UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION

OCTOBER 2025 SEMESTER SESSION

SUBJECT CODE	:	**LEB22103**
SUBJECT TITLE	:	**ELECTRICAL AND ELECTRONIC PRINCIPLES**
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	:	**BACHELOR OF ELECTRICAL AND ELECTRONICS ENGINEERING TECHNOLOGY (MARINE) WITH HONOURS**
TIME / DURATION	:	**2.00 PM - 5.00 PM (3 HOURS)**
DATE	:	**26 JANUARY 2026**

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** questions in Section A. For Section B, answer **THREE (3)** questions.
5. Answer **ALL** questions in the answer booklet provided.
6. Answer **ALL** questions in English language **ONLY**.
7. Formula sheet has been appended for your reference.

THERE ARE 8 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

INSTRUCTION: Answer ALL questions.

Question 1

(a) Define electric charge and electric current using the mathematical relationship between electric current and charge.

(4 marks)

(b) Describe the characteristics of series and parallel circuits in terms of voltage and current distribution.

(4 marks)

(c) Explain the principle of a magnetic field by stating **TWO (2)** characteristics of magnetic field lines.

(4 marks)

(d) Differentiate between solenoid and relay in terms of their construction and application.

(4 marks)

(e) Figure 1 shows a current-carrying conductor placed in a uniform magnetic field between two magnetic poles. The direction of current is into the page as indicated by the symbol (⊗). Discuss the rule used to determine the direction of force acting on the conductor and state the direction of motion of the conductor.

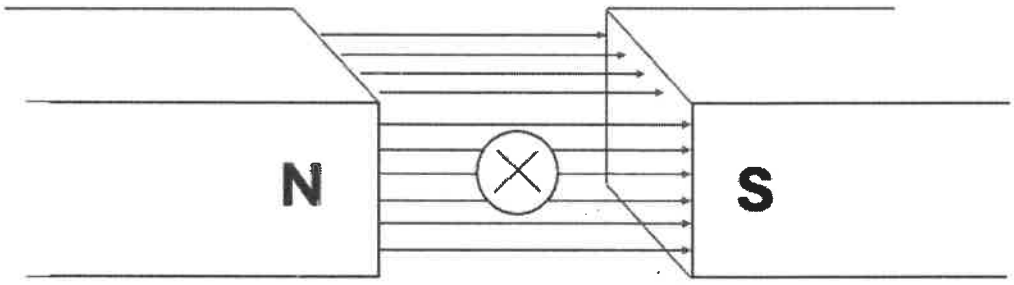

Figure 1

(4 marks)

Question 2

(a) Define electric voltage (potential difference) by using the mathematical relationship between voltage, energy, and charge.

(4 marks)

(b) Describe independent and dependent sources including **ONE (1)** example of each.

(4 marks)

(c) Describe the characteristics of conductors and insulators in terms of energy band gap and electrical resistance.

(4 marks)

(d) Differentiate between n-type and p-type semiconductor materials based on charge carriers and impurity doping.

(4 marks)

(e) Figure 2 illustrates the V–I characteristic curve of a p–n junction diode under forward bias. Explain the behaviour of the diode in the region after the knee voltage.

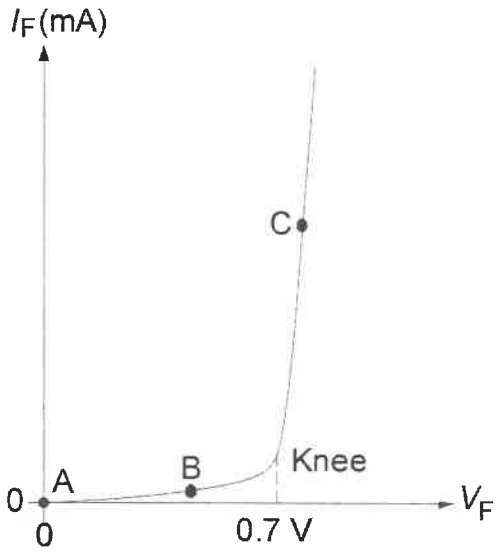

Figure 2

(4 marks)

SECTION B (Total: 60 marks)

INSTRUCTION: Answer THREE (3) questions only.

Question 3

(a) For the circuit in Figure 3, determine the *equivalent resistance, Req* seen at terminals a–b.

