UNIVERSITI KUALA LUMPUR
MALAYSIA ITALY DESIGN INSTITUTE

FINAL EXAMINATION

MARCH 2026 SEMESTER

COURSE CODE	:	PTB30203
COURSE TITLE	:	ENGINEERING MECHANICS:DYNAMICS
PROGRAMME NAME	:	BACHELOR OF ENGINEERING TECHNOLOGY WITH HONOURS
DATE	:	29 JUNE 2026
TIME	:	2:00PM - 4:30PM
DURATION	:	2 HOURS 30 MINUTES

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. This question paper consist of ONE sections.
4. Section A consist of five questions. Answer FOUR (4) questions only.
5. Please write your answer on the answer booklet provided.
6. Please answer all questions in English only.
7. Refer to the attached Formula/ Appendies. ☐ *Tick if applicable*

THERE ARE 6 PAGES OF QUESTIONS INCLUDING THIS PAGE

SECTION A (Total: 100 marks)

Answer FOUR (4) questions.

Please use the answer booklet provided.

Question 1

A boy is standing on a cliff at a height of 26 m (point A), as shown in figure. To the right of the cliff, there is a obstruction of rock formation at a height of 16 m (point B). He throws a rock horizontally with an initial velocity of u = 23 m/s .

Refer Below - Figure1 : A boy throws a rock from point A .

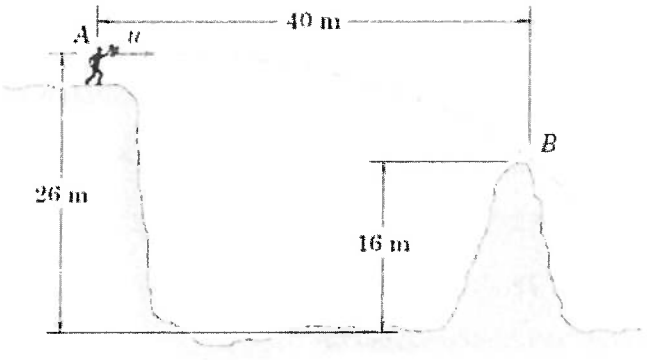


Figure 1: A boy throws a rock from point A

(a) Calculate the magnitude of the velocity when the rock reaches the height of 10.5 m above the ground.

(6 marks)

(b) Calculate the height of the rock from the ground when it reaches it reaches a horizontal distance of 40 m. Based on your result, does the rock clear the obstruction at point B?

(10 marks)

(c) In order for the boy to be able to throw the rock beyond the point B, what is the minimum horizontal velocity that he needs to throw?

(5 marks)

(d) Using the new value of velocity in (c), calculate the rock's total time of flight until it hits the ground level. Assume air resistance is negligible.

(4 marks)

Question 2

A motorcycle rider is travelling, as shown in figure, where his journey starts at origin O. The path taken is described by the equation $y^2 = 2x$, where x is in meters. The rider travels at a constant speed of 60 km/h.

Refer Below - Figure2 : Motorcycle travelling on a path .

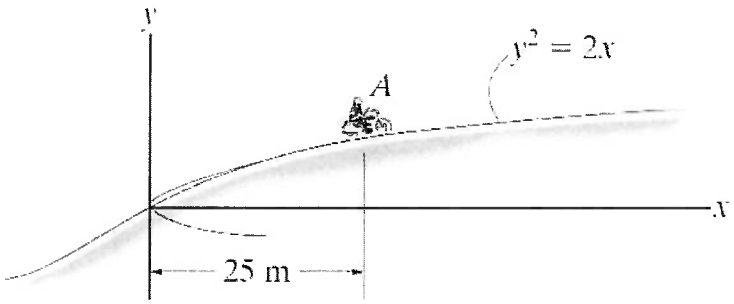


Figure 2: Motorcycle travelling on a path

(a) Determine the numerical values of the first derivative, dy/dx , and the second derivative, d^2y/dx^2 at Point A.

(8 marks)

(b) Using rectangular coordinate, calculate the magnitude of the motorcycle's total acceleration at Point A.

(17 marks)

Question 3

Figure shows a small block of 2 kg mass slides along a smooth track, passing point A and B. The curved section of the track has a radius of curvature, ρ. As the block passes the peak at Point B, it is traveling to the right direction with a speed of 3.5 m/s.

Refer Below - Figure3 : An object slides along a track .

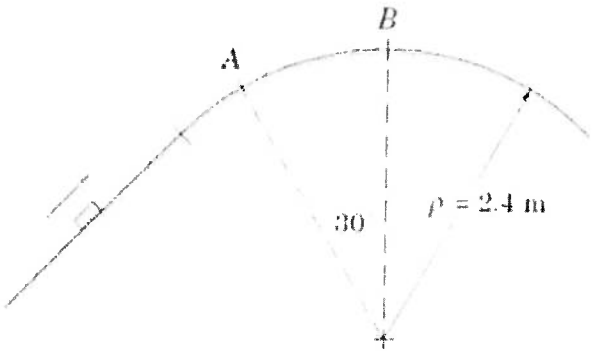


Figure 3: An object slides along a track

(a) Draw the Free Body Diagram of the block at point A and point B, respectively. (Hint: Use n-t diagram)

(4 marks)

(b) Determine the magnitude of the normal force, N_B, exerted by the track on the block at the instant it reaches the peak (Point B). Does the block remain in contact with the track?

