CONFIDENTIAL

UNIVERSITI KUALA LUMPUR
Malaysian Institute of Marine Engineering Technology

FINAL EXAMINATION

JULY 2025 SEMESTER SESSION

SUBJECT CODE	:	**LMD26402 /** LMD25802
SUBJECT TITLE	:	**STATIC AND DYNAMICS**
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	:	**DIPLOMA OF ENGINEERING TECHNOLOGY IN MARINE ENGINEERING**
TIME / DURATION	:	**9.00 AM - 11.30 AM (2 HOURS 30 MINUTES)**
DATE	:	**18 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** questions in Section A. For Section B, answer **TWO (2)** questions **ONLY**.
5. Please write your answers on this answer booklet provided.
6. Answer **ALL** questions in English language **ONLY**.
7. Formula is appended for your reference.

THERE ARE 6 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 the statics, force vectors:

(a) Determine each force acting on the support as shown in Figure 1 below into its *x* and *y* components and express each force as a Cartesian vector.

(10 marks)

(b) Determine the magnitude of the resultant force in Figure 1 and its direction θ, measured counterclockwise from the positive *x* axis.

(10 marks)

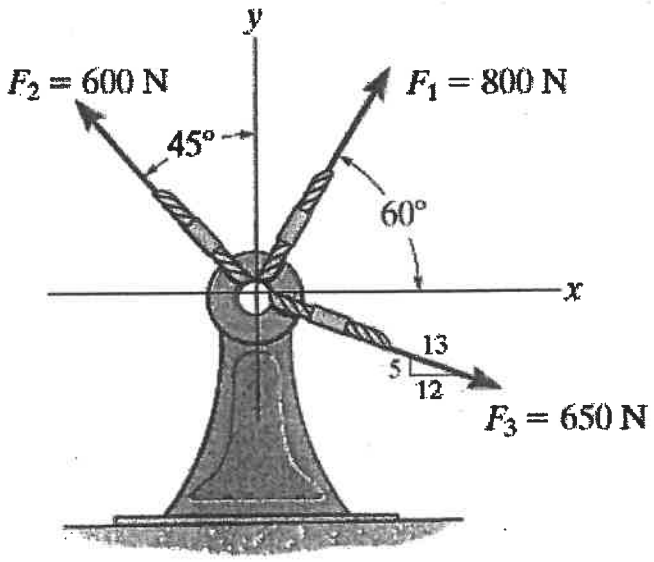


Figure 1. Three forces are acting on support

Question 2

With reference to the statics, equilibrium of particles:

A spring has a stiffness of $k = 800\,N/m$ and an unstretched length of 200 mm. If spring is held in the position as shown in Figure 2 below,

a) Draw and label the free body diagram,

(4 marks)

b) Calculate the force in the spring and

(4 marks)

c) Determine the force in cables BC and BD.

(12 marks)

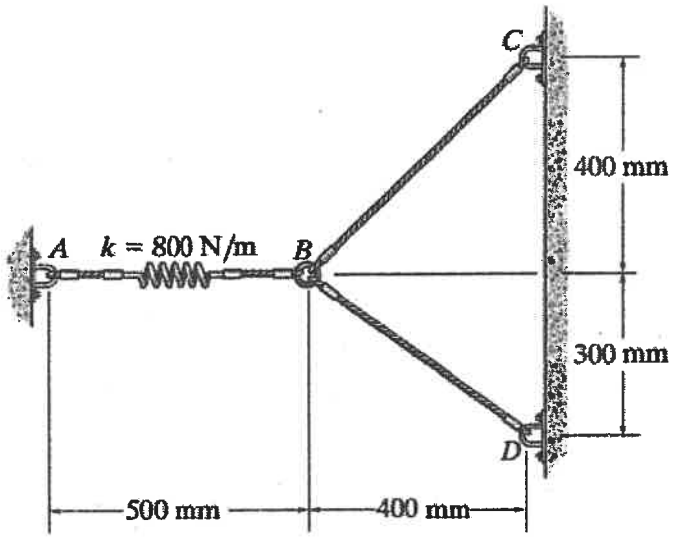


Figure 2. Two cables BC and BD mounted with spring.

Question 3

With reference to the dynamics, kinematics of linear motion:

The train in Figure 3 starts from rest at station *A* and accelerates at 0.5 m/s^2 for 60 s. Afterwards it travels at a constant velocity for 15 minutes. It then decelerates at 1 m/s^2 until it is brought to rest at station *B*. Determine:

(a) the constant velocity which the train travels for 15 min

(4 marks)

(b) the time taken by train from when it started decelerating until it is brought to rest at station *B* and

(4 marks)

(c) the total distance between station A and station B.

