



**UNIVERSITI KUALA LUMPUR**  
**Malaysian Institute of Marine Engineering Technology**

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**FINAL EXAMINATION**  
**FEBRUARY 2025 SEMESTER SESSION**

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<b>SUBJECT CODE</b>	<b>: LED31403</b>
<b>SUBJECT TITLE</b>	<b>: POWER ELECTRONICS AND DEVICES</b>
<b>PROGRAMME NAME</b> (FOR MPU: PROGRAMME LEVEL)	<b>: DIPLOMA OF ENGINEERING TECHNOLOGY IN ELECTRICAL AND ELECTRONICS (MARINE)</b>
<b>TIME / DURATION</b>	<b>: 09.00 AM - 12.00 PM (3 HOURS)</b>
<b>DATE</b>	<b>: 26 JUNE 2025</b>

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**INSTRUCTIONS TO CANDIDATES**

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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 **FOUR (4)** questions **ONLY**.
4. Please write your answers on this 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.

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**THERE ARE 4 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.**

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**INSTRUCTION: Answer FOUR (4) questions only**

**Please use the answer booklet provided**

**Question 1**

**(With reference to Introduction of Power Electronics)**

- a) The basic element of Power Electronic Technology is the power processor which can be seen to provide a number of different conversions. State the FOUR (4) types of power processors in a power system. (4 marks)
- b) The single-phase half-wave rectifier has a purely resistive load of  $R$ , and the delay angle is  $\alpha = \pi/2$ . Determine
- i. Direct Current Voltage  $-V_{dc}$  (2 marks)
  - ii. Direct current,  $I_{dc}$ , (2 marks)
  - iii. Root Mean Square Voltage  $-V_{rms}$ , (2 marks)
  - iv. Root Means Square Current  $-I_{rms}$ . (2 marks)
- c) The full wave-controlled bridge rectifier has an ac input of  $120V_{rms}$  at 60Hz and  $40\Omega$  load resistor. The delay angle is  $60^\circ$ . Determine:
- i) the average current in the load (3 marks)
  - ii) the power absorbed by the load. (3 marks)
  - iii) the source volt-amperes (3 marks)
  - iv) the power factor as seen by the source. (4 marks)

**Question 2****(With reference to AC-DC Converter - rectifier)**

(a) A DC chopper in Figure 1, has a resistive load of  $R = 10\Omega$  and an input voltage of  $V = 200V$ . When the chopper is ON, its voltage drop is  $2V$ , and the chopping frequency is  $1kHz$ . If the duty cycle is  $60\%$ , determine.

i) average output voltage

(3 marks)

ii) RMS value of output voltage

(3 marks)

iii) effective input resistance of chopper

(3 marks)

iv) chopper efficiency.

(4 marks)

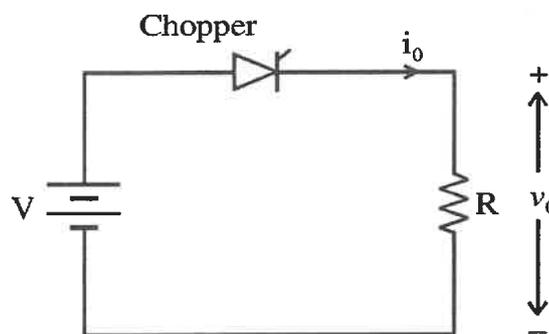


Figure 1

b) DC chopper works on DC voltage as a step-up and step-down transformer. Explain the principle of step-up and step-down DC chopper with R-L load of the transformer. [hint: Include together with chopper circuit in answer]

(12 marks)

**Question 3****(With reference to DC-DC Converter- chopper)**

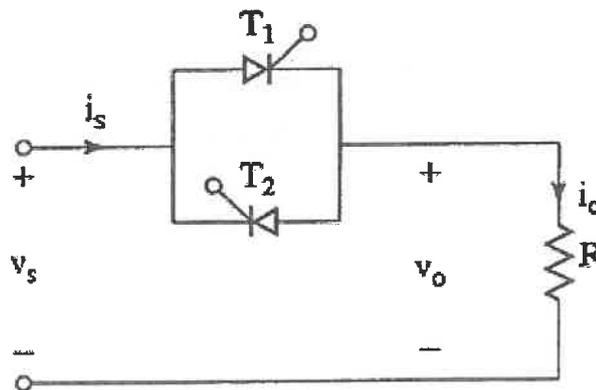
- a) List 5 characteristics of a good inverter and 5 applications of the inverter. (5 marks)
- b) Explain the operation of a single-phase full bridge inverter and sketch the waveform produced. (12 marks)
- c) Single-phase inverter has two types of sources which are voltage source and current source.
- i) Draw the circuit of a single-phase half-bridge inverter, which includes a voltage source, two diodes, and two thyristors using a suitable circuit. (4 marks)
- ii) Draw the circuit of single -phase full bridge inverter, which consists of four diodes and 4 thyristors by using a suitable circuit. (4 marks)

**Question 4****(With reference to DC-AC converter and DC-DC converter)**

- a) Explain:
- i) the function of buck-boost converter (5 marks)
- ii) the working principle of buck converter (5 marks)
- b) The buck-boost converter has the following parameters  
 $V_s = 24V$ ,  $D = 0.4$ ,  $R = 5\Omega$ ,  $L = 100\mu H$ ,  $C = 400\mu F$ ,  $F = 20kHz$   
 Assuming ideal components, calculate;
- i. The output voltage  $V_o$  (4 marks)
- ii. The maximum and minimum inductor current (6 marks)
- iii. The output voltage ripple.

**Question 5****(With reference to DC-AC converter and DC-DC converter)**

- a) i) State the **FOUR (4)** components of Power System that need to be protected. (2 marks)
- ii) List **FOUR (4)** devices in the power protection system. (2 marks)
- iii) Explain any **TWO (2)** protective devices in the power system. (8 marks)
- b) The single phase AC voltage controller in part has a 120Vrms at 50 Hz source. The load resistance is  $15\Omega$ . The delay angle  $\alpha$  is  $90^\circ$



Determine the:

- (i) rms source current to deliver 500W to the load (5 marks)
- (ii) rms and average currents in the SCRs, (5 marks)
- (iii) power factor (3 marks)

**END OF EXAMINATION PAPER**