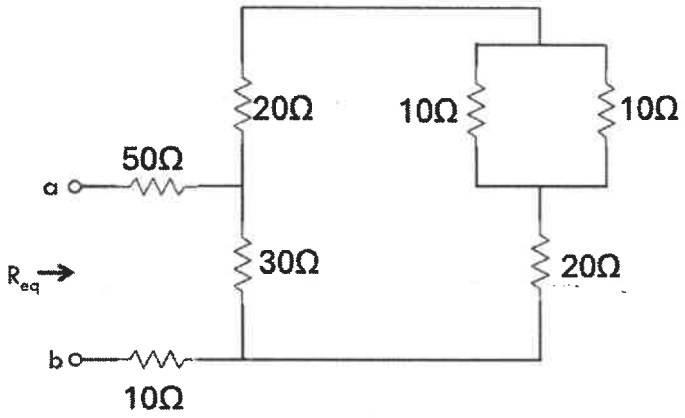

Figure 3

(8 marks)

(b) Using *current division rule*, calculate currents i_1 *and* i_2 in the network shown in Figure 4.

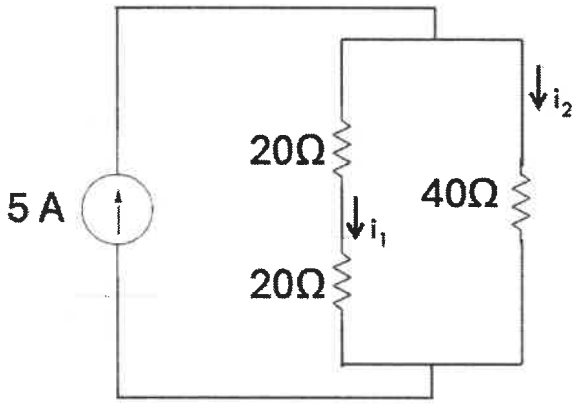

Figure 4

(6 marks)

(c) Classify rectifiers according to their type of rectification using state their circuit configuration.

(6 marks)

Question 4

(a) Compute the total capacitance C_{eq} for the capacitor network in Figure 5.

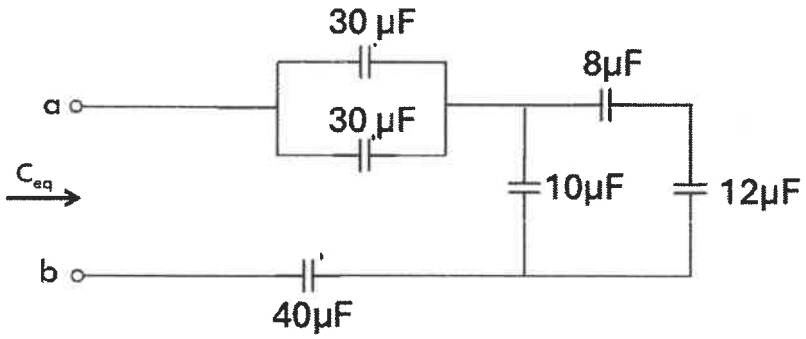

Figure 5

(8 marks)

(b) In the circuit shown in Figure 6, determine V_0 using voltage divider principle.

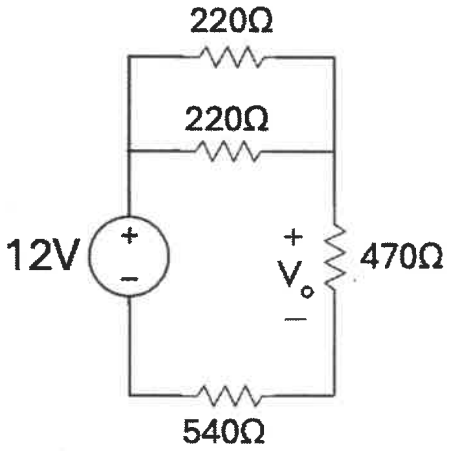

Figure 6

(6 marks)

(c) Differentiate between positive clamper and negative clamper using suitable schematic diagrams, where the output waveform sketches are clearly shown.

(6 marks)

Question 5

(a) Determine the equivalent inductance L_{eq} at terminals a–b for the network shown in Figure 7.

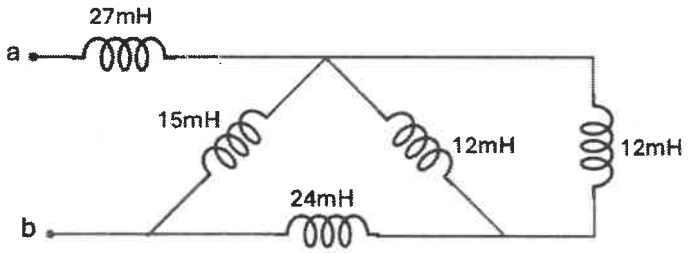

Figure 7

(8 marks)

(b) For the circuit in Figure 8, calculate the loop current, i, by applying Kirchhoff's Voltage Law (KVL).

