

CONFIDENTIAL



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER I
SESSION 2013/2014**

COURSE NAME : DC ELECTRICITY AND MAGNETISM
COURSE CODE : BNR12203
PROGRAMME : BNE
EXAMINATION DATE : JANUARY 2014
DURATION : 3 HOURS
INSTRUCTION : ANSWER **FIVE (5)** QUESTIONS
ONLY

THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

- Q1** (a) Briefly explain the following:
- i) DC system. (1 mark)
 - ii) AC system. (1 mark)
 - iii) Active element. (1 mark)
- (b) Calculate the equivalent resistance R_{ab} at terminals $a-b$ for the circuit in Figure **Q1(b)**. (5 marks)
- (c) Obtain the values of i_1 and i_2 in the circuit shown in Figure **Q1 (c)**. (3 marks)
- (d) Referring to Figure **Q2 (b)**, find:
- (i) Voltage v_1 and v_2 (4 marks)
 - (ii) Current i_1 and i_2 (3 marks)
 - (iii) Power dissipated in the 40Ω resistor. (2 marks)
- Q2** (a) State Kirchoff's Voltage Law (KVL) and write its general formula. (2 marks)
- (b) Referring to Figure **Q2(b)**:
- (i) Use Kirchoff's voltage law to express equations for the two indicated loops (I_1 and I_2) in terms of voltages labelled. (2 marks)
 - (ii) Express V_2 in terms of I_1 , I_2 and R_2 . (1 mark)
- (c) Referring to circuit of Figure **2(c)**, use Kirchoff's laws to analyze the unknown currents and voltages. (15 marks)

- Q3** (a) Determine the number of branches and nodes referring to the circuit shown in Figure **Q2(a)**.
(2 marks)
- (b) Determine the node voltages and power dissipated in R_x for the circuit shown in figure **3(b)** using nodal analysis? Use Cramer's rule in solving the problem.
(10 marks)
- (c) Find the current in the 4Ω resistor in the circuit shown in Figure **3(c)** using Mesh analysis.
(8 marks)
- Q4** (a) State maximum power transfer theorem.
(2 marks)
- (b) Find the value of R_L in the circuit shown in Figure **Q4(b)** that results in maximum power to be produced in R_L . What is the value of P_{Lmax} ?
(10 marks)
- (c) Find Norton's equivalent circuit for the network to the left of terminal a and b in Figure **Q4(c)**.
(8 marks)
- Q5** (a) Discuss electromagnetism in brief. Use appropriate diagram to show magnetic field lines direction related to current flows.
(5 marks)
- (b) State the rule to determine the direction of force on a current carrying conductor in a magnetic field for motor mode operation.
(2 marks)
- (c) A mild steel ring has a mean circumference of 500 mm and a uniform cross-sectional area of 300 mm^2 . An air gap, 1mm in length is now cut in the ring. Assume the relative permeability of the mild steel to remain constant at 1200. This produces a flux of $500 \mu\text{Wb}$. Determine:
- the magnetic force
(3 marks)
 - the magnetomotive force
(3 marks)
 - the reluctance of the steel ring and air gap
(4 marks)
 - the flux produced if the magnetomotive force remains constant
(3 marks)

- Q6** (a) Explain the functions of the following components of DC machine:
- i) windings (3 marks)
 - ii) commutator (3 marks)
- (b) Sketch the equivalent circuit of a DC generator. (3 marks)
- (c) A shunt DC motor rating at 1200 r/min is fed by a 100V source. The line current is 25A and the shunt-field resistance is 100Ω . If the armature resistance is 0.2Ω , calculate the following:
- i) the current in the armature (3 marks)
 - ii) the counter-emf (4 marks)
 - iii) The mechanical power developed by the motor (4 marks)

— END OF QUESTION —

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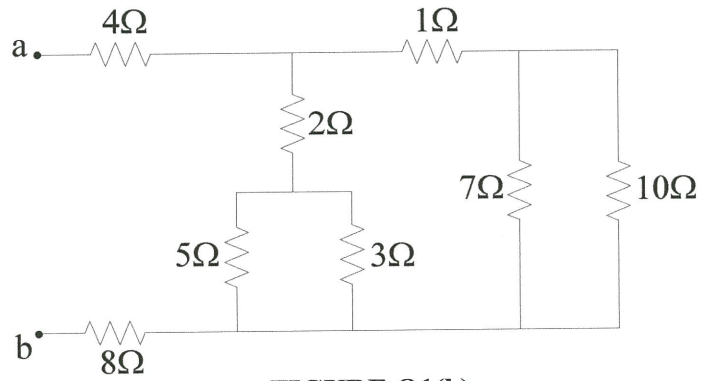


