CONFIDENTIAL

UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION
MARCH 2025 SEMESTER SESSION

SUBJECT CODE	:	**LGD11503**
SUBJECT TITLE	:	**ENGINEERING SCIENCE**
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	:	**DIPLOMA OF ENGINEERING TECHNOLOGY (NAVAL ARCHITECTURE AND SHIPBUILDING)**
TIME / DURATION	:	**09.00 AM - 12.00 PM (3 HOURS)**
DATE	:	**26 JUNE 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 A**.
4. Answer **ALL** question in Section A.
5. Please write your answers on this answer booklet provided.
6. Answer **ALL** questions in English language **ONLY**.
7. Formula table has been appended for your reference.

THERE ARE 8 PAGES OF QUESTIONS, INCLUDING THIS PAGE.

SECTION A (Total: 100 marks)

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

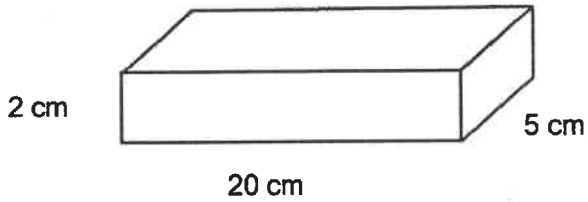
Question 1

(a) State the derived quantity below:

Derived quantity	SI unit
Area	
Volume	
Force	
Speed	
Acceleration	

(5 marks)

(b) A glass slab has a length of 20 cm, width of 5 cm and height of 2 cm. The mass of the glass slab is 700 grams.



Calculate:

i. the mass of the slab in unit kg.

(2 marks)

ii. the volume in unit m^3.

(2 marks)

iii. the density of the glass slab in unit kg/m^3

(2 marks)

(c) The figure shows a graph of velocity, v, against time, t, of a moving object.

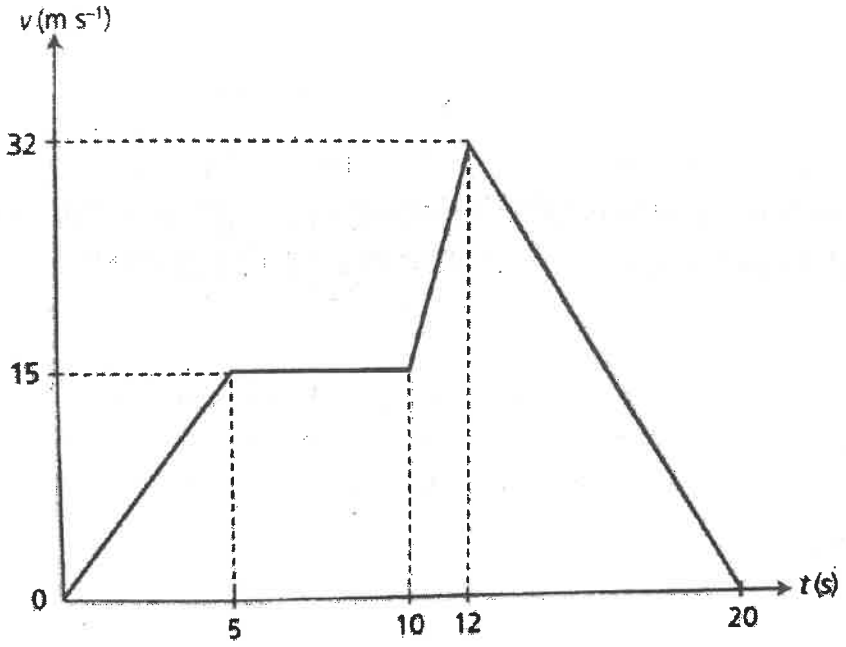


Figure 1: A graph of velocity versus time

Calculate:

i. acceleration of the object at t = 5 seconds

(2 marks)

ii. acceleration of the object from t = 12 seconds to t = 20 seconds

(2 marks)

iii. total distance travelled by the object.

(5 marks)

Question 2

(a) State the differences between a scalar quantity and a vector quantity.

(4 marks)

(b) Two persons are pulling a boat onto the shore using two cables as shown in Figure 2. The first person pulls out with a force, F_A = 40 N directed 45° relative to x-axis. The second person pulls at 37° angle with a force F_B = 30 N.

