CONFIDENTIAL

UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION

FEBRUARY 2025 SEMESTER SESSION

SUBJECT CODE	:	**LMD14103**
SUBJECT TITLE	:	**FUNDAMENTAL OF ELECTRICAL AND ELECTRONICS TECHNOLOGY**
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	:	**DIPLOMA OF ENGINEERING TECHNOLOGY IN MARINE ENGINEERING**
TIME / DURATION	:	**2.00 PM - 5.00 PM (3 HOURS)**
DATE	:	**24 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. This question paper consists of **TWO (2)** sections; Section A and Section B.
4. Answer **ALL** question in Section A, and **TWO (2)** questions **ONLY** in Section B.
5. Please write your answers on this answer booklet provided.
6. Answer **ALL** questions in English language **ONLY**.
7. Answer should be written in blue of black ink except for sketching, graphic and illustration.

THERE ARE 6 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

SECTION A (Total: 60 marks)

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

Question 1

A diode in the ship's rectifier circuit burns out frequently.

(a) Discuss **TWO (2)** bias conditions of a P-N junction diode.

(8 marks)

(b) Explain why a diode allows current in only one direction.

(8 marks)

(c) Differentiate half-wave and full-wave rectification.

(4 marks)

Question 2

With reference to **DC and AC Circuits**:

A marine engineer notices overheating in a DC motor control circuit.

(a) Identify TWO (2) possible causes of overheating.

(7 marks)

(b) Explain how Ohm's Law relates to power dissipation.

(7 marks)

(c) Solve the following: -

i. The power delivered to a circuit by a 240-V generator that supplies 20 A to the circuit.

(3 marks)

ii. The power dissipated in the resistor if the voltage across a 25 000 Ω resistor is 500 V.

(3 marks)

Question 3

With reference to **Magnetism**:

On a ship's deck, a technician tests a solenoid valve for seawater cooling.

(a) Describe how the solenoid moves when energized.

(7 marks)

(b) Identify the role of the spring in the solenoid structure.

(7 marks)

(c) Differentiate between energized and unenergized conditions.

(6 marks)

SECTION B (Total: 40 marks)

INSTRUCTION: Answer TWO (2) questions only.
Please use the answer booklet provided.

Question 4

With reference to **DC and AC Circuits**:

(a) A marine electrical technician is performing maintenance on a DC lighting circuit aboard a vessel. The circuit consists of a 24 V battery connected to three resistors arranged as shown below:

- $R_1 = 4\ \Omega$
- $R_2 = 6\ \Omega$ and $R_3 = 12\ \Omega$ (connected in parallel)
- The combination of R_2 and R_3 is in series with R_1

i. Sketch the circuit diagram based on the description.

(2 marks)

ii. Calculate the equivalent resistance of the entire circuit.

(3 marks)

iii. Compute the total current drawn from the 24 V battery.

(2 marks)

iv. Determine the voltage drop across each resistor.

(3 marks)

(b) An onboard AC generator provides sinusoidal voltage. To ensure compatibility with navigation electronics, the marine engineer must analyse its waveform properties. Given RMS voltage and frequency is 230 V and 50 Hz, calculate: -

i. the peak voltage.

(2 marks)

ii. the average voltage of the waveform.

(2 marks)

iii. the peak-to-peak voltage.

(2 marks)

iv. the angular frequency.

(2 marks)

v. The time taken to complete a cycle.

(2 marks)

Question 5

With reference to **DC and AC Circuits**:

(a) The auxiliary generator on a cruise ship delivers 480V DC and operates continuously for 12 hours, supplying a load current of 120 A to lighting and control systems.

i. Calculate the generator's electrical power output.

(2 marks)

ii. Compute the total energy generated in kilowatt-hour (kWh).

(3 marks)

iii. Determine the battery backup capacity in Ampere-hour (Ah) needed to supply the same load for 1.5 hours in case of generator failure.

(3 marks)

iv. Estimate the operating cost of the generator for 12 hours if the energy cost is RM 0.22 per kWh.

(2 marks)

(b) A large refrigeration motor draws active power of 18 kW with a power factor of 0.65 lagging. To reduce generator load and increase efficiency, engineers plan to improve the power factor to 0.92 using a capacitor bank connected across the motor terminals at 415 V AC, 50 Hz.

i. Calculate the initial reactive power, Q_1 before correction.

(3 marks)

ii. Calculate the target reactive power, Q_2 after correction.

(3 marks)

iii. Determine the reactive power correction, Qc needed.

(2 marks)

iv. Compute the required capacitance to achieve the correction.

(2 marks)

Question 6

With reference to **DC and AC Circuits**:

(a) The emergency bilge pump circuit on a vessel is designed with three resistors in parallel. R_1 = 5 Ω, R_2 = 10 Ω, and R_3 = 20 Ω. The system is powered by a 220 V DC supply.

i. Calculate the total resistance of the circuit.

(2 marks)

ii. Compute the total current drawn from the battery.

(2 marks)

iii. Determine the individual branch currents.

(3 marks)

iv. Calculate the new total current if R_2 fails open.

(3 marks)

(b) A radar's motor control panel is modelled as an RLC series circuit with the value of resistance, R = 30 Ω, inductance, L = 100 mH, capacitance, C = 68 μF, AC supply frequency of 50 Hz and supply voltage of 110 V RMS.

i. Calculate the inductive reactance, X_L.

(2 marks)

ii. Calculate the capacitive reactance, X_C.

(2 marks)

iii. Compute the impedance, Z.

(2 marks)

iv. Determine the rms current.

(2 marks)

v. Determine the power factor and whether the circuit is inductive or capacitive.

(2 marks)

END OF EXAMINATION PAPER