



UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION
JULY 2025 SEMESTER SESSION

SUBJECT CODE	: LMB11903
SUBJECT TITLE	: FUNDAMENTAL OF ELECTRICAL AND ELECTRONICS
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	: BACHELOR OF MARINE ENGINEERING TECHNOLOGY WITH HONOURS
TIME / DURATION	: 09.00 AM – 12.00 PM (3 HOURS)
DATE	: 24 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. This question paper consists of **ONE (1)** section.
4. Please answer **FOUR (4)** questions **ONLY**.
5. Please write your answer in the answer booklet provided.
6. Answer should be written in blue or black ink except for sketching, graphic and illustration.
7. Answer **ALL** questions in English language **ONLY**.

THERE ARE 6 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

(Total 100 marks)

INSTRUCTION: Answer FOUR (4) questions ONLY

Please use the answer booklet provided.

Question 1 (CLO 1)

With reference to characteristics of basic semiconductor and diode rectification.

- (a) Basic semiconductor charge carriers and doping techniques. Explain the following:
- i. The intrinsic and extrinsic semiconductors in terms of their charge carrier behavior. (2 marks)
 - ii. The different types of doping techniques to improve their functionality. (2 marks)
- (b) Analyze the behavior of a PN junction diode under forward and reverse bias conditions, including a labeled V-I characteristic curve. (5 marks)
- (c) A silicon diode is forward-biased with a voltage of 0.7 V and connected in series with a 1.5 k Ω resistor. The supply voltage (V_{supply}) is 0.8 V. Determine the current flowing through the diode. (5 marks)
- (d) Compare the working principles of a full-wave bridge rectifier and a half-wave rectifier, including their output waveforms under different load conditions and a labeled circuit diagram to support your answer. (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 (2 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) An engine room alarm circuit has resistors values of $50\ \Omega$, $70\ \Omega$, and $80\ \Omega$ in series with a 440V AC supply. Thus, calculate.
- i. the total resistance for the circuit. (2 marks)
 - ii. the total current flows in the circuit. (2 marks)
 - iii. the power dissipated by the $70\ \Omega$ resistor (2 marks)
- (b) Referring to Figure 1, the current is flowing in a circuit containing four resistors connected to the series is $10\ \text{Ampere}$. The potential drops across the first, second and third resistors are, respectively: $V=5\text{V}$, $V=8\text{V}$ and $V=7\text{V}$. The equivalent resistance of the circuit is $R=30\ \Omega$. Thus, calculate the following;
- i. the total voltage supplied by the battery, (4 marks)
 - ii. the voltage dropped to resistor R_4 in the circuit. (4 marks)

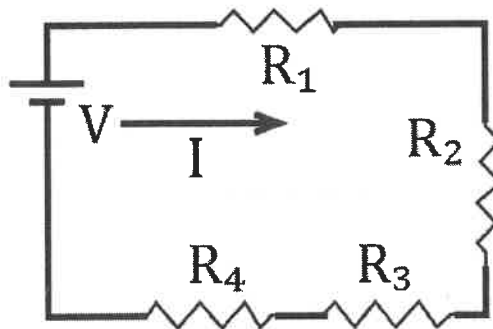


Figure 1.

- (c) A shipboard AC circuit operates at 440V , 60Hz and supplies a load with the current, I is $20\ \text{A}$ has lagging, with a power factor of 0.8 . Calculate the following:
- i. The total Average Power (P) at the source. (5 marks)
 - ii. Total Reactive Power (Q) at the source (6 marks)

Question 3 (CLO 2)

With reference to automatic control system generator.

- (a) Electronic control equipment, such as Programmable Logic Controllers (PLCs), is widely used in marine electrical systems for automation. Explain the operational control system of a PLC from the input to the output device, using actuators and motors as examples. (6 marks)
- (b) The advanced computer-based PID controller is capable of handling complex control tasks. Compare Analogue, Digital, and Computer-based PID Controllers in terms of their operation, advantages, and limitations. (12 marks)
- (c) Automatic control systems are critical for maintaining stable generator output in marine power plants. Compare open-loop and closed-loop control systems for a ship's generator, highlighting their advantages and limitations. (7 marks)

Question 4 (CLO 2)

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

- (a) A solenoid coil was found to have a static resistance of 12Ω when it measured multimeter. If the solenoid coil draws a current of 5 Amperes when connected to a 100 Volt, 1000 Hz supply. Calculate the inductance of the coil. Use the SI unit, mH. (5 marks)
- (b) Referring to Figure 2, 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)

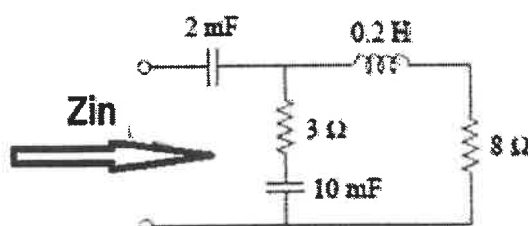


Figure 2.

(c) A 50Ω resistor, a 20mH coil and a $5\mu\text{F}$ capacitor are all connected in parallel across a 50V , 100Hz supply as depicted in Figure 3. Calculate the followings;

i. The total current drawn from the supply

(3 marks)

ii. The current for each brunch (loop)

(3 marks)

iii. The complex impedance of the circuit.

(4 marks)

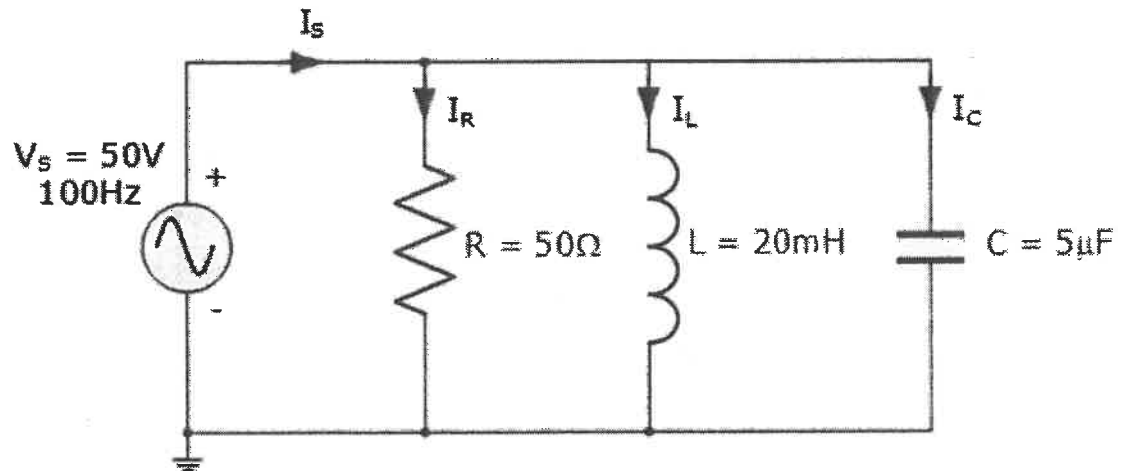


Figure 3.

Question 5 (CLO 2)**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

