

**UNIVERSITI KUALA LUMPUR
MALAYSIAN INSTITUTE OF INDUSTRIAL TECHNOLOGY**

**FINAL EXAMINATION
JANUARY 2016 SEMESTER**

COURSE CODE	: JCB 10203
COURSE TITLE	: ELECTRICAL AND ELECTRONIC DEVICES
PROGRAMME LEVEL	: BACHELOR
DATE	: 30 MAY 2016
TIME	: 9.00 AM – 12.00 PM
DURATION	: 3 HOURS

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
 2. This question paper is printed on both sides of the paper.
 3. This question paper consists of ONE (1) section.
 4. Answer FIVE (5) questions ONLY in Section A.
 5. Please write your answers on the answer booklet provided.
 6. Please answer all questions in English only.
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THERE ARE 8 PAGES OF QUESTIONS EXCLUDING THIS PAGE.

SECTION A (Total: 100 marks)

INSTRUCTION: Answer FIVE (5) questions ONLY.

Please use the answer booklet provided.

Question 1

- (a) Electrical engineering could be summarize into four categories. Explain **TWO (2)** categories of electrical engineering.

(2 marks)

- (b) An energy source forces a constant current of 5A for 4s to flow through a lightbulb. If 2.6kJ is given off in the form of light and heat energy, determine the voltage drop across the bulb.

(2 marks)

- (c) Figure 1 shows a series configuration circuit. From the circuit, solve:

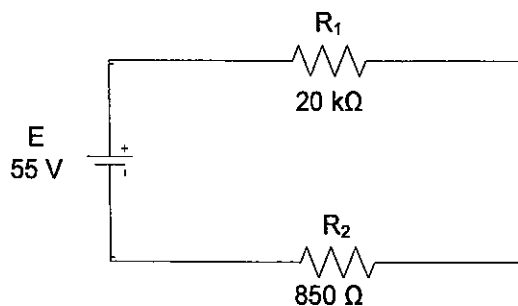


Figure 1: Series configuration circuit.

- (i) Total resistance, R_T .

(2 marks)

- (ii) Total current, I_T .

(2 marks)

- (iii) Voltage across resistor R_1 and R_2 .

(4 marks)

- (iv) Power dissipated by R_1 and R_2 .

(4 marks)

- (v) Power delivered by the source and compare it to the sum of the power levels of part (iv). Justify your answer.

(4 marks)

Question 2

- (a) There are many types of injuries could be happen in electrical engineering. Explain **TWO (2)** types of injuries in electrical safety.

(4 marks)

- (b) Figure 2 shows a series configuration circuit. Using voltage divider rule, determine the voltage across resistor R_1 and R_2 .

(4 marks)

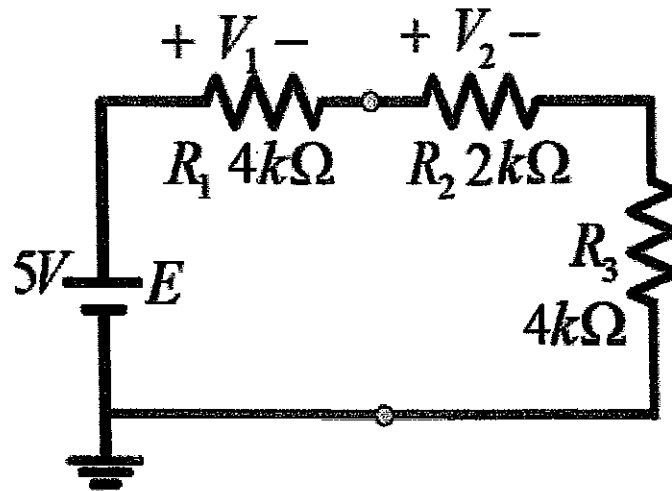


Figure 2: Series configuration circuit.

- (c) Figure 3 shows a series-parallel configuration circuit. From the figure, solve:

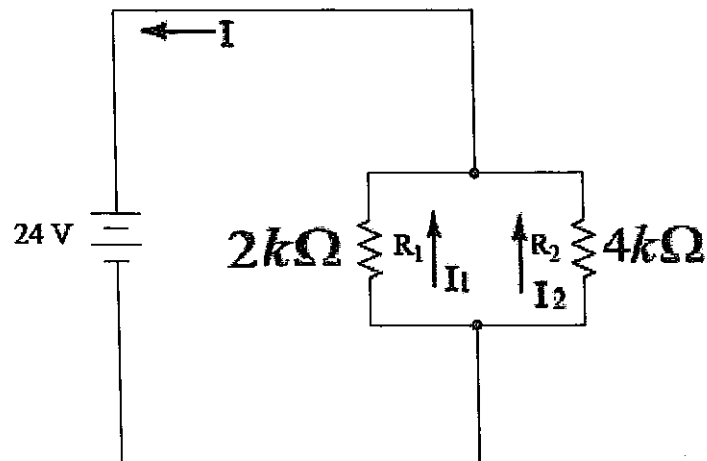


Figure 3: Series-parallel configuration circuit.