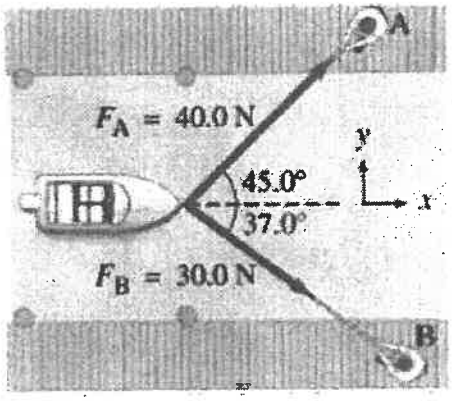


Figure 2: Three coplanar forces act on the body.

i. Calculate the x-component and y-component of all forces, F_A and F_{Bd}.

(6 marks)

ii. Calculate the magnitude of the resultant force.

(6 marks)

iii. Compute the direction of the resultant force.

(4 marks)

Question 3

a) State the theory of Newton's Law below:

i. Newton's First Law

ii. Newton's Second Law

(6 marks)

b) A person pushes a 14 kg lawn mower at constant speed with a force of F = 88 N directed along the handle, which is at an angle of 45^0 to the horizontal ground as shown in Figure 3.

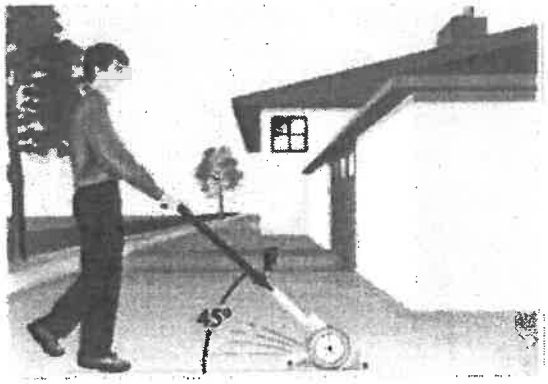


Figure 3: A person moves the lawn mower at constant speed.

i. Draw a free body diagram showing all forces acting on the mower.

(3 marks)

ii. Calculate the friction force, F_f on the mower.

(3 marks)

iii. Calculate the normal force, F_N exerted vertically upward on the mower by the ground.

(3 marks)

iv. Determine the force required by a person to push the lawn mower from rest to a speed of 1.5 m/s in 2.5 seconds, given that the friction force stays the same.

(5 marks)

Question 4

a) Explain the term below:

i. Kinetic energy

ii. Potential energy

(6 marks)

b) Suhaila pushed a book 1.50 m to the left along a horizontal table with a horizontal force, F=7.50N as shown in Figure 4. Given the friction force is 1.60N.

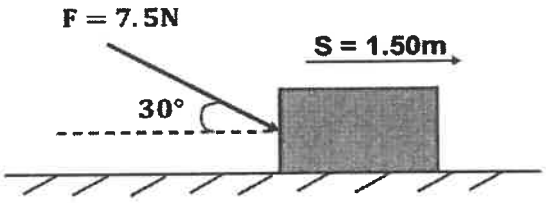


Figure 4: A book on the horizontal table.

Determine:

i. the work done by the 7.5 N force.

(3 marks)

ii. the work done by friction force

(3 marks)

iii. the net work done on the book.

(3 marks)

c) Figure 5 below shows a trolley of mass 6 kg passing through point A with a velocity of 6m/s. It slides down a rail to point C. Determine total energy at point A.

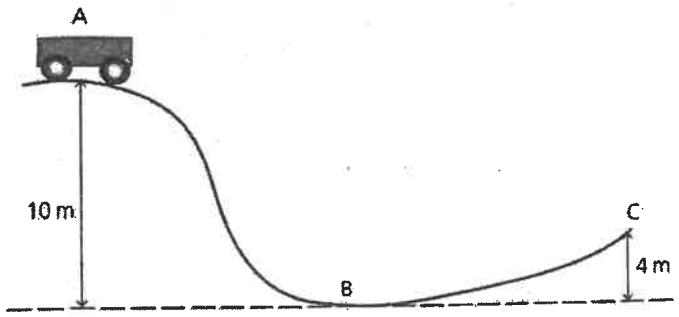


Figure 5: A trolley at a height of 10 m slides down from A to C.

