**FACULTY OF ELECTRICAL & ELECTRONICS ENGINEERING**

**FINAL EXAMINATION**

| | | |
|---|---|---|
| **COURSE** | **:** | **CIRCUIT ANALYSIS I** |
| **COURSE CODE** | **:** | **BEE1133** |
| **LECTURER** | **:** | **NOR RUL HASMA BINTI ABDULLAH** |
| | | **MAHFUZAH BINTI MUSTAFA** |
| | | **MARLINA BINTI YAKNO** |
| | | **NORMANIHA BINTI ABD GHANI** |
| **DATE** | **:** | |
| **DURATION** | **:** | **3 HOURS** |
| **SESSION/SEMESTER** | **:** | **SESSION 2015/2016 SEMESTER I** |
| **PROGRAM** | **:** | **BEE/BEC/BEP** |

**INSTRUCTIONS TO CANDIDATES**

1. This question paper consists of **FIVE (5)** questions. Answer **ALL** the questions.
2. All answers to a new question should start on new page.
3. All the calculations and assumptions must be clearly stated.
4. Candidates are not allowed to bring any material other than those allowed by the invigilator into the examination room.

**EXAMINATION REQUIREMENTS**

1. **Appendix 1** : Table of Formulas

**DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO**

This examination paper consists of **EIGHT (8)** printed pages including front page

## QUESTION 1

a) Discuss a basic concept of Kirchhoff Current Law (KCL) and Kirchhoff Voltage Law (KVL).

**[4 Marks]**
**[CO1, PO1, C2]**

b) For the circuit in Figure 1, use the simplification techniques to determine:

i) Current, ***I***

ii) Voltage, ***V***

iii) Power delivered by the 72 V source

**[16 Marks]**
**[CO1, PO1, C3]**

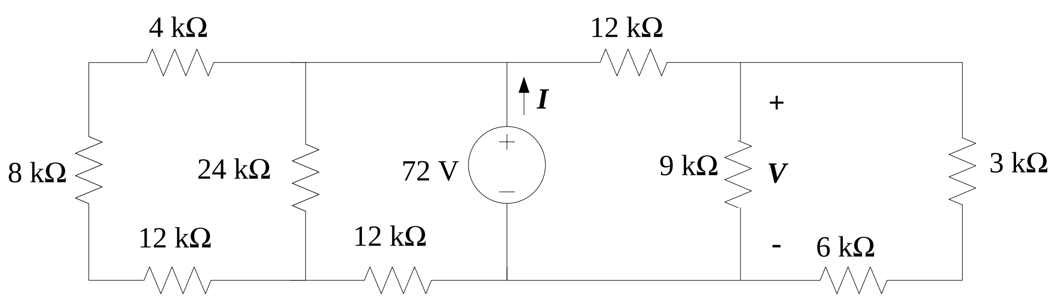


Figure 1

**QUESTION 2**

For the circuit in Figure 2, use mesh analysis to determine:

(a) Current, $I_1$ *to* $I_4$.

