UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION
FEBRUARY 2025 SEMESTER SESSION

SUBJECT CODE	:	**LEB12003**
SUBJECT TITLE	:	**ELECTRIC CIRCUIT**
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	:	**BACHELOR OF ELECTRICAL AND ELECTRONICS ENGINEERING TECHNOLOGY (MARINE) WITH HONOURS**
TIME / DURATION	:	**2.00 PM – 5.00 PM (3 HOURS)**
DATE	:	**28 JUNE 2025**

INSTRUCTIONS TO CANDIDATES

1. **Please read CAREFULLY the instructions given in the question paper.**
2. **This question paper has information printed on both sides of the paper.**
3. **Consist of ONE (1) Section ONLY. Answer FOUR (4) question only.**
4. **Please write your answers on the answer booklet provided.**
5. **Answer all questions in English language only.**

THERE ARE 6 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

SECTION A (Total: 100 marks)

INSTRUCTION: Answer only FOUR (4) questions.
Please use the answer booklet provided.

Question 1

With reference to **Direct Current (DC) Circuits**:

During a fault analysis review, you are tasked with determining the **node voltages** in a section of a shipboard power system to verify proper load distribution.

(a) Identify the node voltages V_1, V_2 and V_3 in a three-node circuit shown in Figure 1 to check load distribution.

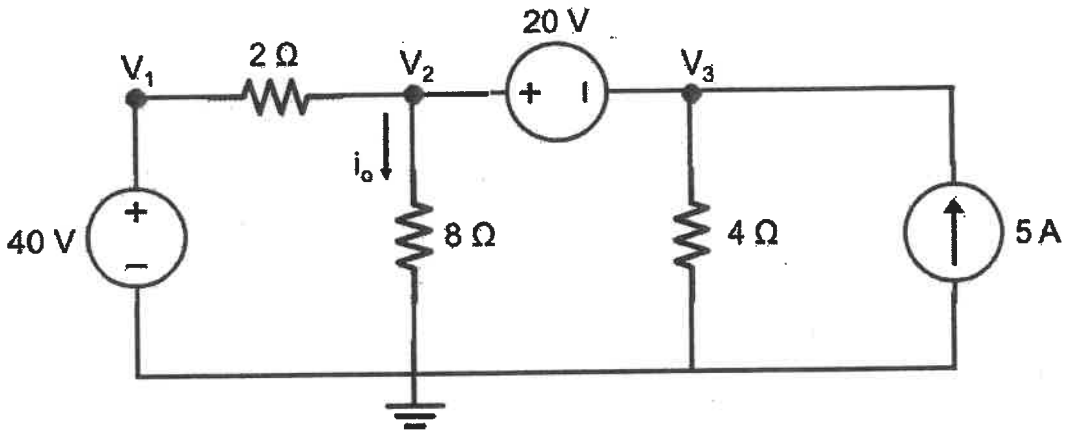

Figure 1

(17 marks)

(b) Calculate the current i_o through the 8 Ω resistor and the corresponding power it dissipates to confirm safe operation.

(8 marks)

Question 2

With reference to **Direct Current (DC) Circuits**:

A technician needs to design a monitoring system for a piece of equipment. To optimize the sensor circuit connected across two points A and B, it is required to replace the existing network with its **Norton equivalent**.

(a) Calculate the Norton equivalent current (I_N) and resistance (R_N) across terminals A and B for the circuit shown in Figure 2.

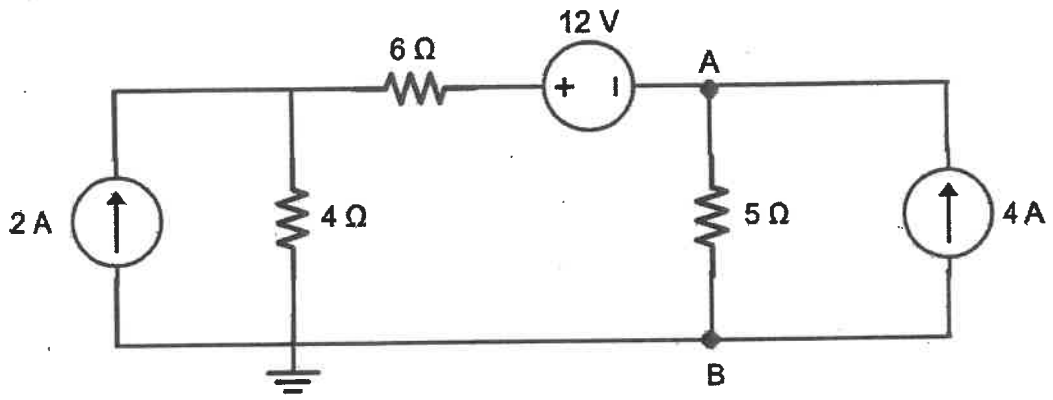

Figure 2

(16 marks)

(b) Identify the load resistance (R_L) that allows for maximum power transfer from the source.

(2 marks)

(c) Calculate the maximum power delivered to R_L.

(7 marks)

Question 3

With reference to **Single-Phase Alternate Current (AC) Circuits**:

You are designing the power supply for the ship's auxiliary equipment, which operates at a lagging power factor. You are required to calculate the necessary parameters for improving power factor.

(a) A single-phase motor draws 10 A from a 230 V, 50 Hz supply at a power factor of 0.7 lagging. Calculate the real power consumed by the motor.

(3 marks)

(b) Calculate the value of the capacitor required to improve the power factor to 0.95 lagging.

(18 marks)

(c) After correction, calculate the new line current drawn by the motor.

(2 marks)

(d) Calculate the reduction in reactive power after power factor correction.

(2 marks)

Question 4

With reference to **Three-Phase Alternate Current (AC) Circuits**:

A shipboard galley is fitted with a balanced 3-phase electric cooking system (Wye-connected), using purely resistive elements. Each cooking unit operates at a phase voltage of 240 V and is rated at 12 kW per phase. The system is supplied by a 415 V, 50 Hz three-phase power supply.

(a) Calculate the resistance of each cooking element.

(4 marks)

(b) Determine the total line current drawn by the system.

(4 marks)

(c) Compare the power dissipation if the same heaters were reconnected in Delta (Δ).

(12 marks)

(d) Illustrate the wiring diagram of the Wye-connected cooking elements with a neutral connection.

(5 marks)

Question 5

With reference to **Magnetism and Electromagnetic Induction:**

A ship's alternator is undergoing testing. Engineers observe that the voltage output is not consistent.

(a) Calculate the magnetic flux density if the magnetic flux through a coil of area 0.015 m^2 is 0.003 Wb.

(4 marks)

(b) Determine the induced EMF in a 200-turn coil when the flux drops to zero in 0.1 s.

(5 marks)

(c) Identify **TWO (2)** factors that affect the magnitude of induced EMF in shipboard alternators.

(4 marks)

(d) With the aid of a diagram, determine the induction of EMF in a coil resulting from a changing magnetic field, in accordance with Faraday's Law.

(12 marks)

END OF EXAMINATION PAPER