CONFIDENTIAL

UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION

JULY 2025 SEMESTER SESSION

SUBJECT CODE	:	**LMB31902**
SUBJECT TITLE	:	**MARINE ELECTROTECHNOLOGY 1**
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	:	**BACHELOR OF MARINE ENGINEERING TECHNOLOGY WITH HONOURS**
TIME / DURATION	:	**9.00 AM – 11.30 AM (2 HOURS 30 MINUTES)**
DATE	:	**23 DECEMBER 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. Answer **FOUR (4)** questions **ONLY**.
4. Please write your answers on the answer booklet provided.
5. Answer **ALL** questions in English language **ONLY**.
6. Answer should be written in blue or black ink except for sketching, graphic and illustrations.
7. Formula has been appended for your reference.

THERE ARE 4 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

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

Question 1

(With Reference to - Marine Electro Technology)

a) i. Differentiate between single-wire and multi-stranded conductor materials used in shipboard electrical systems.

[5 marks]

ii. Calculate the current-carrying capacity of a single-core copper cable (single-wire and multi-stranded) given the following:

- Conductor cross-sectional area: 10 mm^2
- Ambient temperature: 45°C
- Installation in air
- Derating factor for high temperature: 0.87
- Base current capacity at 30°C: 65 A

[10 marks]

b) Categorize the insulation materials used for marine electrical cables. For each category, point out the effect of at least three environmental factors (from: temperature, oxidation, fire, oil, seawater, acids, solvents) on insulation integrity. Present your answer in a table.

[10 marks]

Question 2

(With Reference to - Emergency Power)

a) Explain the purpose of emergency power systems and describe common sources of emergency power on a ship.

[6 marks]

b) Describe the importance of regular maintenance for a ship's power system and list common tasks to help prevent blackouts.

[9 marks]

c) Compare the advantages and disadvantages of using diesel generators versus battery banks as emergency power sources on ships.

[10 marks]

Question 3

(With reference to: Electronics and Power Electronics)

a) Explain the performance characteristics of a Bipolar Junction Transistor (BJT) used in a shipboard signal amplification system.

[10 marks]

b) A silicon NPN bipolar junction transistor (BJT) is used in a common-emitter amplifier configuration. The circuit is powered with a DC supply voltage of V_{CC}=12 V The transistor has the following resistor values in its biasing network, as shown in Figure 1.

- Collector resistor: R_C=2kΩ
- Base resistor: R_B=100kΩ
- Emitter resistor: R_E=1kΩ

Assume:

- The transistor current gain (DC beta) β=100
- The base-emitter voltage drop V_{BE}=0.7 V
- The transistor is operating at room temperature, and all capacitors are large enough to act as short circuits for AC signals (so this is purely DC analysis).

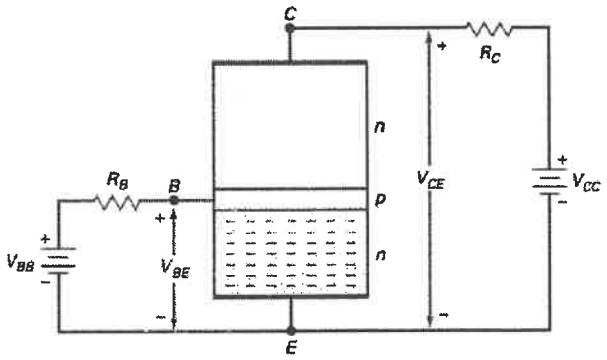

Figure 1

i. Calculate the base current IB
(Hint: Use Thevenin's theorem to simplify the base biasing network if needed.)

[4 marks]

ii. Determine the collector current IC using the relation between IC and IB.

[4 marks]

iii. Calculate the emitter voltage VE, collector voltage VC and collector-emitter voltage VCE

[4 marks]

iv. Determine whether the transistor is operating in active mode or saturation. Justify your answer
[3 marks]

Question 4

(With reference to: DC Machine)

a) A 50hp, 250 V, 1200 r/min dc shunt motor with compensating windings has an armature resistance (including the brushes, compensating windings, and interpoles) of 0.06 Ω. Its field circuit has a total resistance Radj + RF of 50 Ω, which produces a no-load speed of 1200 r/min. There are 1200 turns per pole on the shunt field winding.

i. Find the speed of this motor when its input current is 100 A. [5 marks]

ii. Find the speed of this motor when its input current is 200 A. [5 marks]

iii. Provide your justification based on your answers in (i) and (ii). [5 marks]

b) The motor in (a) is now connected in separately excited circuit as shown in Figure 1. The motor is initially running at speed, n = 1103 r/min with VA = 250 V and Ia = 120 A, while supplying a constant-torque load. If VA is reduced to 200 V, determine

i. . the internal generated voltage, EA. [5 marks]

ii. . the final speed of this motor, n2 [5 marks]

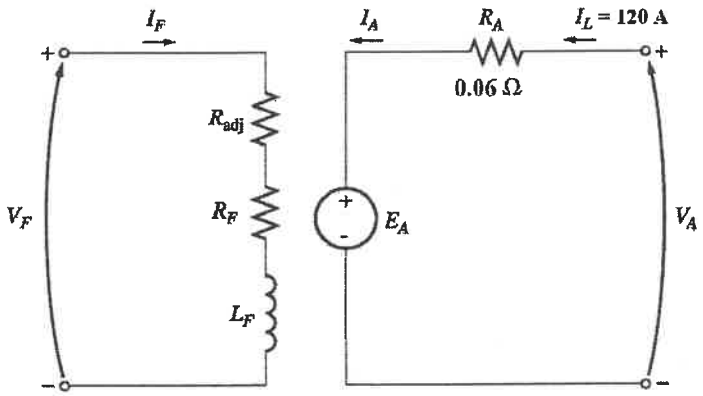

Figure 1

Question 5

(With Reference to - Operational Safety of High-Voltage Installations)

(a) Identify and describe the different levels of the Hierarchy of Controls.

[10 marks]

(b) Explain the most effective control measures in the Hierarchy of Control for preventing electrical hazards in high-voltage environments.

[8 marks]

(c) Discuss examples of engineering controls and administrative controls in the Hierarchy of Controls. that can be implemented before resorting to PPE in high-voltage electrical safety management.

[7 marks]

END OF EXAMINATION PAPER

FORMULAS

$$I_B = \frac{V_{CC} - V_{BE}}{R_B + (\beta + 1)R_E}$$

1)

$$V_{CE} = V_{CC} - I_C \cdot R_C$$

2)

$$I_{C(sat)} = \frac{V_{CC} - V_{CE(sat)}}{R_C}$$

$$I_B = \frac{I_{C(sat)}}{\beta_{forced}} \quad (\text{use } \beta_{force}$$

3)

$$I_C = \beta \cdot I_B = 90 \cdot 40\,\mu A = 3.6\,mA$$

4)