(b) Voltage at point *b*

**[20 Marks]**
**[CO2, PO1, C3]**

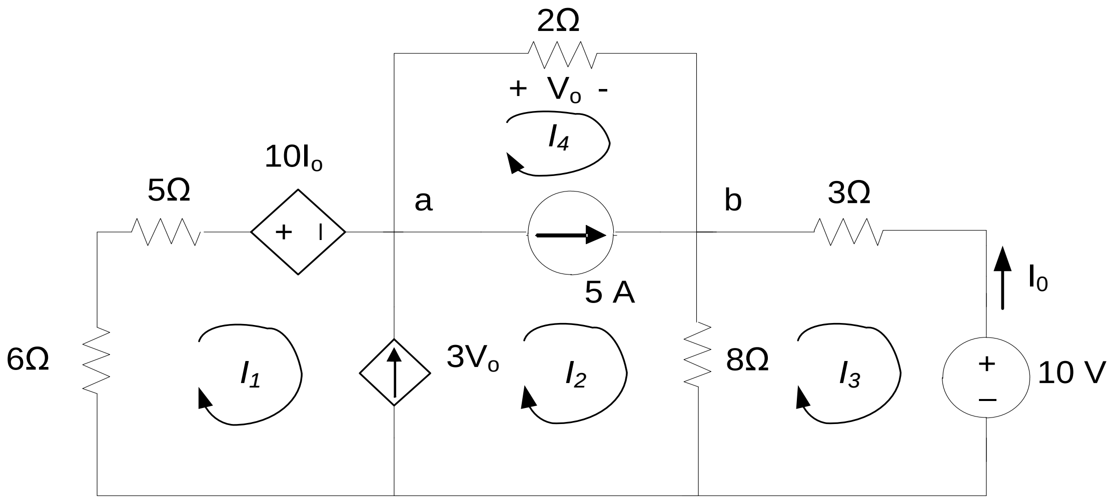


Figure 2

## QUESTION 3

a) For the circuit shown in Figure 3, determine the current, ***i*** by using superposition theorem.

**[10 Marks]**
**[CO2, PO1, C3]**

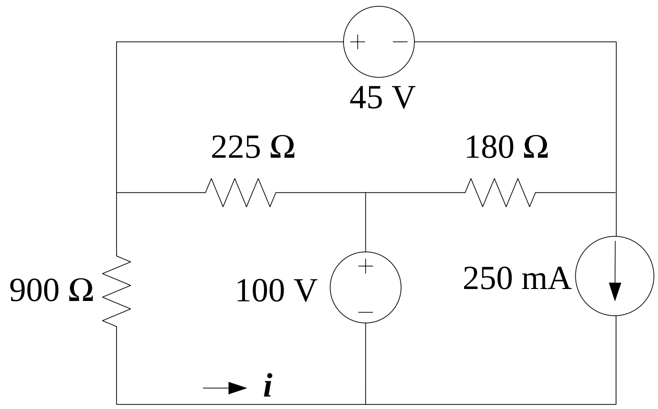


Figure 3

b) Use a sequence of source transformation to find ***i*** as shown in Figure 4.

**[5 Marks]**
**[CO2, PO1, C3]**

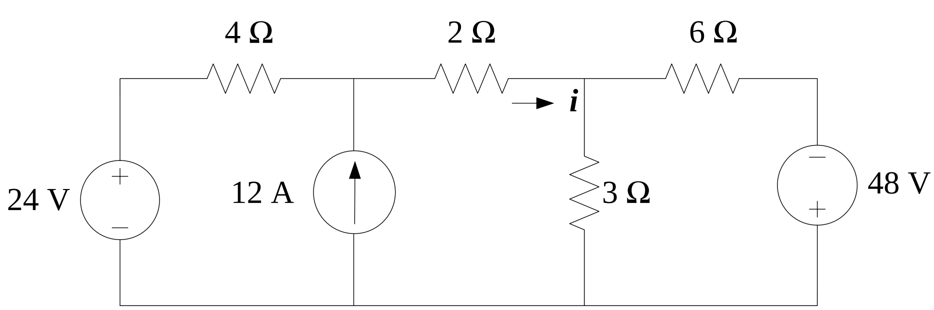


Figure 4

## QUESTION 4

By using Norton theorem for the circuit shown in Figure 5:

(a) Find the Norton equivalent resistance, $R_N$ at terminal a-b.

(b) Find the Norton current, $I_N$ flow through terminal a-b.

(c) Draw the Norton equivalent circuit.

(d) From 4(c), draw the Thevenin equivalent circuit and find the voltage across $R_L$=2 Ω.

(e) Calculate the maximum power, $P_{max}$ transferred to the load.

