



UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION
FEBRUARY 2025 SEMESTER SESSION

SUBJECT CODE : LMD13503 / LMD121703 / LED11303

SUBJECT TITLE : ENGINEERING SCIENCE

PROGRAMME NAME : DET IN ELECTRICAL AND ELECTRONICS (MARINE)
(FOR MPU: PROGRAMME LEVEL)
DET IN MARINE ENGINEERING

TIME / DURATION : 09.00 AM - 12.00 PM
(3 HOURS)

DATE : 1 JULY 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 **TWO (2)** sections; Section A and Section B.
 4. Answer **ALL** question in Section A, and **TWO (2)** questions **ONLY** in Section B.
 5. Please write your answers on this answer booklet provided.
 6. Answer **ALL** questions in English language **ONLY**.
 7. Table of formulae and appendices has been appended for your reference.
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THERE ARE 8 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

SECTION A (Total: 60 marks)

**INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.**

Question 1

Concerning the linear motion, dynamics, fluid and heats:

- (a) State Newton's First Law of Motion and Newton's Second Law of Motion (6 marks)
- (b) Differentiate between velocity and acceleration (4 marks)
- (c) Explain the term atmospheric pressure (4 marks)
- (d) Explain the temperature of a substance (3 marks)
- (e) State three (3) methods of heat transfer (3 marks)

Question 2

- (a) A speedboat that is initially at rest moves along a straight line and reached a speed of 10 m/s in 50 s. Determine:
- i. the acceleration of the speedboat (3 marks)
- ii. the distance made by the speedboat in 50 (3 marks)
- iii. the velocity in the next 30 s if the speedboat continues its motion with constant acceleration (4 marks)

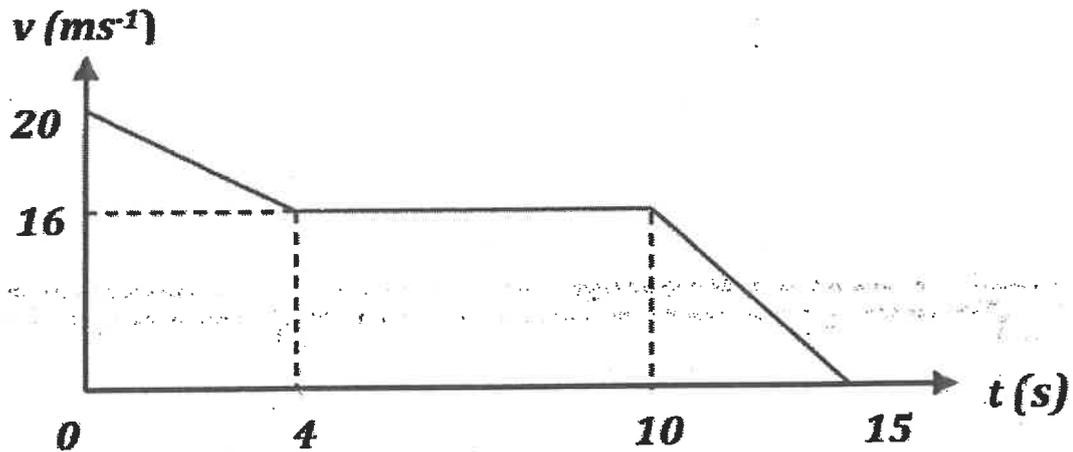


Figure 1

(b) Figure 1 shows a velocity versus time graph of moving object.

- i. When does the object move with constant velocity?
(2 marks)
- ii. Determine the acceleration of the object in,
 - (a) the first 4 s
(2 marks)
 - (b) the last 5 s
(2 marks)
- iii. Find the distance traveled by the object when it is moving with constant velocity
(2 marks)
- iv. Determine the total distance traveled by the object.
(2 marks)

Question 3

With reference to work, energy and power:

(a) A hoop of mass 4 kg is moving horizontally with a speed of 2 m/s. Calculate:

i. the work done on the hoop to change its speed to 6 m/s.

(4 marks)

ii. the constant force that would do this work in a distance of 8 m.

(3 marks)

iii. the power expended to change the speed in a time of 3.0 s.

(3 marks)

(b) The kinetic energy of the vehicle is 8×10^6 J as moves on a horizontal plane.

i. Compute power is required to stop the vehicle in 20 s

(3 marks)

ii. Determine the force required to stop the vehicle in 20 s if it mass is 1500 kg

(3 marks)

(c) An electric motor consumes 100 Watts of power to obtain 90 Watts of mechanical power.

Determine the percentage of efficiency.

