UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2012/2013

COURSE NAME	:	ELECTRICAL AND ELECTRONIC TECHNOLOGY
COURSE CODE	:	BNJ10903
PROGRAMME	:	1BNH/ 1BNK
EXAMINATION DATE	:	JUNE 2013
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS ONLY FROM SIX (6) QUESTIONS PROVIDED

THIS QUESTION PAPER CONSISTS OF **ELEVEN (11)** PAGES

Q1 (a) Draw the symbolic representation of the dependent voltage source and independent current source.

(1 mark)

(b) What is the difference between active and passive elements?

(1 mark)

(c) A 1.2kW electric heater has a resistance of 6Ω.

(i) How much current does it draw?

(3 marks)

(ii) Determine the total energy used for 45 minutes heater operation.

(3 marks)

(d) (i) When the voltage across a resistor is 120V, the current through it is 2.5mA. Calculate its conductance.

(2 marks)

(ii) The voltage across a 5kΩ resistor is 16V. Find the current through the resistor.

(2 marks)

(e) A 20V source is applied to a resistor with colour bands brown, black, red, and silver. Calculate the minimum and maximum currents based on the tolerance of the resistor.

(3 marks)

(f) Two electric bulbs are connected in series across a 24V battery. The specification of the bulbs are as follows:

- Bulb 1: 24V, 10W,
- Bulb 2: 24V, 4W.

By drawing the circuit and making calculation on the power dissipated by each bulb, determine which bulb will glow brighter.

(10 marks)

Q2 (a) Consider the circuit of **Figure Q2(a)**.

(i) Determine the total circuit resistance, R_T.

(3 marks)

(ii) Determine the current I_T through the voltage sources.

(2 marks)

(iii) Solve for the currents I_1 and I_2.

(4 marks)

(iv) Calculate the voltage V_{ab}.

(2 marks)

(b) Determine the voltage across each of the resistors in the circuit shown in **Figure Q2(b)**.

(3 marks)

(c) Derive the Thevenin equivalent circuits for the circuit in **Figure Q2(c)**.

(11 marks)

Q3 (a) **Figure Q3(a)** shows the basic structure of a parallel plate capacitor. Given the area of the plates is 0.6cm^2 and the distance between the plates is 4mm. Determine the relative permittivity of the dielectric material in order to have 10pF capacitor if the permittivity of vacuum is 8.85×10^{-12}F/m.

(4 marks)

(b) Determine the equivalent capacitance for the circuit in **Figure Q3(b)**.

(5 marks)

(c) Calculate the inductance of 3cm length solenoid without a core with 200 turns and 2.5cm^2 cross sectional area. Given the permeability of air is 1.257×10^{-6}H/m.

(3 marks)

(d) Determine the equivalent inductance for the circuit in **Figure Q3(d)**.

(7 marks)

(e) If the flux density in a certain magnetic material is 2.3T and the area of the material is 300mm^2, calculate is the flux through the material?

(2 marks)

(f) Draw the construction of a permanent-magnet speaker and explain its operation.

(4 marks)

Q4 (a) (i) Define frequency and state its unit.

(3 marks)

(ii) Which sine wave in **Figure Q4(a)(ii)** has the higher frequency? Determine the frequency and the period of both waveforms.

(6 marks)

(b) The output waveform A of an AC system is as shown in **Figure Q4(b)** with the V_{RMS} is 150V. Calculate:

(i) Amplitude (V_{max}).
(ii) The angular frequency, ω.
(iii) The phase angle.
(iv) Considering waveform A as the reference, write the equation of waveform B in the form of $v = V_m\sin(\omega t \pm \phi)$.

(8 marks)

(c) The current in an a.c. circuit at any time t seconds is given by: $I = 120\sin(100\pi t + 0.36)$A. Find:

(i) The peak value, the periodic time, the frequency and phase angle relative to $120\sin 100\pi t$.
(ii) The value of the current when $t = 0$.
(iii) The value of the current when $t = 8$ms.
(iv) The time when the current first reaches 60A.

(8 marks)

Q5 (a) (i) Sketch the symbol of diode and its basic structure.

(3 marks)

(ii) Sketch the connection of a diode to a DC source when it is in reverse biased state.