**[20 Marks]**
**[CO2, PO1, C3]**

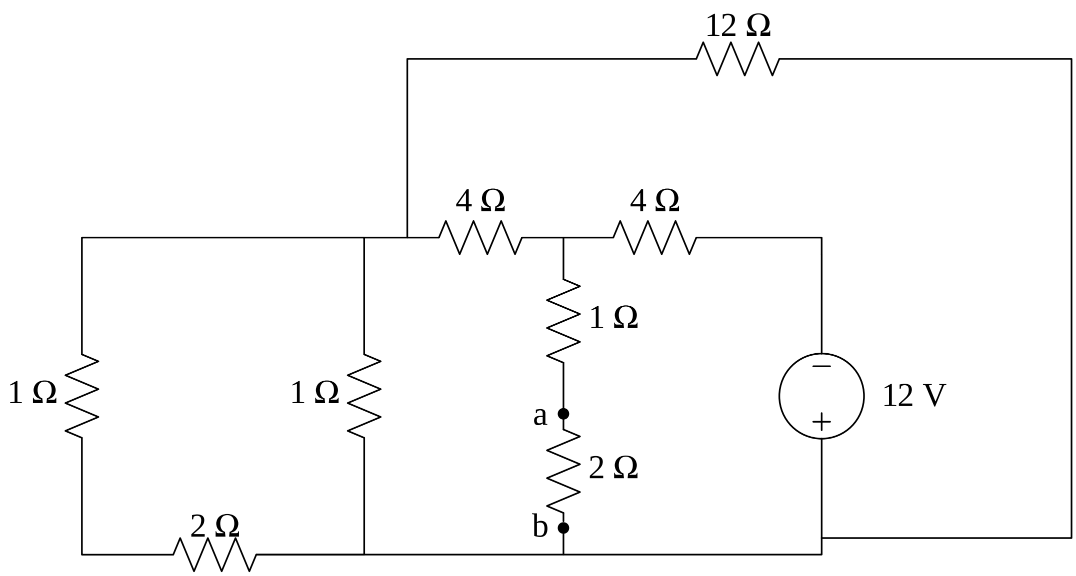


Figure 5

**QUESTION 5**

a) The switch **1** in Figure 6 has been in position ***a*** for a long time. At $t = 0$, the switch moves instantaneously to position ***b***. At the instant the switch makes contact with terminal ***b***, switch **2** opens. Determine:

(i) The capacitor voltage $V_0(t)$ for $t > 0$

(ii) The capacitor voltage at $t = 5$ ms and $t = 10$ ms.