FIGURE Q1(b)

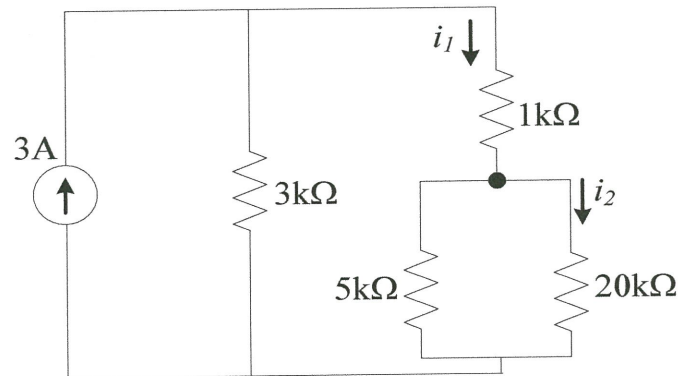


FIGURE Q1(c)

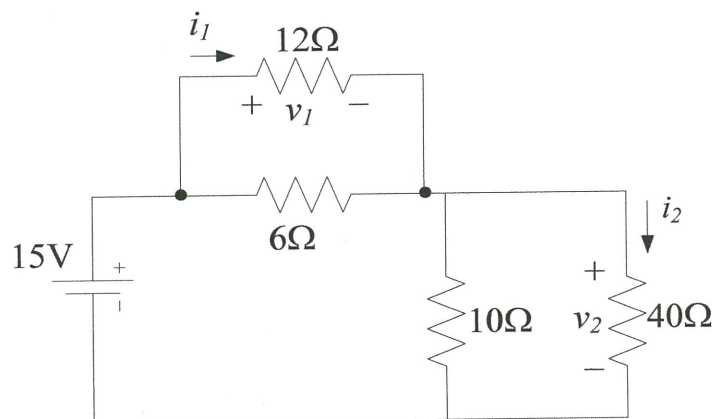


FIGURE Q1(d)

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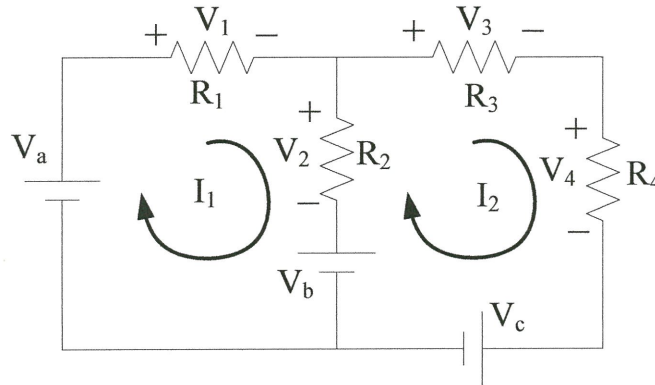


FIGURE Q2(b)

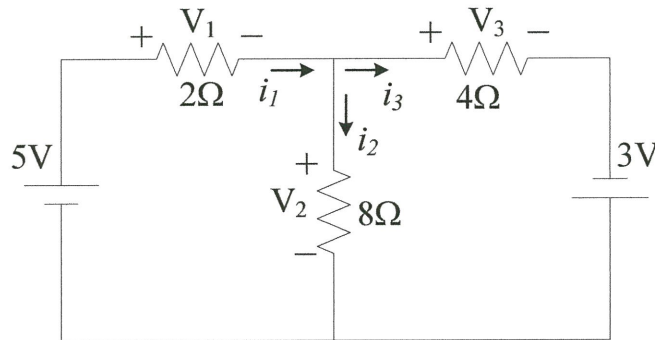


FIGURE Q2(c)

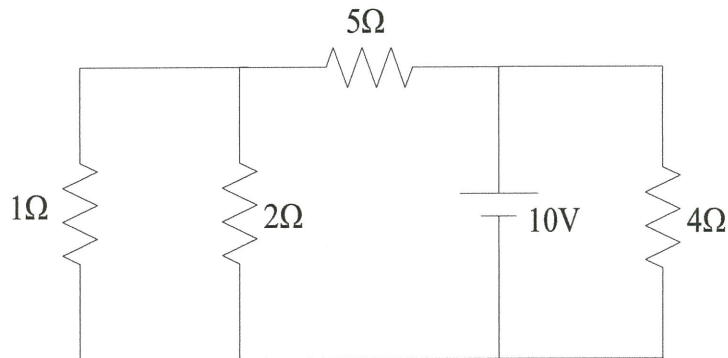


FIGURE Q3(a)