(6 marks)

(c) Calculate the magnitude and direction of the total acceleration vector at Point A. (Hint: Use both the tangential component and the normal component of acceleration)

(6 marks)

(d) Assuming the track is frictionless between Point A and Point B, calculate the speed of the block when it passes Point A. (Hint: Use principle of conservation of energy)

(5 marks)

(e) Determine the maximum speed of the block in order to maintain its contact with the track at point A.

(4 marks)

Question 4

Two boats, A and B, leave the pier P at the same instant and travel in the directions shown in the figure. Each boat travels at a constant speed of v_A = 40 m/s and v_B = 30 m/s, respectively.

Refer Below - Figure4 : Two boats leaving pier at different direction .

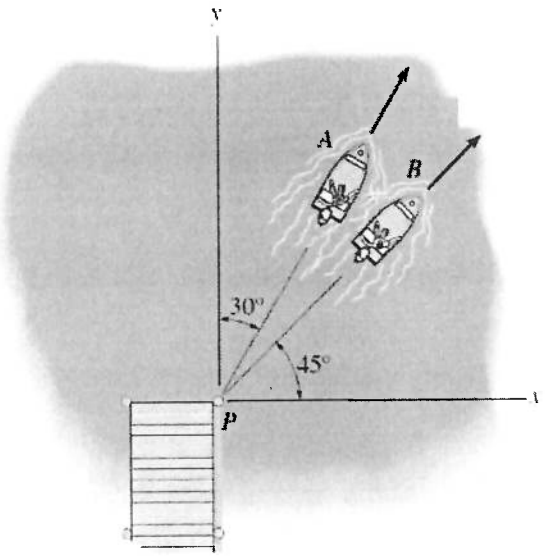


Figure 4: Two boats leaving pier at different direction

(a) Draw the vector diagram showing the velocity direction of v_A and v_B and the relative velocity of boat A with respect to boat B, $v_{A/B}$.

(6 marks)

(b) Determine the speed of boat A and its angle as observed from boat B.

(15 marks)

(c) How long after leaving the pier will the boats be 1500 m apart?

(4 marks)

Question 5

Figure shows a reel is attached to a cable with an applied force of P = 60 N. The reel is initially resting on the two rollers A nd B of the dispenser and consequently turns after force P is applied. The reel has a mass of 200 kg and a radius of gyration about its rotating axis of 0.6 m. Assume the mass of the rollers and the mass of the cable is negligible.

Refer Below - Figure5 : Arrangement of reel and cable .

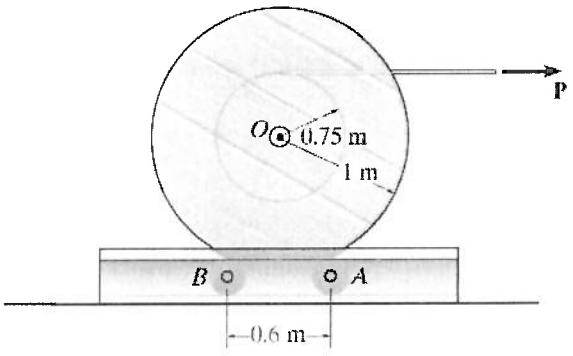


Figure 5: Arrangement of reel and cable

(a) What is the mass moment of inertia of the reel about its center O?

(5 marks)

(b) Calculate the total work done by force P, , for reel to rotate 2 revolutions.

(8 marks)

(c) Determine the angular velocity of the reel after it has made 2 revolutions, starting from rest. (Hint: Use principle of work and energy)

(12 marks)

END OF EXAMINATION PAPER

Formulae

Kinematics of Particle

$v = \frac{ds}{dt}$	$a = \frac{dv}{dt}$	$a = v\frac{dv}{ds}$
$a \cdot ds = v \cdot dv$	$\frac{d}{dx}(uv) = v\frac{du}{dx} + u\frac{dv}{dx}$	$\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$
$v = v_o + at$	$S = v_o t + (1/2)at^2$	$v^2 = v_o^2 + 2aS$
$v_{B/A} = v_B - v_A$	$a = v^2/\rho$	$\rho = \frac{[1 + (dy/dx)^2]^{3/2}}{\lvert d^2y/dx^2 \rvert}$

Kinetics of Particle

$PE = mgh$	$KE = \frac{mv^2}{2}$	$SE = \frac{kx^2}{2}$
$F_f = \mu F_n$	$W = Fs$	$T_1 + \sum U_{1-2} = T_2$
$\sum F = ma$	$W = mg$	$P = \frac{W}{t} = Fv$

Kinematics of Rigid Body

$\omega = d\theta/dt$	$\alpha = d^2\theta/dt$	$\alpha \cdot d\theta = \omega \cdot d\omega$
$\omega = \omega_o + \alpha t$	$\theta = \omega_o t + (1/2)\alpha t^2$	$\omega^2 = \omega_o^2 + 2\alpha\theta$
$S = r\theta$	$v = r\omega$	$a = r\alpha$

Kinetics of Rigid Body

$I = \frac{mr^2}{2}$ (solid disc/shaft)	$P = \frac{W}{t} = Fv$	$W = M\theta$
$\sum M = I\alpha$	$U_M = \int_{\theta_1}^{\theta_2} M d\theta$	$I = mk^2$
	$KE = \frac{I\omega^2}{2}$	