CONFIDENTIAL

UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION

JULY 2025 SEMESTER SESSION

SUBJECT CODE	:	**LEB11203**
SUBJECT TITLE	:	**ENGINEERING SCIENCE**
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	:	**BACHELOR OF ELECTRICAL AND ELECTRONICS ENGINEERING TECHNOLOGY (MARINE) WITH HONOURS**
TIME / DURATION	:	**09.00 AM - 12.00 PM (3 HOURS)**
DATE	:	**17 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 **TWO (2)** sections; Section A and Section B.
4. Answer **ALL** question in Section A, and **THREE (3)** 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.

THERE ARE 7 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (Total: 40 marks)

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

Question 1

With reference to Newton's law, simple harmonic motion, fluid and heat.

(a) Newton's First Law of motion is also known as the Law of Inertia. Using appropriate example, explain inertia.

(4 marks)

(b) Most of the oscillating system experience damping due to external force. Distinguish between overdamping and critical damping.

(6 marks)

(c) Using the concept of Pascal's Principle, explain how a certain hydraulic lift system could be designed to lift a large amount of load compared to its input force.

(6 marks)

(d) Conduction is one of the methods used to transfer heat. Describe the conduction process.

(4 marks)

Question 2

With reference to work, energy and power:

Figure 1 shows a container slide down from a height of 1.5 m from a conveyor at a speed of 2 m/s. Assuming no losses due to friction, calculate:

(a) the total mechanical energy of the container at point A if it has a mass of 10 kg.

(4 marks)

(b) the speed of the container at point B

(3 marks)

(c) the work done by the conveyor to move the container from point A to B.

(4 marks)

(d) the force required to do the work if the horizontal distance between point A and point B is 4 m.

(3 marks)

(e) the power needed to move the container from point A to B.

(6 marks)

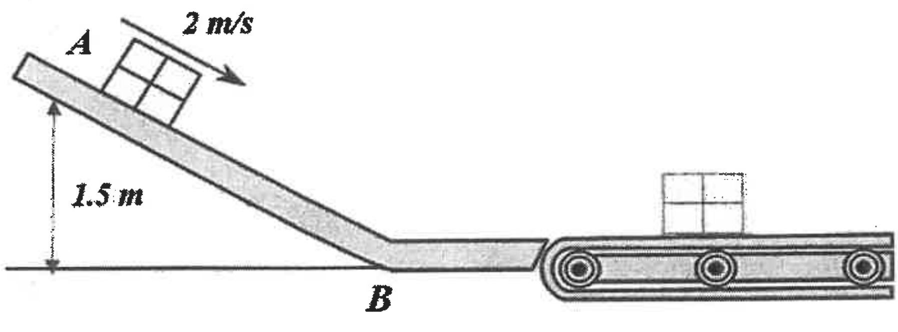

Figure 1

SECTION B (Total: 60 marks)

INSTRUCTION: Answer only THREE (3) questions.
Please use the answer booklet provided.

Question 3

With reference to rotational motion:

The flywheel of the steam engine runs with a constant angular velocity of 350 rev/min. The flywheel stops 1.5 hours after the steam engine is turned off.

(a) Calculate the angular acceleration of the wheel during the slowdown in unit rad/s^2.

(6 marks)

(b) Determine the number of revolutions the flywheel makes before stopping.

(4 marks)

(c) Compute the tangential acceleration of the flywheel at the point 30 cm from the rotational axis.

(3 marks)

(d) At the instant the flywheel is turning at 100 rev/min, determine the tangential velocity of the flywheel at the point 50 cm from the axis of rotation.

(4 marks)

(e) Calculate the centripetal acceleration when the flywheel moves with the velocity obtained in question (c) above.

(3 marks)

Question 4

With reference to simple harmonic motion:

(a) A particle undergoes linear Simple Harmonic Motion with maximum displacement of 10 cm and frequency 30 Hz. At the instant t = 0 s, the particle is +6 cm from the equilibrium position. Write the expression for the displacement of the particle.

(8 marks)

(b) A 300 g mass connected to a spring that has a spring constant of 150 N/m. The mass oscillates on a horizontal, frictionless surface with an amplitude of 4 cm. Determine:

i. the total energy of the system

(3 marks)

ii. the speed of the mass at x = 2 cm

(6 marks)

iii. the kinetic energy at x = 3 cm.

(3 marks)

Question 5

With reference to Archimedes' principle:

(a) A rectangular pontoon has a base dimension of 1.2 m by 0.8 m. It sinks 0.15 m in fresh water of density 1000 kgm^3. Calculate:

i. the buoyant force that supports the pontoon in fresh water

(4 marks)

ii. the depth the pontoon sinks in sea water if the density of seawater is 1035 kg/m^3

(4 marks)

iii. the weight of the ballast that causes the pontoon to sink to a depth of 0.3 m in seawater.

(4 marks)

(b) A 0.4 kg unknown material is found sinks in oil that has a relative density of 0.78. The buoyant force that supports the material is 4.5 N. Determine the relative density of the unknown material.

(8 marks)

Question 6

With reference to First Law of Thermodynamics:

Suppose a system of monatomic ideal gas has an initial temperature of 320 K. The gas expands slowly at a constant pressure of 140 kPa from a volume of 1.2 L to 2.5 L.

(a) Compute the final temperature of the gas when the volume has expanded to 2.5 L.

(4 marks)

(b) Calculate the work done by the gas.

(4 marks)

(c) Determine the change in internal energy.

(8 marks)

(d) If the molar heat capacity of the gas at a constant pressure is 20.8, determine the heat absorbed.

(4 marks)

END OF EXAMINATION PAPER

APPENDIX

1. TABLE OF FORMULAE

$v = u + at$	$s = ut + \frac{1}{2}at^2$	$s = \frac{1}{2}(u + v)t$
$v^2 = u^2 + 2as$	$F = ma$	$F_f = \mu F_N$
$KE = \frac{1}{2}mv^2$	$PE = mgh$	$W = KE_f - KE_i$
$W = F\cos\theta . x$	$P \frac{W}{t}$	$\omega_f = \omega_i + \alpha t$
$\theta = \omega_i t + \frac{1}{2}\alpha t^2$	$\theta = \frac{1}{2}(\omega_i + \omega_f)t$	$\omega_f^2 = \omega_i{}^2 + 2\alpha\theta$
$s = r\theta$	$v = r\omega$	$a_t = r\alpha$
$a_c = \frac{v^2}{r}$	$f = \frac{1}{T}$	$\omega = 2\pi f$
$\omega = \sqrt{\frac{k}{m}}$	$F = -kx$	$v = \omega\sqrt{A^2 - x^2}$
$a = -\omega^2 x$	$E = \frac{1}{2}m\omega^2 A^2$	$K = \frac{1}{2}m\omega^2(A^2 - x^2)$
$U = \frac{1}{2}m\omega^2 x^2$	$RD = \frac{\rho_{substance}}{\rho_{water}}$	$\rho = \frac{m}{V}$
$F_B = W_o$	$F_B = \rho_f V_f g$	$PV = nRT$
$W = P(V_f - V_i)$	$\Delta U = \frac{3}{2}nR(T_f - T_i)$	$Q = nC_P\Delta T$

2. CONSTANT VALUES:

Gravitational acceleration, g = 9.81 m/s^2

Density water = 1000 kg/m^3

Standard atmospheric pressure = 1 atm = 1.013 x 10^5 Pa

Universal gas constant, R = 8.314 J/mol. K

1 Liter = 1 × 10^{-3} m^3