



**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>: LMB11903</b>
<b>SUBJECT TITLE</b>	<b>: FUNDAMENTAL OF ELECTRICAL AND ELECTRONICS</b>
<b>PROGRAMME NAME</b> (FOR MPU: PROGRAMME LEVEL)	<b>: BACHELOR OF MARINE ENGINEERING TECHNOLOGY WITH HONOURS</b>
<b>TIME / DURATION</b>	<b>: 09.00 AM – 12.00 PM (3 HOURS)</b>
<b>DATE</b>	<b>: 30 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 questions consists **ONE (1) Section ONLY**. Please answer **FOUR (4) questions ONLY**.
  4. Please write your answers on the answer booklet provided.
  5. Answer should be written in blue or black ink except for sketching, graphic and illustration.
  6. Answer all questions in English language **ONLY**.
  7. *Formula sheet has been appended for your reference.*
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**THERE ARE 5 PAGES OF QUESTIONS, INCLUDING THIS PAGE.**

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(Total 100 marks)

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

**Please use the answer booklet provided.**

**Question 1 (CLO 1)**

**With reference to characteristics of semiconductor and diode rectification.**

- (a) Describe intrinsic and extrinsic semiconductors. Thus, describe the **doping** process that can affect the conductivity of semiconductors. (4 marks)
- (b) Explain the behavior of a PN junction diode for a forward and reverse bias conditions. Illustrate your answers with a sketch of a V-I characteristic curve. (5 marks)
- (c) A silicon diode is forward biased with a voltage of 0.8 V and a resistor of 1 k $\Omega$  connected in series in the circuit. Calculate the current through the diode. (5 marks)
- (d) Explain the working principle of a full-wave bridge rectifier. Illustrate your answer with a complete labeled circuit diagram and waveform. (5 marks)
- (e) A Silicon Controlled Rectifier (SCR) is used in a half-wave-controlled rectifier circuit. The input voltage is  $V_m=200$  V. The SCR is triggered at  $\alpha=60^\circ$ . Calculate the following:
- i. Average output voltage across resistive load (3 marks)
  - ii. RMS output voltage (3 marks)

**Question 2 (CLO 2)**

**With reference to circuit theory to solve simple DC problems (Ohms Law, Kirchoff Law).**

- (a) Three resistors of 5  $\Omega$ , 10  $\Omega$ , and 15  $\Omega$  are connected in series with a 12 V supply.
- i. Determine the total resistance for the circuit. (2 marks)
  - ii. Calculate the total current flows in the circuit. (2 marks)
  - iii. Calculate the voltage dropped across each resistor. (2 marks)

- (b) Referring to Figure 1, determine the current through each of the resistors and the power dissipated in each of them. Calculate the power supplied by the current source.

(6 marks)

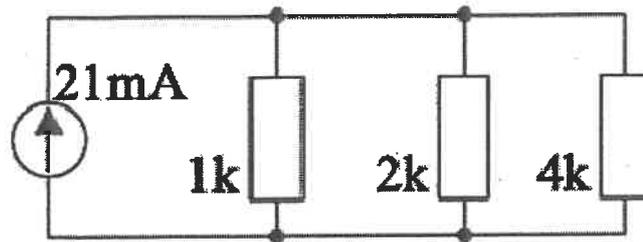


Figure 1.

- (c) Referring to the circuit shown in Figure 2, determine the total average power, reactive power, and complex power at the source and at the load.

(7 marks)

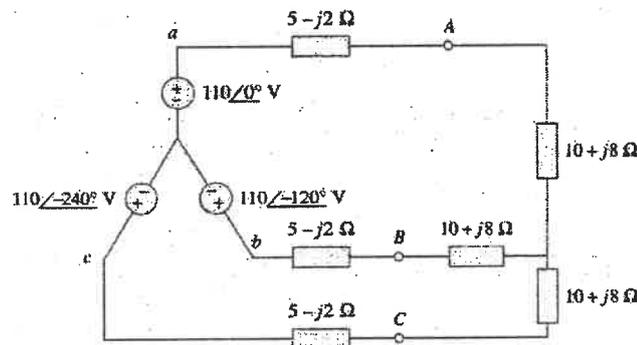


Figure 2.

- (d) An electric circuit consists of four resistors,  $R_1 = 12\ \text{Ohm}$ ,  $R_2 = 12\ \text{Ohm}$ ,  $R_3 = 3\ \text{Ohm}$  and  $R_4 = 6\ \text{Ohm}$ , and are connected with a source of emf  $E_1 = 6\ \text{Volt}$ ,  $E_2 = 12\ \text{Volt}$ . Determine the electric current flows in the circuit as shown in Figure 3.

(6 marks)

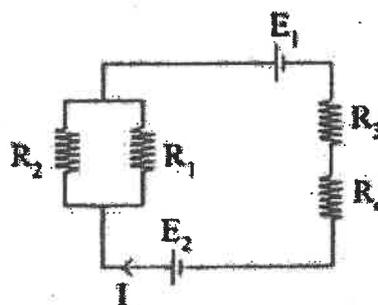


Figure 3.

**Question 3 (CLO 2)**

With reference to automatic control system generator.

- (a) Electronic control equipment refers to devices and systems used to regulate, monitor, and control electrical and electronic circuits. Explain the operational control system using Programmable Logic Control (PLC) from the input to the output device, such as actuators and motors. (6 marks)
- (b) The advanced computer-based PID controller is capable of handling complex control tasks. Compare the Analogue vs Digital vs Computer PID Controllers. (9 marks)
- (c) Control equipment for the main engine, generator and boiler is essential to enhance the operational efficiency. Produce a closed-loop block diagram of controller system. (10 marks)

**Question 4 (CLO 2)**

With reference to fundamentals of alternating current, power in AC, impedance.