(4 marks)

SECTION B (Total: 40 marks)

INSTRUCTION: Answer only TWO (2) questions.
Please use the answer booklet provided.

Question 4

With reference to Newton's Law of Motion:

Figure 2 shows a pulley system which consists of a load ($m_2 = 10 \text{ kg}$) hanging over a smooth pulley. A wooden block ($m_1 = 20 \text{ kg}$) is placed on a rough surface which has coefficient of friction, $\mu = 0.18$. After being released, the system accelerates in the direction as shown.

- (a) Sketch the free body diagram to show all the forces acting on objects. (6 marks)
- (b) Determine the frictional force acted between m_1 and the surface. (6 marks)
- (c) Calculate the acceleration of the system. (8 marks)

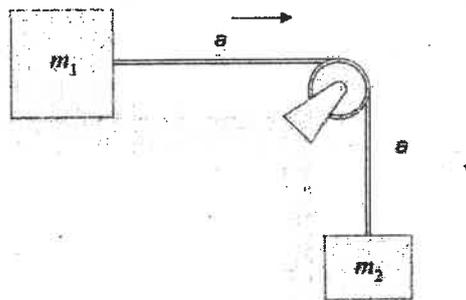


Figure 2

Question 5

With reference to rotational motion and simple harmonic motion:

(a) A wheel of radius 0.4 m starts rotating from rest and after 6 s its angular velocity is 3.6 rad/s. Calculate:

i. the angular acceleration of the wheel

(4 marks)

ii. the angular velocity after 3.0 s

(4 marks)

iii. the tangential acceleration

(4 marks)

(b) A mass which hangs from the end of a vertical helical spring is in SHM of amplitude 2cm. If three complete oscillations take 4.0 s, determine the acceleration of the mass:

i. at the equilibrium position

(4 marks)

ii. when the displacement is maximum

(4 marks)

Question 6

With reference to fluid and heat:

(a) An oil manometer is used to measure the pressure of the gas in a tank as shown in Figure 4. The specific gravity of the oil is 0.8, the atmospheric pressure is 120 kPa and the manometer column height is 90 cm. Determine:

i. the density of the oil

(4 marks)

ii. the pressure of the gas in the tank

(4 marks)

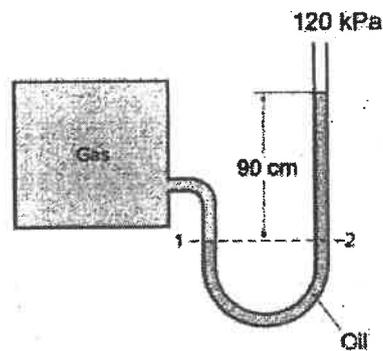


Figure 3

(b) The amount of heat produced when 2 kg petrol is completely burned is 96 000 kJ.

Determine:

i. the calorific value of the petrol

(3 marks)

ii. the useful energy released by 300 g petrol

(3 marks)

(c) A coal sample contains 82% carbon, 8% hydrogen, 3% oxygen, 1% Sulphur, 2% nitrogen and 4% ash by mass. Determine:

i. the higher caloric value

(3 marks)

ii. lower calorific value of the coal.

(3 marks)

END OF QUESTION PAPER

1. Table of Formulae

$v = u + at$	$s = ut + \frac{1}{2} at^2$	$s = \frac{1}{2}(u + v)t$
$v^2 = u^2 + 2as$	$F = ma$	$F_f = \mu F_N$
$W = mg$	$W = F \cos \theta \cdot x$	$W = KE_f - KE_i$
$KE = \frac{1}{2}mv^2$	$PE = mgh$	$P = \frac{W}{t}$
$\omega_f = \omega_i + at$	$\theta = \frac{1}{2}(\omega_i + \omega_f)t$	$\theta = \omega_i t + \frac{1}{2} at^2$
$\omega_f^2 = \omega_i^2 + 2a\theta$	$f = \frac{1}{T}$	$\omega = 2\pi f$
$\omega = \sqrt{\frac{k}{m}}$	$a = -\omega^2 x$	$v = \omega \sqrt{A^2 - x^2}$
$SG = \frac{\rho_{\text{substance}}}{\rho_{\text{water}}}$	$\rho = \frac{m}{V}$	$P = \rho gh$
$P = \frac{F}{A}$	$Q = mc\Delta T$	$\frac{Q}{t} = \frac{kA\Delta T}{l}$

2. Constant Values

Gravitational acceleration, $g = 9.81 \text{ m/s}^2$

Density of water = 1000 kg/m^3

Standard atmospheric pressure = $1 \text{ atm} = 1.013 \times 10^5 \text{ Pa}$

