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Code No. : 12128 N/O

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS), HYDERABAD

Accredited by NAAC with A++ Grade

B.E. II-Semester Main & Backlog Examinations, August-2023

Engineering Mechanics

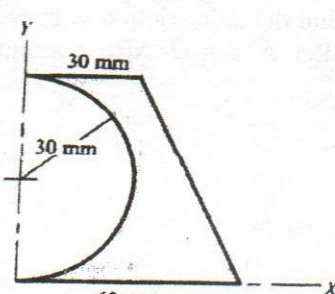
(Common to Civil, EEE & Mech.)

Time: 3 hours

Max. Marks: 60

Note: Answer all questions from Part-A and any FIVE from Part-B

Part-A (10 × 2 = 20 Marks)

Q. No.	Stem of the question	M	L	CO	PO
1.	Define the product of inertia.	2	1	1	1
2.	State the parallel axis theorem for finding mass moment of inertia.	2	1	1	1
3.	Explain curvilinear motion with an example from real-world applications.	2	1	2	1
4.	Define instantaneous centre of rotation by means of an example.	2	1	2	1
5.	What is the difference between kinematics and kinetics?	2	1	3	1
6.	What do you mean by the term 'dynamic equilibrium'?	2	2	3	1
7.	State the principle of work-energy that is applied to a particle in translation motion.	2	1	4	1
8.	A block of weight 50 N is placed on a smooth inclined plane which makes 45 degrees with horizontal. Calculate the work done when the block is pulled by 5m?	2	2	4	2
9.	Define conservation of linear momentum principle.	2	1	5	1
10.	Define the coefficient of restitution in the context of collisions between two objects.	2	1	5	1
Part-B (5 × 8 = 40 Marks)					
11. a)	Find the product of inertia of the shaded area shown in Fig. 1 about the specified X and Y axes.	4	3	1	2
 <p>Figure 1</p>					
b)	Determine the mass moment of inertia of a homogeneous sphere of radius r with respect to a diameter.	4	2	1	2
12. a)	A particle has an initial velocity of 60 m/s up and to the right at a slope of 0.75. The components of accelerations are constant at $a_x = -3.5 \text{ m/s}^2$ and $a_y = -6 \text{ m/s}^2$. Compute the radius of curvature at the start and at the end of the path.	4	3	2	2

b) A ball thrown by a boy in the street is caught by another boy on a balcony of a building 4 m above the ground and 18 m away after 2 sec. Calculate the initial velocity and the angle of projection.

4 3 2 2

13. a) The two bodies in Fig. 2 are separated by a spring. Their motion down the incline is resisted by a force $P = 900 \text{ N}$. The coefficient of kinetic friction is 0.3 under A and B. Determine the force in the spring.

4 3 3 2

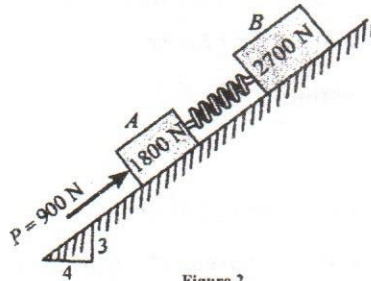


Figure 2

b) Refer to Fig. 3, assume A weighs 900 N and B weighs 30 N. Determine the acceleration of the bodies if the coefficient of kinetic friction is 0.1 between the cable and the fixed drum. Assume an angle of overlap of 180 degrees between the cable and the drum.

4 3 3 2

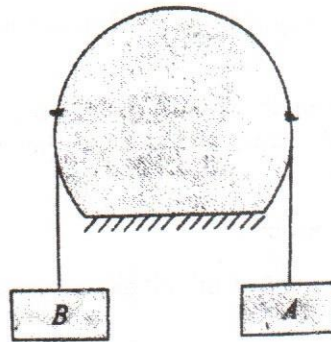


Figure 3

14. a) Body A in Fig. 4 drops 3.6 m from rest before striking the ground. Pulley B is mounted on an axle 0.075 m in radius, and the axle friction is constant at 175 N. How many turns will B make after A stops? Also compute the tension in the cord before A hits the ground.

