CONFIDENTIAL

UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION

JULY 2025 SEMESTER SESSION

SUBJECT CODE	:	**LED11803**
SUBJECT TITLE	:	**ENGINEERING SCIENCE**
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	:	**DET IN ELECTRICAL AND ELECTRONICS (MARINE)**
TIME / DURATION	:	**09.00 AM – 12.00 PM (3 HOURS)**
DATE	:	**17 DECEMBER 2025**

INSTRUCTIONS TO CANDIDATES

1. Please **CAREFULLY** read 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 B.
4. Answer **ALL** questions in Section A. For Section B, answer **TWO (2)** questions **ONLY**.
5. Please write your answers on the answer booklet provided.
6. Answer **ALL** questions in English language **ONLY**.
7. Table of Formulae has been appended for your reference.

THERE ARE 8 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 60 marks)

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

Question 1

With reference to linear motion, dynamics and heat:

(a) Explain free fall motion.

(4 marks)

(b) Differentiate between mass and weight.

(4 marks)

(c) i. Describe work done on an object.

(3 marks)

ii. State the conservation of mechanical energy.

(3 marks)

(d) i. Define heat.

(3 marks)

ii. State THREE (3) methods of heat transfer.

(3 marks)

Question 2

With reference to linear motion:

(a) A patrol vessel reduces its speed uniformly from 8 m/s to 3 m/s as it approaches a harbour over a distance of 90 m. Calculate:

i. the deceleration of the vessel

(3 marks)

ii. the time taken for the speed to decrease from 8 m/s to 3 m/s

(3 marks)

iii. the total time required for the vessel to stop from its starting point if it constantly decelerates.

(3 marks)

(b) Figure 1 shows a velocity versus time graph representing the straight-line motion of a submarine as it travels during a propulsion test. Compute:

i. the acceleration of the object in the first 10 seconds.

(2 marks)

ii. the acceleration of the object in the last 5 seconds.

(2 marks)

iii. the total distance traveled by the object.

(4 marks)

iv. the average velocity of the object.

(3 marks)

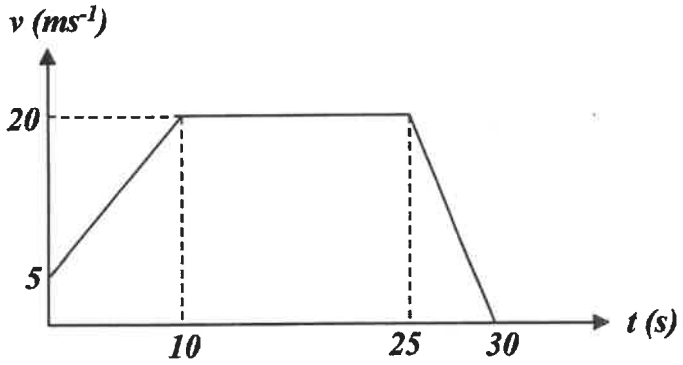

Figure 1

Question 3

With reference to work, energy and power:

A motor is used to pull 180 kg load up the ramp through a distance of 5 m. The height of the ramp is 3 m as illustrated in Figure 2. Determine:

(a) the work done to change the speed from 6 m/s to 1 m/s

(4 marks)

(b) the force, F_T that would do this work over a distance of 5 m

(3 marks)

(c) the power expended by the motor to change the speed

(6 marks)

(d) the efficiency if the input power of the motor is 3 kW

(3 marks)

(e) the change in potential energy experienced by the load.

(4 marks)

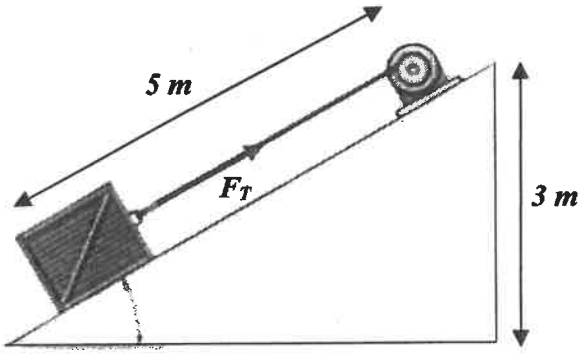

Figure 2

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:

A pulley system consists of a load (m_B = 15 kg) hanging over a smooth pulley. A wooden block (m_A = 40 kg) placed on a rough surface which has coefficient of friction, μ = 0.21. After being released, the system accelerates in the direction as shown in Figure 3.

