UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION

OCTOBER 2025 SEMESTER SESSION

SUBJECT CODE	:	**LEB21102**
SUBJECT TITLE	:	**MARINE ELECTRO-TECHNOLOGY**
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	:	**BET (NAVAL ARCHITECTURE AND SHIPBUILDING) WITH HONOURS** **BET (OFFSHORE) WITH HONOURS**
TIME / DURATION	:	**9.00 AM - 11.30 AM (2 HOURS 30 MINUTES)**
DATE	:	**30 JANUARY 2026**

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. This question paper consists of **FIVE (5)** questions.
4. Answer **ALL** questions.
5. Please write your answer on the answer booklet provided.
6. Answer all questions in English language **ONLY**.

THERE ARE 6 PAGES OF QUESTIONS, EXCLUDING THIS COVER PAGE.

INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

QUESTION 1

(a) Describe the purpose of a distribution board (DB) in a basic electrical system.

(4 marks)

(b) Differentiate between a series circuit and a parallel circuit.

(4 marks)

(c) Identify ONE (1) real-life example of a series circuit and ONE (1) real-life example of a parallel circuit.

(4 marks)

(d) Define voltage, current, and resistance according to Ohm's Law.

(6 marks)

(e) Describe ONE (1) reason why earthing is essential in the basic electrical system.

(2 marks)

QUESTION 2

(a) Differentiate between DC, single-phase AC, and three-phase AC systems in terms of current and voltage.

(4 marks)

(b) Identify TWO (2) safety measures that must be considered when installing electrical equipment.

(2 marks)

(c) A 230 V single-phase heater is to be installed in the workshop's AC single-phase supply circuit. The heater has a rated power of 2 kW and a power factor of 0.8. Calculate:

i. The line current drawn by the heater.

(3 marks)

ii. The apparent power, (S).

(2 marks)

iii. The reactive power (Q).

(2 marks)

(d) A 15 kW three-phase motor is supplied at 415 V line-to-line, 50 Hz with a power factor of 0.85.

i. Calculate the line current drawn by the motor.

(3 marks)

ii. Calculate the apparent power (S).

(2 marks)

iii. Assess if the motor can be connected to a 13 A single-phase outlet, and justify your answer.

(2 marks)

QUESTION 3

A single-phase, 50 Hz, step-down transformer is used to supply a workshop control panel. The transformer is rated 5 kVA, 2300 V / 230 V. During operation, the transformer supplies a load that draws 18 A at 0.85 power factor lagging on the secondary side.

The equivalent resistance and reactance referred to the secondary side are 0.04 Ω and 0.06 Ω, respectively.

(a) Calculate the secondary output power delivered to the load.

(5 marks)

(b) Analyze the secondary terminal voltage under the given load condition, considering the voltage drop across the equivalent impedance.

(7 marks)

(c) Evaluate the percentage voltage regulation of the transformer and justify whether the transformer performance is suitable for workshop equipment.

(8 marks)

QUESTION 4

(a) A three-phase is generated when three coils are placed 120° apart and the whole rotated in a uniform magnetic field. If the three-phase windings are kept independent then 6 wires are needed to connect a supply source to loads.

To reduce the number of wires, it is usual to interconnect the three ways in Star connection or Delta connection.

i. Analyze the Star connection by deriving the relationship between phase current and line current, and between phase voltage and line voltage. Illustrate your answer with a phasor diagram for line voltage.

(5 marks)

ii. Analyze the Delta connection by deriving the relationship between phase current and line current, and between phase voltage and line voltage. Illustrate your answer with a phasor diagram for line current.

(5 marks)

(b) A balanced three-phase, 415 V, 50 Hz supply is used to operate a workshop motor connected in a star (Y) configuration. The motor draws a line current of 18 A at a power factor of 0.82 lagging. The motor efficiency is 90%.

i. Analyze and calculate the phase voltage and phase current of the motor.

(4 marks)

ii. Calculate the total three-phase input power supplied to the motor.

(4 marks)

iii. Evaluate the mechanical output power of the motor and comment on its suitability for continuous operation.

(2 marks)

QUESTION 5

(a) The basic part of dc machine called a stationary part (stator) and rotary part (armature). Explain the parts of stator and armature.

(5 marks)

(b) Elaborate TWO (2) types of dc motor; your answer must include the definition, the electrical diagram and formula associated from current and voltage.

(5 marks)

(c) A series motor has an armature resistance of 0.2 Ω and a series field resistance of 0.3 Ω. It is connected to a 240V supply and at a particular load runs at 24 rev/s when drawing 15 A from the supply.

i. Calculate the generated e.m.f at this load.

(2 marks)

ii. Calculate the speed of the motor when the load is changed such that the current is increased to 30 A. Assume that this caused the doubling of the flux.

(2 marks)

iii. Analyze the result due to changes of current and speed.

(1 mark)

(d) A 320 V shunt motor takes a current of 80 A and runs at 1000 $rev/\min$. If the iron, friction windage losses amount to 1.5 kW, the shunt field resistance is 40 Ω and the armature resistance is 0.2 Ω. Calculate the overall efficiency of the machine.

(5 marks)

END OF EXAMINATION PAPER

FORMULA SHEET

$$I = \frac{P}{V \times pf}$$

$$S = \frac{P}{pf}$$

$$Q = \sqrt{S^2 - P^2}$$

$$P_{load} = V_S \times I_S \times pf$$

$$\%VR = \frac{V_{no\text{-}load} - V_{full\text{-}load}}{V_{full\text{-}load}} \times 100\%$$

$$V_{phase} = \frac{V_{line}}{\sqrt{3}}$$

$$I_{phase} = I_{line}$$

$$P_{in} = \sqrt{3} \times V_{line} \times I_{line} \times pf$$

$$P_{mech} = \eta \times P_{in}$$

$$E_g = V - I(R_A + R_S)$$

$$N_2 = N_1 \times \frac{\Phi_1}{\Phi_2} \times \frac{I_2}{I_1}$$

$$V_A = V - I_A R_A$$

$$P_{mech} = V_A I_A$$

$$\eta = \frac{P_{mech}}{V I_{total}} \times 100\%$$