(2 marks)

(b) (i) Two common types of relays are Normally Closed (NC) and Normally Opened (NO). Describe briefly about the two relays using a relevant diagram.

(5 marks)

(ii) Explain the function of rectifier and filter in the block diagram of DC power supply system as illustrated in **Figure Q5(b)(ii)**.

(5 marks)

(c) A 5kVA single-phase transformer has a turns ratio of 10:1 and is fed from a 2.5kV supply. By neglecting losses, determine:

(i) The full-load secondary current.

(5 marks)

(ii) The minimum load resistance which can be connected across the secondary winding to give full load kVA.

(3 marks)

(iii) The primary current at full load kVA.

(2 marks)

Q6 (a) (i) Write the Boolean expression and the truth table for the logic diagrams in **FigureQ6(a)(i)**.

(6 marks)

(ii) Draw a logic diagram circuit for the Boolean expression $\overline{A} \cdot \overline{B} + A \cdot B = Y$. Use inverters, AND gates and OR gates.

(4 marks)

(b) The truth table in **Table Q6(b)**, shows the operation of the four inputs of a logic circuit and its resulting outputs. Obtain the simplest Boolean expression of this logic circuit using Karnaugh map.

(6 marks)

(c) (i) Using block diagrams show the differences between motor and generator.

(4 marks)

(ii) State three advantages of AC induction motor.

(3 marks)

(iii) A three-phase two-pole induction motor is connected to a 50 Hz supply. Determine the synchronous speed of the motor in rev/min.

(2 marks)

- END OF QUESTION -

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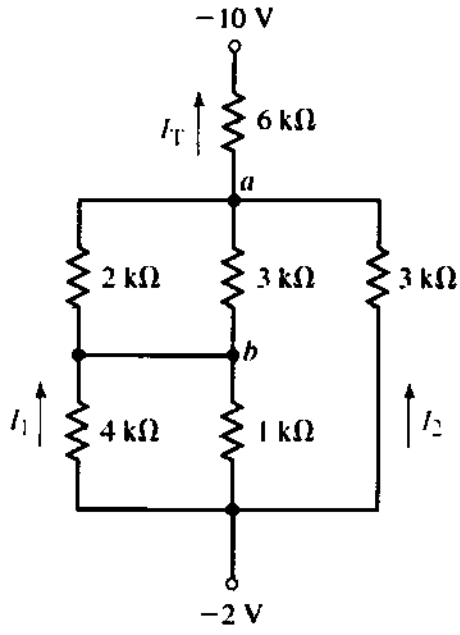

FIGURE Q2(a)

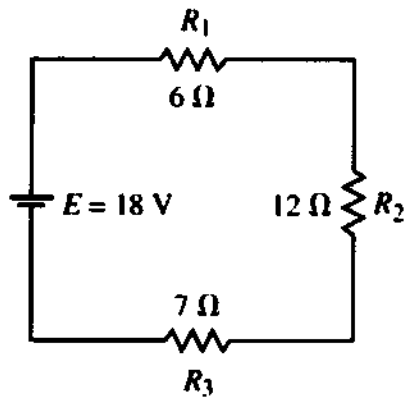

FIGURE Q2(b)

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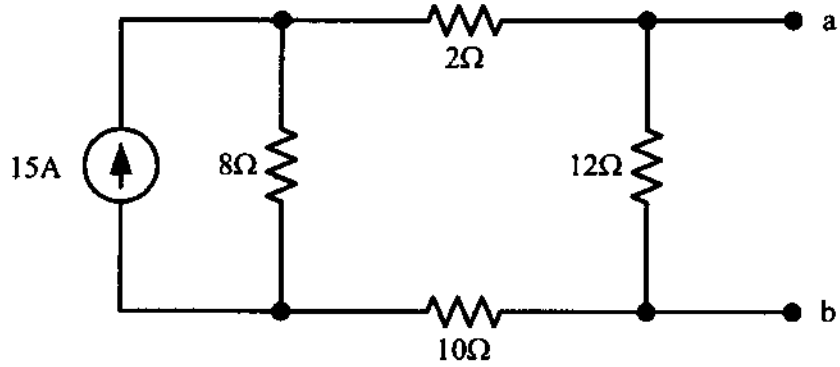

FIGURE Q2(c)