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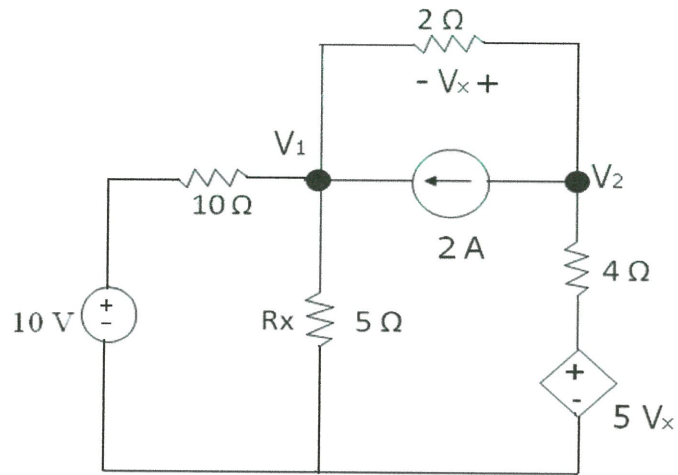


FIGURE Q3(b)

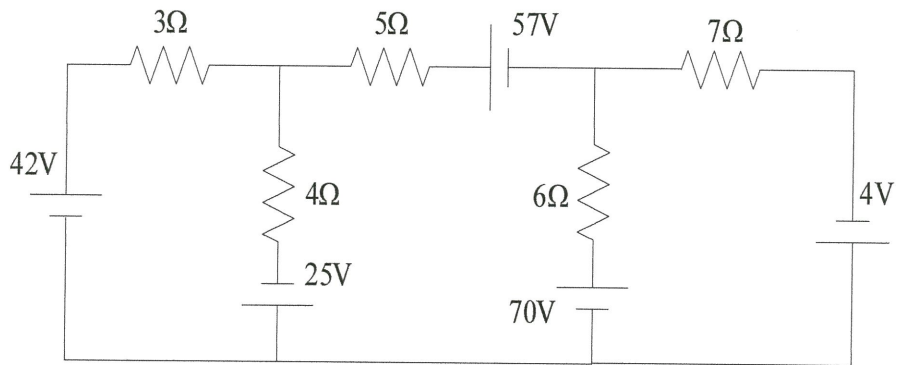


FIGURE Q3(c)

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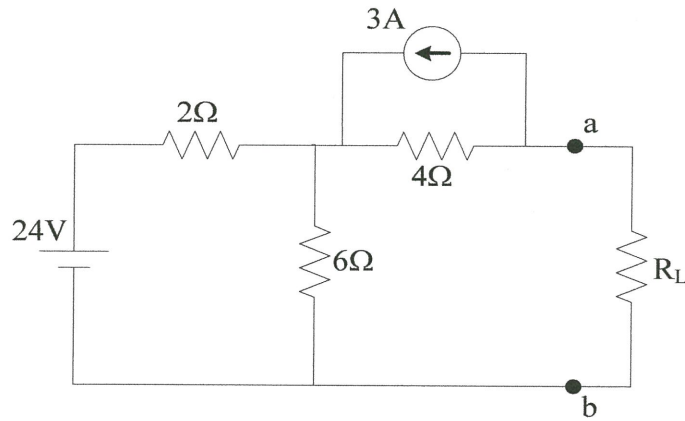


FIGURE Q4(b)

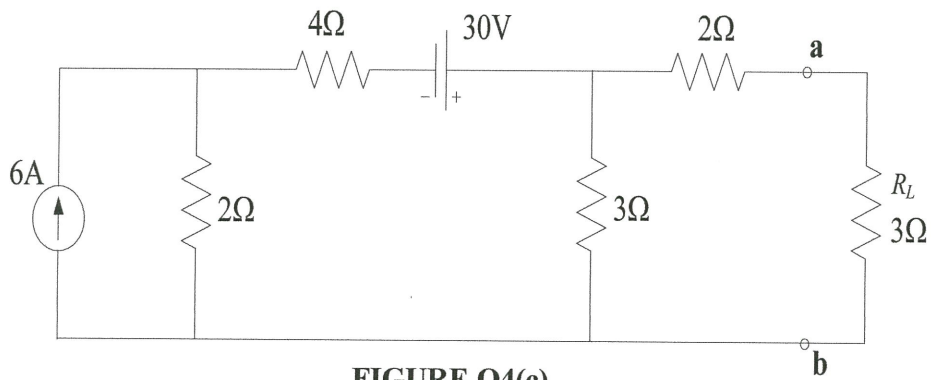


FIGURE Q4(c)