(12 marks)

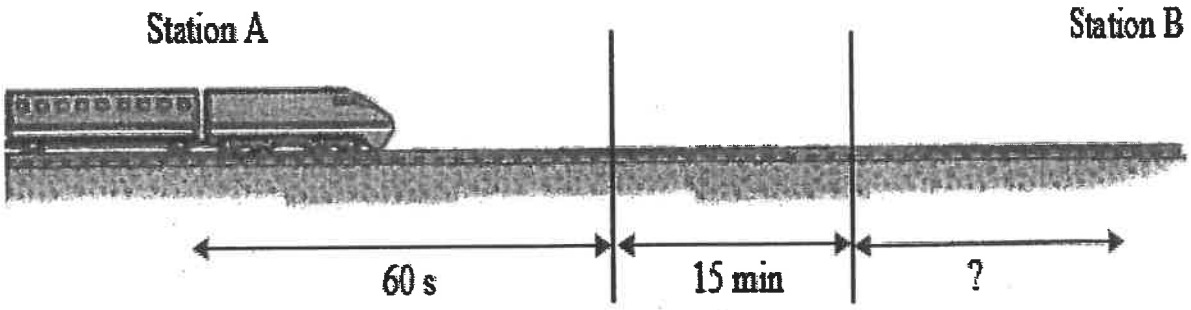


Figure 3. The time frame for a train which moved from Station A to Station B

SECTION B (Total: 40 marks)

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

Question 4

With reference to the statics, centroid and center of gravity:

Determine the distance $\bar{z}$ to the centroid of the shape in Figure 4 which consists of a cone with a hole of 100 mm diameter and height, h = 50 mm bored into its base.

(20 marks)

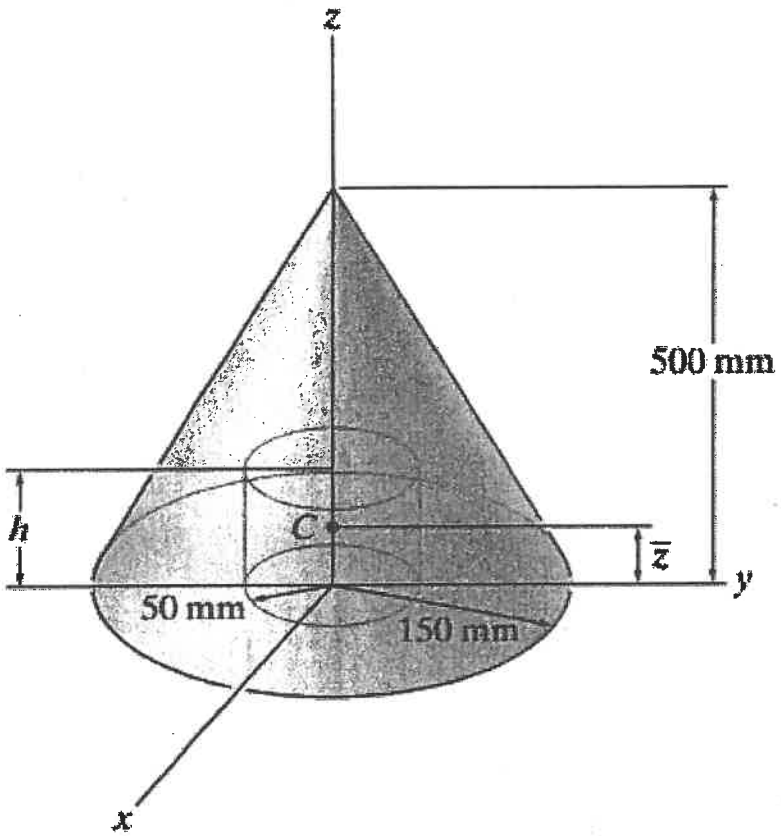


Figure 4 The small cylinder bored from the cone

Question 5

With reference to the dynamics:

(a) Describe the meaning of Work in dynamics term.