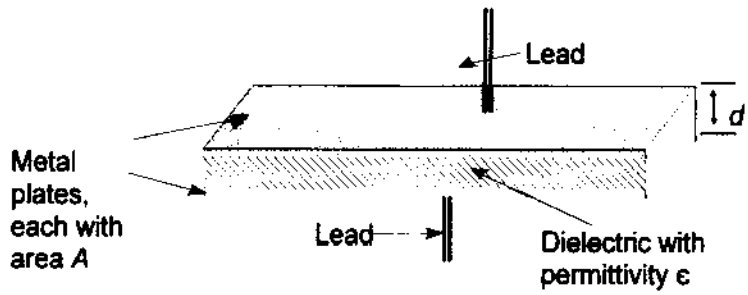

FIGURE Q3(a)

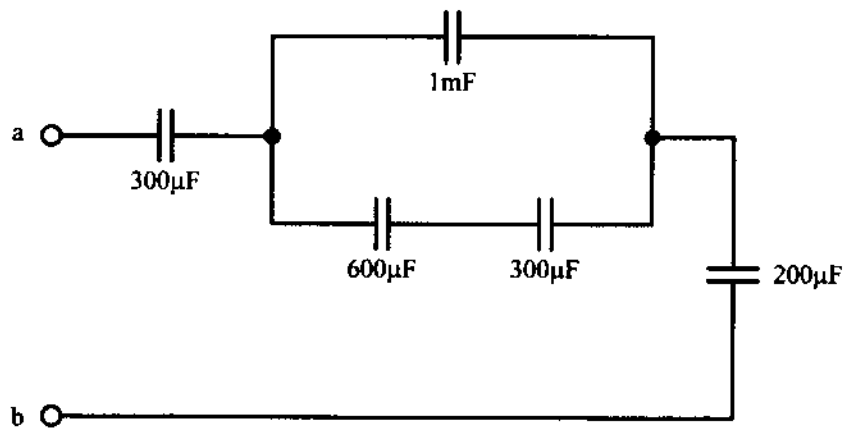

FIGURE Q3(b)

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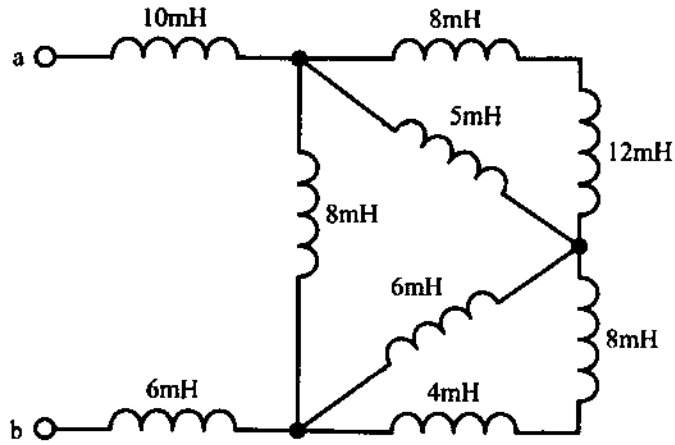

FIGURE Q3(d)

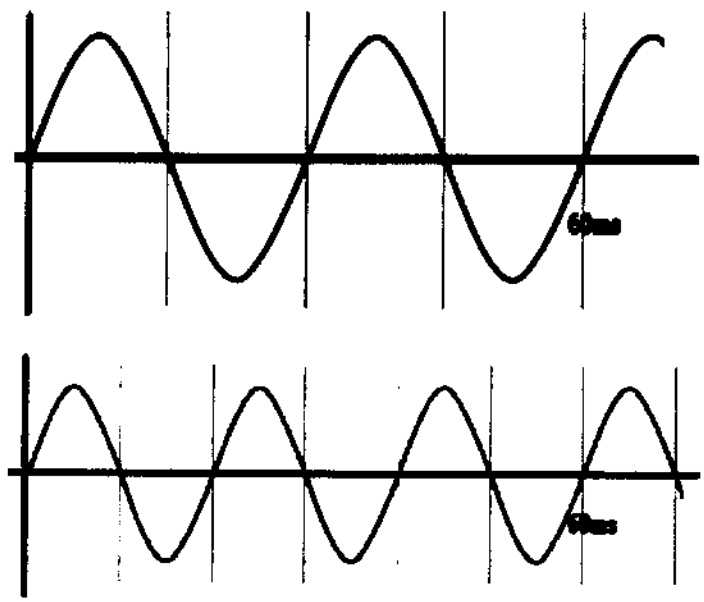

FIGURE Q4(a)(ii)