- (a) A single-phase RLC circuit has the following parameters shown in Table 1.

Table 1.

Resistance, R	20 $\Omega$
Inductor, L	0.2 H
Capacitor, C	100 $\mu$ F
Supply voltage, V	240 $\angle$ 0 $^\circ$ V (rms)
Frequency, f	50Hz

- i. Calculate the total impedance, Z. (5 marks)
- ii. Calculate the current, I (5 marks)
- iii. Find the complex power S and express it in the form  $S=P+jQ$  (5 marks)

- (b) Referring to Figure 4, the circuit consists of components resistors, inductors and capacitors. Calculate the input impedance,  $Z_{in}$ . Show your work solutions. Assuming that the circuit operates at  $\omega = 50\text{rad/sec}$ .

(10 marks)

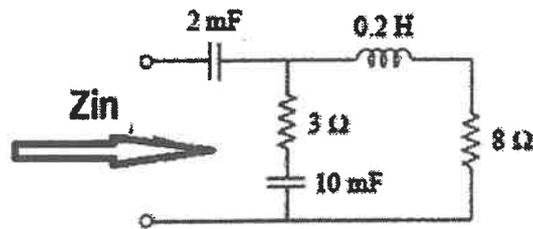


Figure 4.

**Question 5 (CLO 1)**

**With reference to mutual induction and electromagnetism.**

- (a) Determine the factors affecting the magnitude of induced voltage according to Faraday's Law. (3 marks)
- (b) A 500-turn coil is rotated in a magnetic field so that the flux changes sinusoidally as  $\phi = 0.02 \sin(100\pi t)$ . Produce the expression for the induced emf. (5 marks)
- (c) Discuss the main components of a simplified DC generator. (5 marks)
- (d) A 5KVA single-phase transformer has a turns ratio of 10: 1 and is fed from a 2.5KV supply. Neglecting losses. Determine the following.
- i. the full load secondary current (4 marks)
  - ii. the minimum load resistance which can be connected across the secondary winding to give full load kVA. (4 marks)
  - iii. the primary current at full load kVA. (4 marks)

**END OF EXAMINATION PAPER**

Formula Sheet

<p>Single-phase controlled rectifier.</p> $V_{avg} = \frac{V_m}{\pi} (1 + \cos \alpha)$	<p>Ohm's Law</p> $V = I.R$															
<p>Vrms Output Voltage for SCR</p> $V_{rms} = V_m \times \sqrt{\frac{1}{2} \left(1 + \frac{\sin 2\alpha}{2\alpha}\right)}$	<p>Resistor in series</p> $R_{eq} = \sum_{i=1}^n R_i = R_1 + R_2 + \dots + R_n$															
<p>Power delivered</p> $P = V_{rms} \times I_{rms}$	<p>Resistor in parallel</p> $R_{eq} = \left(\sum_{i=1}^n \frac{1}{R_i}\right)^{-1} = \left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots + \frac{1}{R_n}\right)^{-1}$															
<p>JK Excitation Table</p> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th><math>Q_n \rightarrow Q_{n+1}</math></th> <th>J</th> <th>K</th> </tr> </thead> <tbody> <tr> <td>0 → 0</td> <td>0</td> <td>X</td> </tr> <tr> <td>0 → 1</td> <td>1</td> <td>X</td> </tr> <tr> <td>1 → 0</td> <td>X</td> <td>1</td> </tr> <tr> <td>1 → 1</td> <td>X</td> <td>0</td> </tr> </tbody> </table>	$Q_n \rightarrow Q_{n+1}$	J	K	0 → 0	0	X	0 → 1	1	X	1 → 0	X	1	1 → 1	X	0	<p>AC Equation</p> $Y = A \sin \theta$
$Q_n \rightarrow Q_{n+1}$	J	K														
0 → 0	0	X														
0 → 1	1	X														
1 → 0	X	1														
1 → 1	X	0														
<p>Reluctance</p> <div style="border: 1px solid black; padding: 10px; width: fit-content; margin: 10px auto;"> <math display="block">\mathcal{R} = \frac{l}{\mu A}</math> </div>	<p>Power dissipated</p> $P = \frac{V_{rms}^2}{R}$															
<p>Permeability</p> <div style="border: 1px solid black; padding: 10px; width: fit-content; margin: 10px auto;"> <math display="block">\mu_r = \frac{\mu}{\mu_0}</math> </div>	<p>Inductive Reactance</p> $X_L = 2\pi fL$															
<p>Voltage induced</p> $v_{ind} = N \left(\frac{d\phi}{dt}\right)$	<p>Capacitive Reactance</p> $X_C = \frac{1}{2\pi fC}$															
<p>Impedance in series</p> $Z_{total} = Z_1 + Z_2 + \dots$	<p>Impedance in parallel</p> $\frac{1}{Z_{total}} = \frac{1}{Z_1} + \frac{1}{Z_2} + \dots$															
<ul style="list-style-type: none"> <li>• True Power (P): <math>P = VI \cos \theta</math></li> <li>• Reactive Power (Q): <math>Q = VI \sin \theta</math></li> <li>• Apparent Power (S): <math>S = VI</math></li> <li>• Power Factor (pf): <math>\cos \theta = \frac{R}{Z}</math></li> </ul>																