**[16 Marks]**
**[CO3, PO1, C3]**

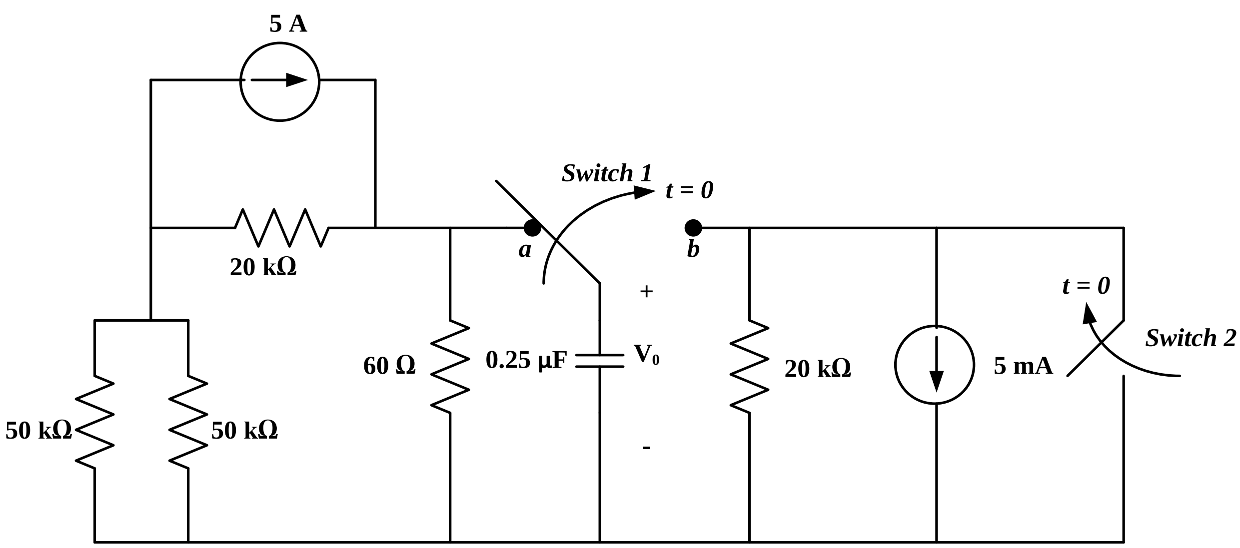


Figure 6

b) The switch in Figure 7 has been open for long time before closing at $t = 0$. Find the inductor voltage $V_0(t)$ for $t > 0$.

**[14 Marks]**
**[CO3, PO1, C3]**

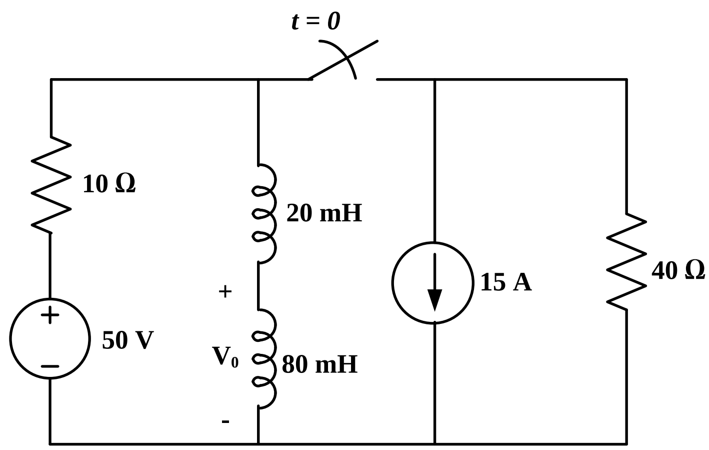


Figure 7

**END OF QUESTION PAPER**

**APPENDIX** - Table of Formulas

1. $P_{\max} = \dfrac{V_{th}^{\ 2}}{4R_{th}}$

2. The unit step function

$$u(t) = \begin{cases} 0, & t < 0 \\ 1, & t > 0 \end{cases}$$

3. $V_C = \dfrac{1}{C}\int_{t_0}^{t} idt + v(t_0)$ ; $\qquad i_L = \dfrac{1}{L}\int_{t_0}^{t} vdt + i(t_0)$

4. $i_C = C\dfrac{dv}{dt}$ ; $\qquad V_L = L\dfrac{di}{dt}$

5. $\tau = RC$; $\qquad \tau = L/R$

6. $v(t) = V_0 e^{-t/\tau}$ ; $\qquad i(t) = I_0 e^{-t/\tau}$

7. $v(t) = v(\infty) + [v(0) - v(\infty)]e^{-t/\tau}$

8. $i(t) = i(\infty) + [i(0) - i(\infty)]e^{-t/\tau}$

9. $R_1 = \dfrac{R_b R_c}{R_a + R_b + R_c}$ , $R_2 = \dfrac{R_a R_c}{R_a + R_b + R_c}$ , $R_3 = \dfrac{R_b R_a}{R_a + R_b + R_c}$

10. $R_a = \dfrac{R_1R_2 + R_2R_3 + R_3R_1}{R_1}$ , $R_b = \dfrac{R_1R_2 + R_2R_3 + R_3R_1}{R_2}$ , $R_c = \dfrac{R_1R_2 + R_2R_3 + R_3R_1}{R_3}$