(a) Sketch the free body diagram to show all the forces acting on both objects.

(6 marks)

(b) Calculate the frictional force acted between m_A and the surface.

(6 marks)

(c) Determine the acceleration of the system.

(8 marks)

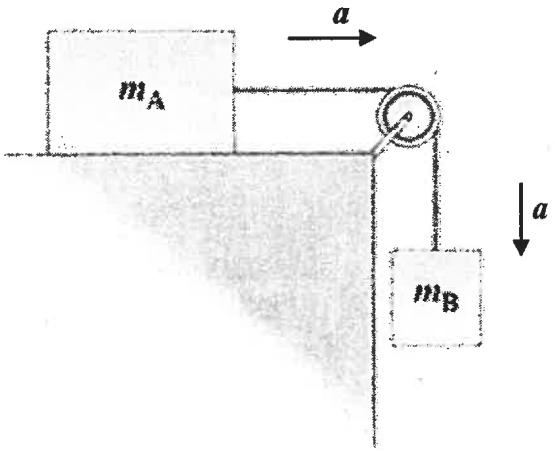

Figure 3

Question 5

With reference to rotational motion and simple harmonic motion:

(a) A windmill is rotating with uniform angular acceleration and takes 60 s to increase its angular velocity from 20 rev/min to 45 rev/min.

i. Express the initial and final angular velocity in unit rad/s.

(4 marks)

ii. Determine the angular acceleration of the windmill.

(3 marks)

iii. Calculate the angular displacement made by the disc in 60 seconds.

(3 marks)

iv. If the torque acted on the windmill 30 Nm, compute its rotational inertia

(3 marks)

(b) A 0.2 kg load is attached to the end of a spring so that it can vibrate in Simple Harmonic Motion. The amplitude is 10 cm and period of the oscillation is 0.25 seconds. Calculate:

i. the angular frequency

(3 marks)

ii. the kinetic energy at x = 7 cm

(4 marks)

Question 6

With reference to fluid and heat:

(a) Figure 4 shows an oil manometer which is used to measure the pressure of the gas in a tank. The local atmospheric pressure is 110 kPa, the specific gravity of the oil is 0.85 and the manometer column height is 80 cm. Determine:

i. the density of the oil

(3 marks)

ii. the pressure of the gas in the tank

(4 marks)

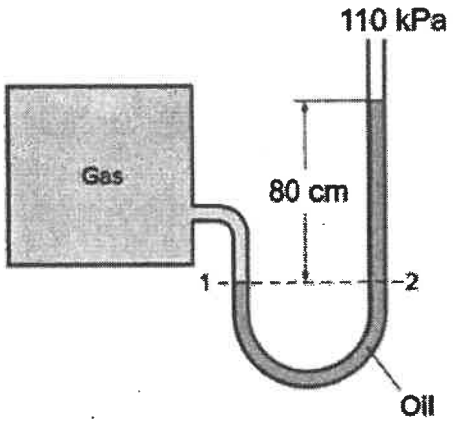

Figure 4

(b) A 0.2 kg piece of metal is heated to 90°C and dropped into an ideal calorimeter containing 0.5 kg of unknown liquid initially at 20°C. The equilibrium temperature achieved by the system is 21.5°C. The specific heat capacity of metal is 128 J/kg.°C.

i. Calculate the heat lost by the metal.

(3 marks)

ii. Determine the specific heat capacity of the unknown liquid.

(3 marks)

(c) A copper and aluminum rod have the same length and same cross-sectional area of 0.8 m and 0.02 m^2 are attached together as in Figure 5. The copper end is maintained at a temperature of 205°C while the aluminum end is fixed at 0°C. After a while, the two rods achieved a steady state. The thermal conductivity of copper is 397 J/s.m.°C and aluminum is 238 J/s.m.°C.

i. Determine the temperature, T at the point where the two rods are joined.

(4 marks)

ii. Calculate the rate of heat flow through the aluminum rod.

(3 marks)

Figure 5

END OF EXAMINATION PAPER

APPENDIX

1. TABLE OF FORMULAE

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

2. CONSTANT VALUES:

Gravitational acceleration, g = 9.81 m/s^2

Density water = 1000 kg/m^3

Standard atmospheric pressure = 1 atm = 101.3 kPa