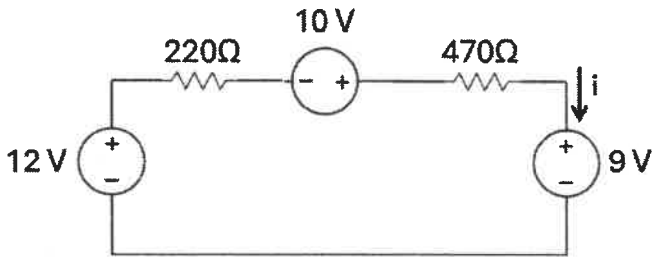

Figure 8

(6 marks)

(c) Compare forward bias and reverse bias operation of a p–n junction diode by explaining the conduction behavior in each condition with reference to depletion layer and current flow.

(6 marks)

Question 6

(a) According to the inductor circuit in Figure 9 under DC steady–state condition, calculate the current i_x flowing through the inductor.

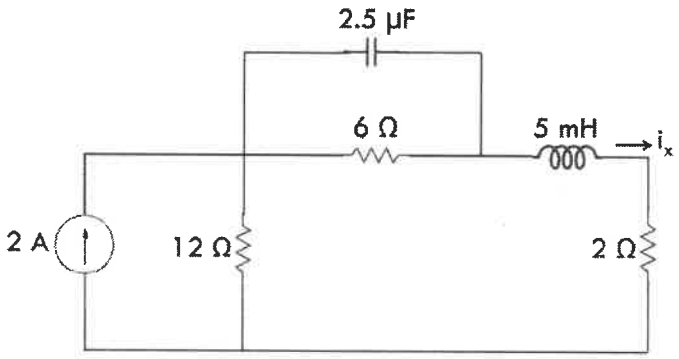

Figure 9

(8 marks)

(b) For the network in Figure 10, determine i(t) for t > 0, assuming the switch (S1) was open for a long time and closes at t = 0. Given $i_x(t) = i_x(0^+)e^{-t/\tau}$.

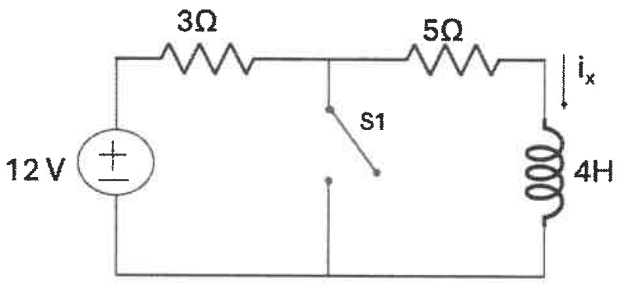

Figure 10

(6 marks)

(c) Analyse the V-I characteristics of a p-n junction diode under forward bias and reverse bias.

Question 7

(a) Figure 11 shows a silicon diode (0.7 V drop) connected in forward bias with a series resistor and DC supply. Determine:

i. Diode current, I_D

ii. Voltage across the resistor, V_R

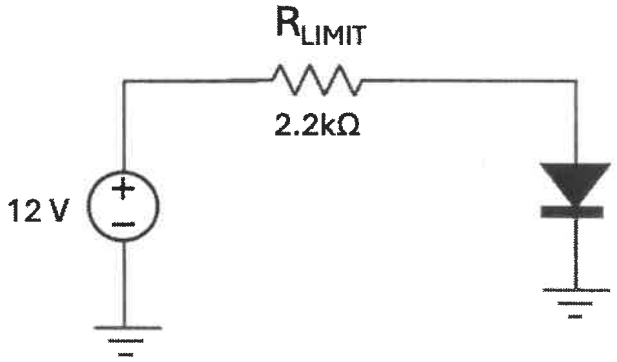

Figure 11

(8 marks)

(b) The diode in Figure 12 is now reverse biased with V_S = 10 V. Assume ideal diode reverse current ≈ 0 A. Determine:

i. Reverse current

ii. Voltage across diode

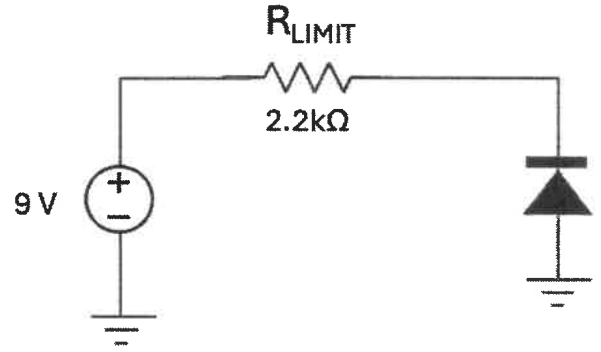

Figure 12

(6 marks)

(b) Differentiate between half–wave rectifier and full–wave rectifier in terms of:

i. Circuit configuration

ii. Efficiency of rectification

iii. Output waveform characteristics

(6 marks)

END OF EXAMINATION PAPER