5 4 4 2

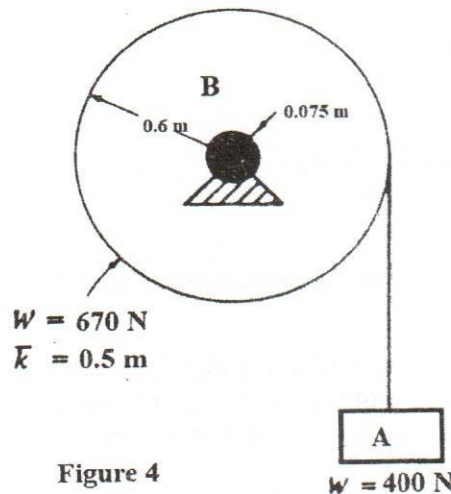


Figure 4

- b) A sphere, of 100 N weight rolling with initial velocity 9 m/s, starts up a plane inclined 30 degrees with the horizontal as shown in Fig. 5. How far will it roll up the plane?

3 3 4 2

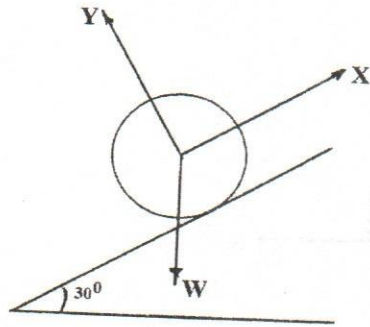


Figure 5

15. a) The system shown in Fig. 6 is moving rightward at a velocity of 5 m/s when a constant horizontal force P is applied as shown. Determine the value of P that will give the system a leftward velocity of 10 m/s in a time interval of 10 s. Coefficient of kinetic friction is 0.30.

4 4 5 2

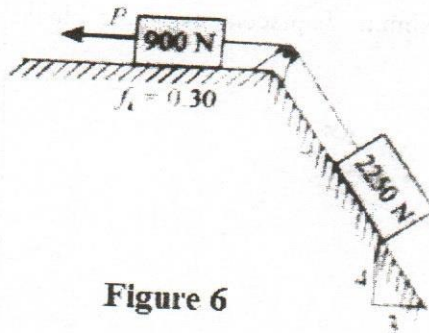


Figure 6

- b) A bullet weighing 0.3 N and moving at 670 m/s penetrates the 45 N body as shown in Fig. 7 and emerges with a velocity of 180 m/s. How far and how long does the body then move?

4 3 5 2

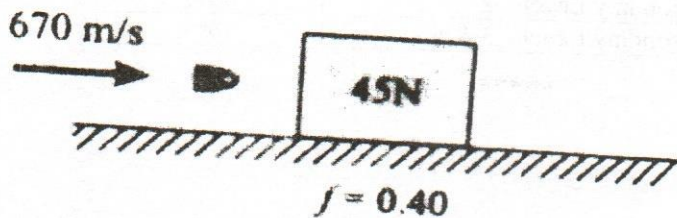


Figure 7

16. a) Determine the product of inertia of the quarter circular area shown in Fig. 8 with respect to the given X and Y axes.

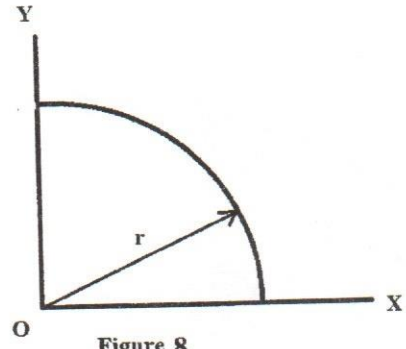


Figure 8

4 2 1 2

b) What is a rigid body? Explain various motions a rigid body can undergo with sketches.

4 2 2 1

17. Answer any *two* of the following:

a) How D'Alembert's principle is useful in kinetics of particles? Explain with a suitable example.

4 2 3 1

b) A block of weight 75 N is pushed up along a 20 degrees inclined plane with a velocity of 10 m/s. Assume the coefficient of kinetic friction between the plane and the block is 0.2. Find the maximum displacement of the block before it comes to rest. (Refer Fig. 9)

4 3 4 2

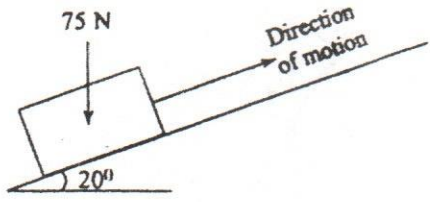


Figure 9

c) A 20-kg block A moving 12 m/s horizontally to the right meets a 16-kg block B moving 8 m/s horizontally to the left. If the coefficient of restitution is $e = 0.7$, determine the speeds of A and B immediately after impact.

4 2 5 2

M : Marks; L: Bloom's Taxonomy Level; CO; Course Outcome; PO: Programme Outcome

i)	Blooms Taxonomy Level - 1	20%
ii)	Blooms Taxonomy Level - 2	30%
iii)	Blooms Taxonomy Level - 3 & 4	50%