- (i) Total current flow through the circuit, I .

(4 marks)

- (ii) Current flow through resistor R_1 and R_2 .

(4 marks)

- (iii) Kirchhoff's current law (KCL) states that the algebraic sum of currents entering a node is equal to algebraic sum of currents leaving a node. From your answer in part (i) and (ii), prove that the total current entering node is equal to total current leaving node, $\sum I_{\text{entering}} = \sum I_{\text{leaving}}$.

(4 marks)

Question 3

- (a) With the aid of suitable diagram, compares **TWO (2)** characteristic between voltmeter and ammeter loading effects.

(6 marks)

- (b) For the following figure, examine current I_x by applying nodal analysis.

(6 marks)

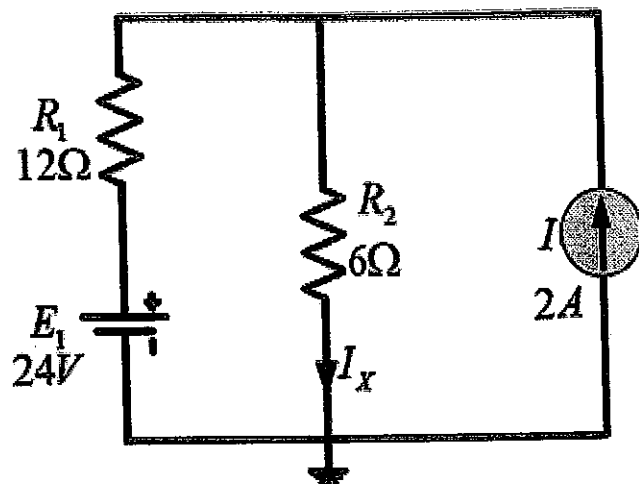


Figure 4: Parallel circuit with current source.

- (c) Figure 5 illustrates series-parallel configuration circuit with two sources. Using superposition theorem, simplify the circuit to get I_1 .

(8 marks)

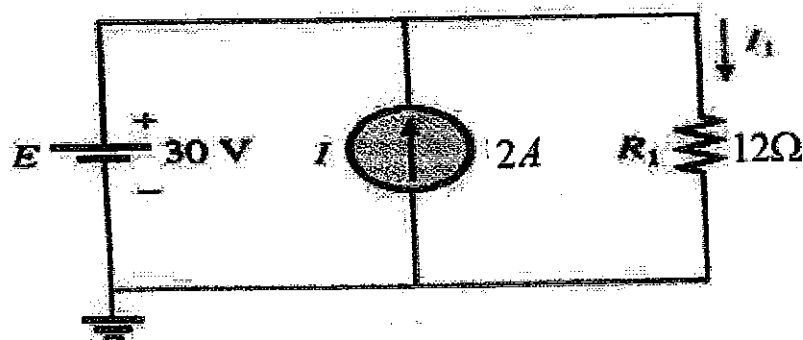


Figure 5: Series-parallel circuit with two sources.

Question 4

- (a) With the aid of suitable diagram, explain **THREE (3)** basic factors of capacitor construction.

(6 marks)

- (b) For RC circuit as shown in Figure 6, solve for:

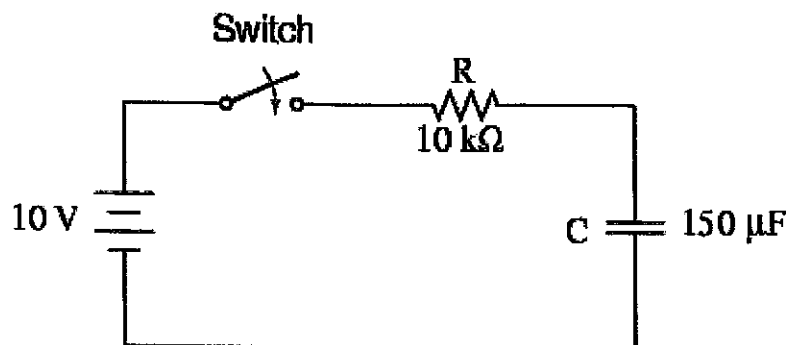


Figure 6: RC circuit.

- (i) Torque, τ .
- (ii) Voltage change after 3.45 s.
- (iii) Current change after 0.25 s.
- (c) A speaker of 10Ω resistive impedance is connected to a supply of 15V with internal resistive impedance of 1Ω as shown in Figure 7.

