An AUTONOMOUS Institution

ACE-R20

Question Paper Code: ME203ES

Semester End Examination
I B. Tech- II Semester- September /October 2021
Engineering Mechanics
(common to CIVIL, MECH)

Time: 3 Hours   Max. Marks: 70
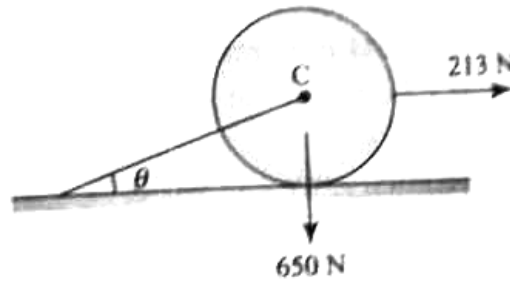
H. T. No

Answer any five full questions from the following. All Questions carry equal marks.
M=Marks; CO=Course Outcomes; PO= Program Outcomes

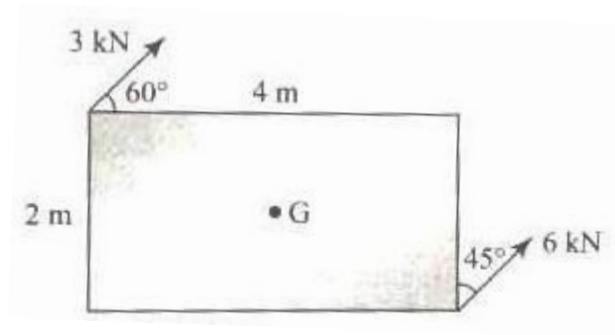| Q.No	Question	M	CO	PO
1. a)	Two loads are suspended from flexible cable APQD as shown in figure. Neglating self weight of cable, determine the tension in segments AP, PQ, and QD. Also determine the value of β and x.	7	1	1,2
b)	A cylindrical wooden log of 1200kg is kept within inclined planes, which are mutually perpendicular as shown in figure. Considering contact surface smooth, determine the forces of reaction.	7	1	1,2

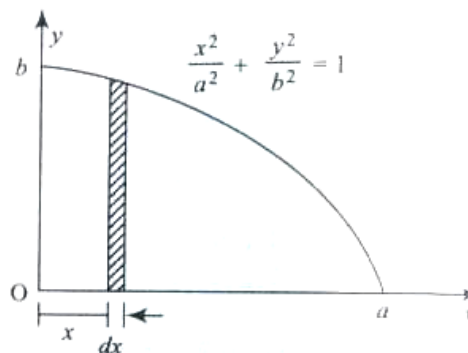| 2. a)	a right circular roller of weight 650 N rests on a smooth horizontal floor and is kept in position with a string. Determine the tension in the string and floor reaction if there is a pull of 213 N	7	1	1,2