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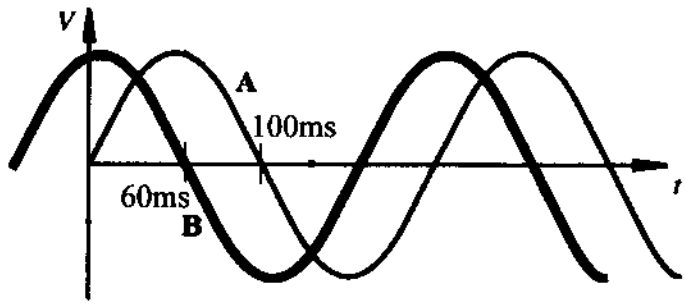

FIGURE Q4(b)

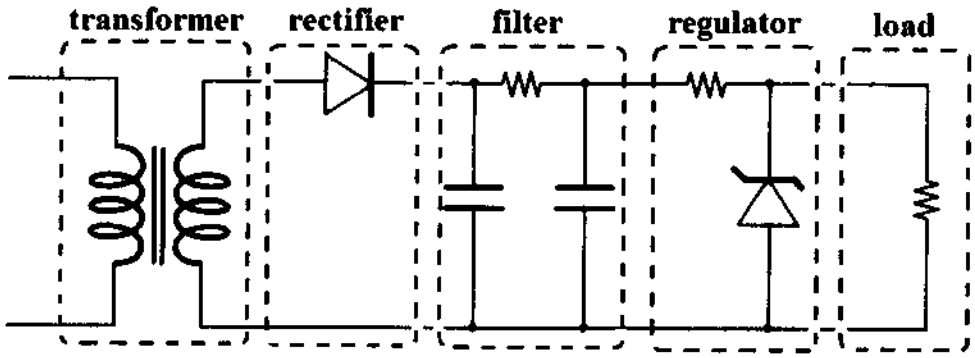

FIGURE Q5(b)(ii)

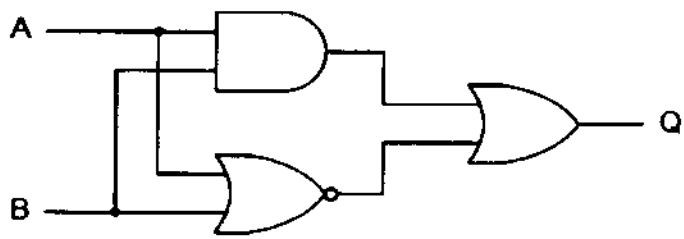

FIGURE Q6(a)(i)

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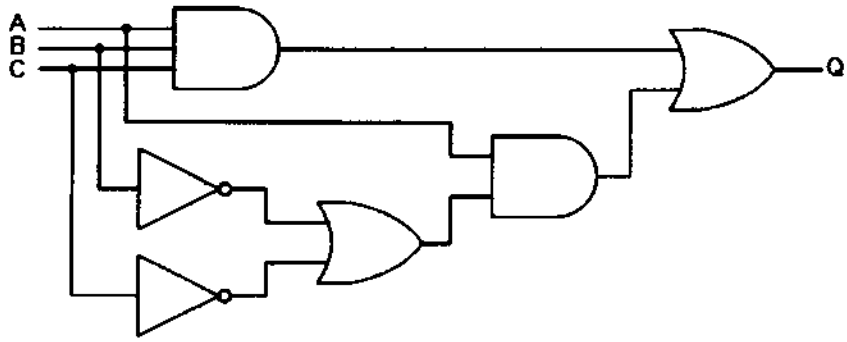

FIGURE Q6(a)(ii)

TABLEQ6(b)

A	B	C	D	Y2
0	0	0	0	1
0	0	0	1	1
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	0	1
0	1	1	1	1
1	0	0	0	1
1	0	0	1	1
1	0	1	0	0
1	0	1	1	0
1	1	0	0	0
1	1	0	1	0
1	1	1	0	0
1	1	1	1	0