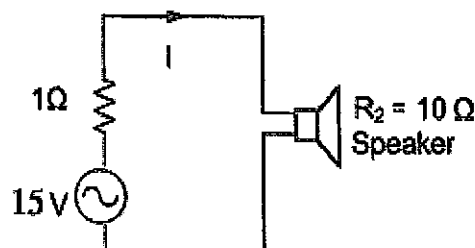


Figure 7: AC circuit with speaker load.

- (i) Determine the power absorbed by the speaker.
- (ii) To maximize the power transfer to the speaker, a transformer of 1:2 turns ratio is used between source and speaker. Re-draw the AC circuit with the transformer. Then, solve the power taken by the speaker.

(5 marks)

Question 5

- (a) With the aid of suitable diagram, compares the characteristics between direct current (dc) and alternate current (ac).

(4 marks)

- (b) For the following network:

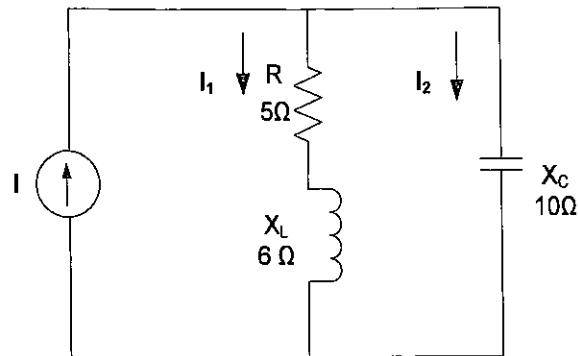


Figure 8: RLC network.

- (i) If $I = 30\text{ A} \angle 20^\circ$, determine I_1 using the current divider rule.

(2 marks)

- (ii) Repeat part (i) for I_2 .

(2 marks)

- (iii) Verify Kirchhoff's current law (KCL) at one node.

(2 marks)

- (c) Figure 9 shows an AC circuit. Given $Z_1 = 42\Omega \angle -10^\circ$ and $Z_2 = 4\Omega \angle 30^\circ$. Analyze the total:

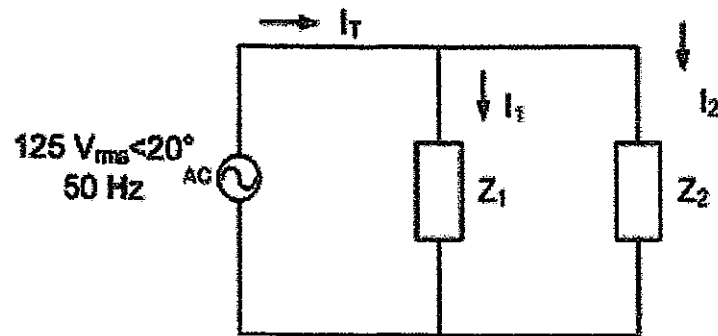


Figure 9: AC circuit.

- | | | |
|-------|-------------------------|-----------|
| (i) | Apparent power, S_T . | (4 marks) |
| (ii) | Real power, P_T . | (2 marks) |
| (iii) | Reactive power, Q_T . | (2 marks) |
| (iv) | Power factor. | (2 marks) |

Question 6

- (a) Explain **THREE (3)** advantages and disadvantages of electronic driven variable reluctance motor.

(6 marks)

- (b) A 3ϕ , 300V, 100hp, 60Hz, four-pole induction machine delivers rated output power at a slip of 0.02. Solve:

- (i) Synchronous speed.

(2 marks)

- (ii) Rotor speed.

(2 marks)

- (iii) Speed of the rotating air gap field.

(2 marks)

- (iv) Frequency of the rotor circuit.

(2 marks)

- (c) A three-phase wound-rotor induction machine can be represented by an equivalent three-phase rotor winding. Figure 10 illustrates an equivalent circuit model for induction machine. From the figure, draw the AC equivalent circuit for:

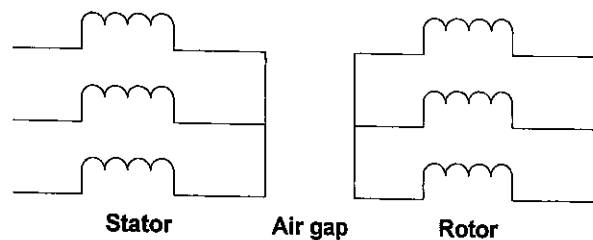


Figure 10: Induction machine equivalent circuit.

- (i) Stator winding.

(3 marks)

- (ii) Rotor winding.

(3 marks)

END OF EXAMINATION PAPER