(5 marks)

Question 5

(a) A uniform plank which is 6 m long and has a weight of 300 N is supported horizontally by two ropes A and B suspended vertically. A weight of 150 N rests on the plank at C where AC = 2 m. Calculate the force in each rope (R_1 and R_2).

(8 marks)

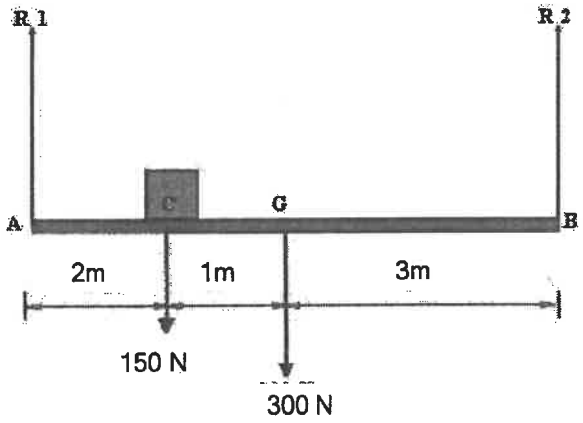


Figure 6: Uniform plank

(b) A 120 kg quantity of cold water at 25°C is heated to 80°C. If the energy required to raise the temperature is 2.31×10^7 J, calculate the specific heat capacity of the water.

(5 marks)

(c) Figure 7 shows a 100m steel cable spanning a river when the temperature is 30 °C. When night comes, the temperature drops to 0 °C. The coefficient of linear expansion, α of the steel is 12×10^{-6} °C $^{-1}$.

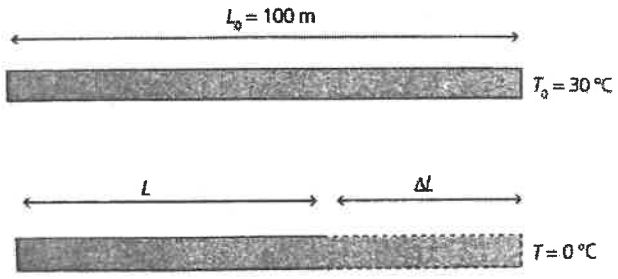


Figure 7: Steel cable

Calculate:

i. the change in length of the cable when temperature changes from 30 °C to 0 °C.

(4 marks)

ii. the new length of the cable at 0 °C.

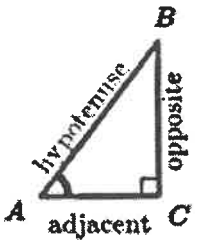
(3 marks)

END OF EXAMINATION PAPER

APPENDIX

1. TABLE OF FORMULAE

$v = u + at$	$s = ut + \frac{1}{2}at^2$	$s = \frac{1}{2}(u + v)t$
$v^2 = u^2 + 2as$	$D_R = \sqrt{\Sigma D_x{}^2 + \Sigma D_y{}^2}$	$\tan\theta = \frac{\Sigma D_y}{\Sigma D_x}$
$v = \frac{dx}{dt}$	$v = \frac{ds}{dt}$	$v_{avg} = \frac{total\ distance}{time\ taken} = \frac{\Delta x}{\Delta t}$
$v_{avg} = \frac{displacement}{time} = \frac{\Delta s}{\Delta t}$	$F = ma$	$F_f = \mu F_N$
$KE = \frac{1}{2}mv^2$	$PE = mgh$	$W = mg$
$W = F.s$	$W = F\cos\theta\,.\,x$	Total energy = KE +PE
$\Delta L = \alpha L_0 \Delta T$ $\therefore\ L = L_0 + \Delta L$	$Q = mc\Delta T$ $\frac{Q}{t} = \frac{kA\Delta T}{l}$	Moment = Force x distance $\sum M$ *(anticlockwise moment)* $= \sum M$ *(clockwise moment)* $\sum F = 0$



$$\sin(A) = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\cos(A) = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\tan(A) = \frac{\text{opposite}}{\text{adjacent}}$$

2. CONSTANT VALUES:

Gravitational acceleration, g = 9.81 m/s^2

Density water = 1000 kg/m^3

Standard Temperature Pressure, STP conditions: P = 1 atm = 1.013 x 10^5 Pa

T = 273 K