(4 marks)

(b) A 2 Mg car as shown in Figure 5 has a velocity of $v_1 = 100\,km/h$ when the driver sees an obstacle in front of the car. It takes 0.75 s for him to react and lock the brakes, causing the car to skid. If the coefficient of kinetic friction between the tires and the road is $\mu_k = 0.25$, determine

i. the normal reaction to the car

(3 marks)

ii. the frictional forces acting on the car

(3 marks)

iii. the distance travelled by car during the reaction time (before the driver locked the brakes), and

(4 marks)

iv. the total distance travelled by car before it stops.

(6 marks)

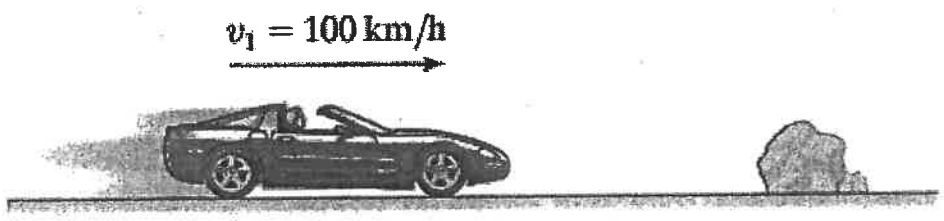


Figure 5: The obstacle and the car situated on the road

Question 6

With reference to the dynamics, Impulse, momentum and impact:

(a) Describe the meaning of impact.

(4 marks)

(b) State **TWO (2)** types of impact.

(2 marks)

(c) A ball as shown in Figure 6 strikes the smooth wall with a velocity $(v_b)_1 = 20\,m/s$. The coefficient of restitution between the ball and the wall is e = 0.75. Determine the velocity of the ball just after the impact and the value of angle θ.

(14 marks)

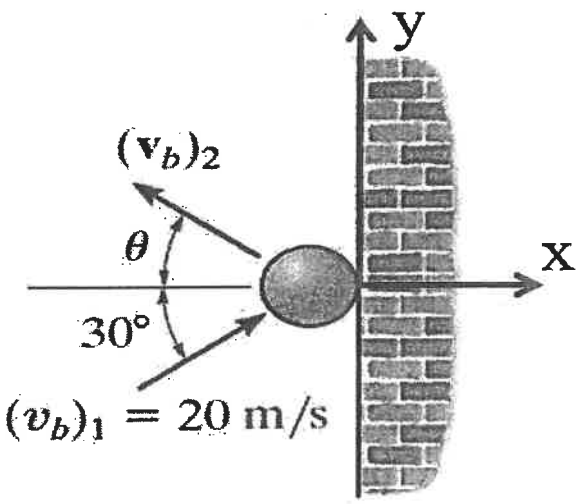
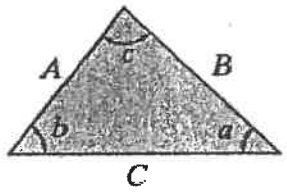


Figure 6: The ball strikes the smooth wall

END OF EXAMINATION PAPER

Appendix 1 Formulae

$F_s = ks$ $v = v_o + a_c t$ $s = s_o + v_o t + (1/2)\, a_c t^2$ $v^2 = (v_o)^2 + 2a_c(s - s_o)$	$\sum mv_1 = \sum mv_2$ $T_1 + \sum U_{1-2} = T_2$ $e = \dfrac{(v_B)_2 - (v_A)_2)}{(v_A)_1 - (v_B)_1}$
$\bar{x} = \dfrac{\sum \tilde{x} A}{\sum A}$ $\bar{y} = \dfrac{\sum \tilde{y} A}{\sum A}$	$\bar{x} = \dfrac{\sum \tilde{x} V}{\sum V}$ $\bar{y} = \dfrac{\sum \tilde{y} V}{\sum V}$
$a_n = \dfrac{v^2}{\rho}$ $a_t = v = \dfrac{dv}{dt} =$ $a = \sqrt{{a_t}^2 + {a_n}^2}$	$I_x = I_x + A\,(d_y)^2$ $x_B = x_A + (v_A)_x t$ $y_B = y_A + (v_A)_y t + \dfrac{1}{2} a_y t^2$
	Cosine law: $C = \sqrt{A^2 + B^2 - 2AB\cos c}$ Sine law: $\dfrac{A}{\sin a} = \dfrac{B}{\sin b} = \dfrac{C}{\sin c}$
$F_{Rx} = \sum F_x$ $F_{Ry} = \sum F_y$	$F_R = \sqrt{F_{Rx}^2 + F_{Ry}^2}$ and $\theta = \tan^{-1}\left\lvert\dfrac{F_{Ry}}{F_{Rx}}\right\rvert$