213 N

C

θ

650 N

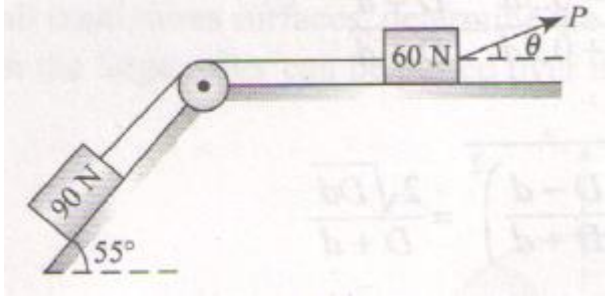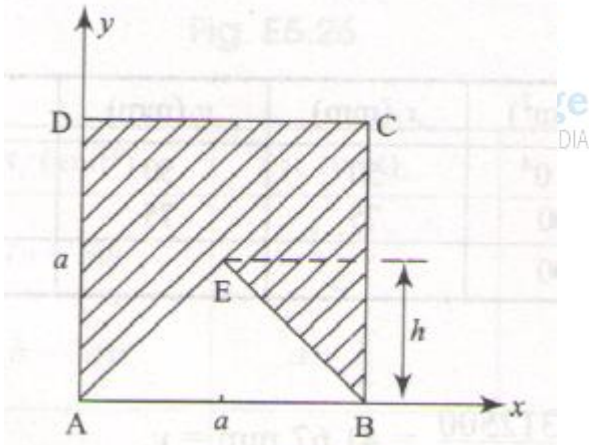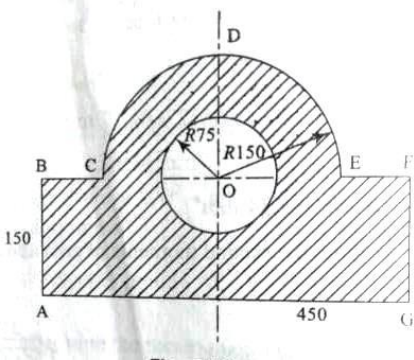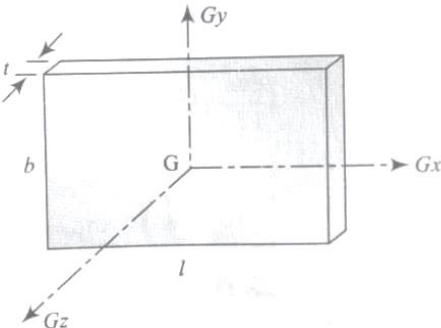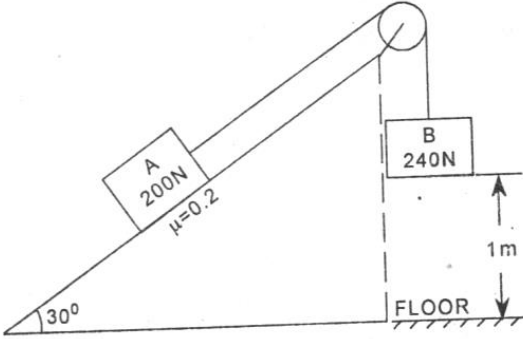| b)	A 2 m X 4 m plate is subjected to a system of two coplanar forces as shown in figure. Determine the equivalent action at centroid of the plate that may replace the force system.	7	1	1,2,3

3 kN

60°   4 m

2 m   • G

45° 6 kN

3. a)	Using direct integration method, determine the coordinates of the centroid of quarter of an ellipse $x^2/a^2 + y^2/b^2 = 1$.	7	2	1,2

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

y

b

O

x   dx

a

b)	With neat sketches explain the frictional phenomena associated with the working principle of differential jack.	7	2	1,2	
4. a)	Determine the least value of P to cause motion to impend rightwards. Assume the pulley frictionless and coefficient of friction of all contiguous surfaces is 0.2.	7	2	1,2,1	

b)	An isosceles triangle ABE is to be cut from a square ABCD of side a. Determine the altitude h of this triangle, so that its vertex E will be the centroid of the shaded area.	7	2	1,2,1	

5. a)	Compute the second moment of the area of the bearing block with respect to its base.	7	3	1,3	

		7	3	1,2
b)	Determine the mass moment of intertia of a rectanglular plate shown in figure with respect to centroidal axis. Take mass density as ρ.			

6.	Two blocks A and B are connected as shown. When the motion begins the block B is in 1m above the floor. Assuming the pulley to be frictionless and weightless, determine a) The velocity of the block A when the block B touches the floor. b) How far the block A will move up the plane.	14	3	2,3,4

7. a)	A bar of 4m long and of small cross section rotates in a horizontal plane about a vertical axis through one end. It accelerates uniformly from 600 rev/min to 900 rev/min in an interval of 5 seconds. What are the normal and tangential components of acceleration of the mid points of bar 4 seconds after acceleration begins.	7	4	1,2,3
b)	A railway car is moving with a velocity of 20m/s. The diameter of the wheel is 1m. The wheel is running on a straight rail without slipping. Find the velocity of the point on the circumference at 60° in the clockwise direction from the top at any instant.	7	4	1,2
8. a)	A ball thrown vertically upward at 20 m/s from a window 50 m above the ground. Determine the (i) Maximum rise of the ball from ground, and (ii) time and velocity of the ball hitting the ground.	7	5	1,3
b)	A motorist travelling at 18 kmph applies brakes suddenly and comes to rest skidding 75m. Determine the time required to stop the car.	7	5	1,3