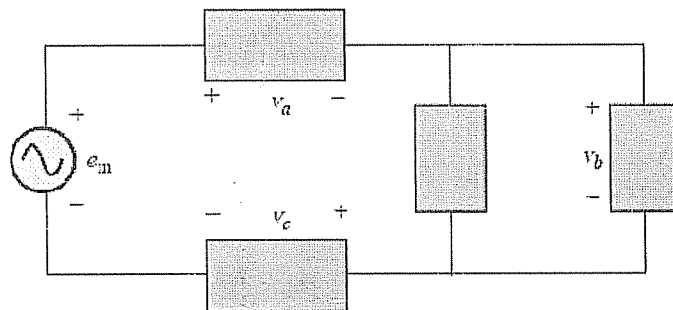


Figure Q5(b)

- (c) A series combination of $R = 10\Omega$ and $L = 20\text{mH}$ has a current $i = 5 \cos(500t + 10^\circ)$ A. Obtain

- (i) the total voltage across R and L.

(4 marks)

- (ii) sketch the phasor diagram of V and I.

(2 marks)

- (d) For the network of Figure Q5(d), calculate [express the answer in polar form]

- (i) the total impedance Z_T .

(4 marks)

- (ii) the voltage V_2 and the current I_L .

(6 marks)

- (ii) the power factor of the network.

(3 marks)

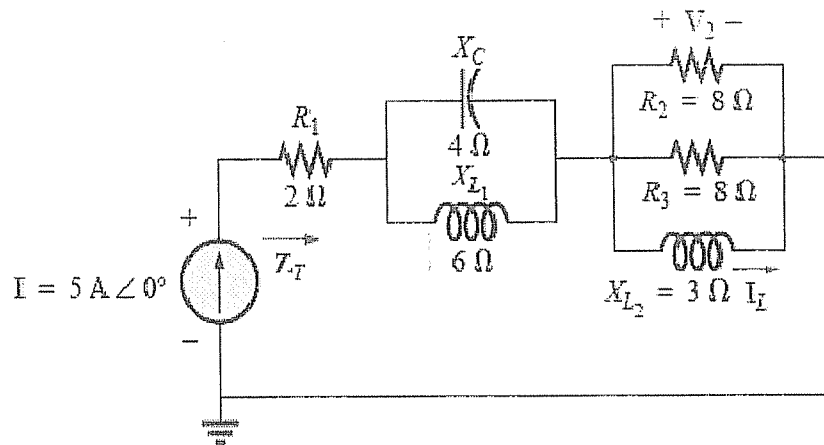


Figure Q5(d)

Question 6

- (a) A coil of negligible resistance and inductance 100mH is connected in series with a capacitance of 2 μ F and a resistance of 10 Ω across a 50V, variable frequency supply. Determine
- the resonant frequency. (2 marks)
 - the current at resonance. (2 marks)
 - Justify the resonance condition happens with quantitative calculation. (4 marks)
 - the Q-factor of the circuit. (2 marks)
- (b) For the network of Figure Q6(b), calculate
- the overall active, reactive and apparent power. (4 marks)
 - the power factor (2 marks)
 - the total current, I_s . (3 marks)

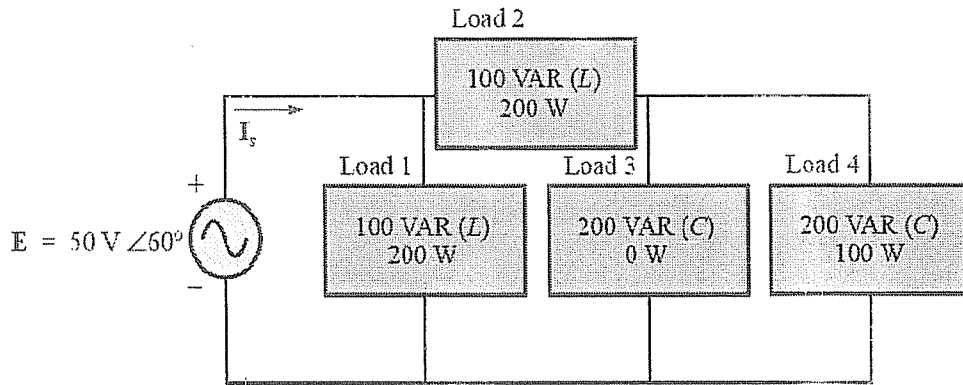


Figure 6(b)

- (c) Given a series RLC network in Figure 6(c), prove that the resonant frequency equation is shown as below :

$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

Explain how resonance happen in series RLC network?

(6 marks)

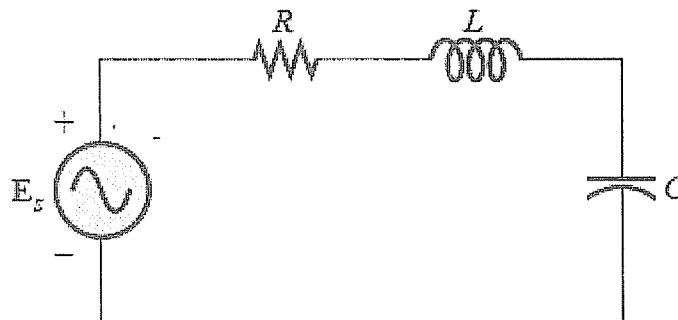


Figure 6(c)

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