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PES UNIVERSITY

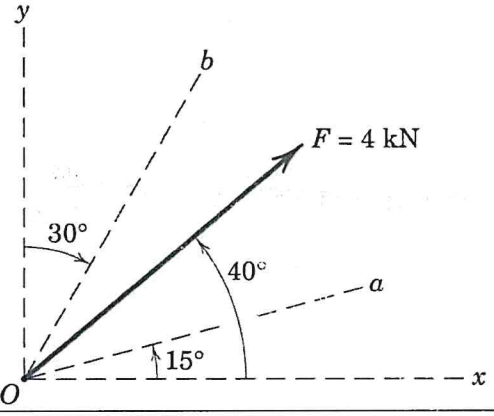
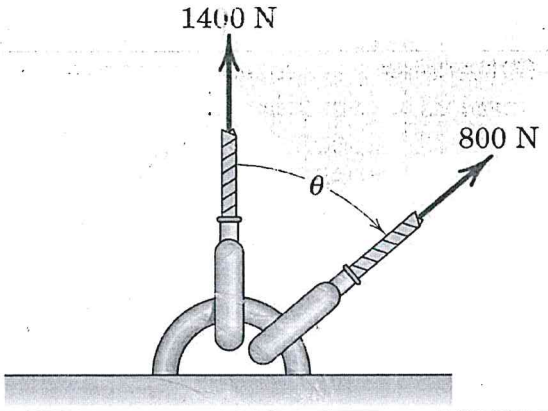
PES University, Bengaluru
(Established under Karnataka Act No. 16 of 2013)

UE20CV101

MAY 2022: END SEMESTER ASSESSMENT B. TECH. I/II SEMESTER

UE20CV101 – ENGINEERING MECHANICS STATICS

Time: 3 Hrs	Answer All Questions	Max Marks: 100

1	a)	State and prove Varignon's Theorem.	05
	b)	Determine the components F_a and F_b of the 4-kN force along the oblique axes a and b. Determine the projections P_a and P_b of F onto the a- and b-axes. 	07
	c)	At what angle θ must the 800-N force be applied in order that the resultant R of the two forces has a magnitude of 2000 N? For this condition, determine the angle β between R and the vertical. 	08

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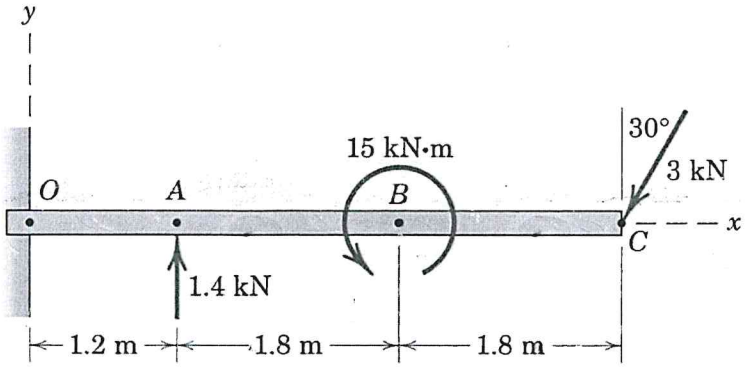
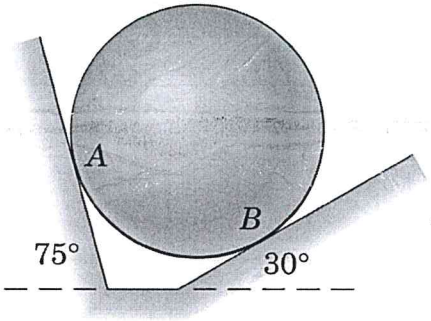
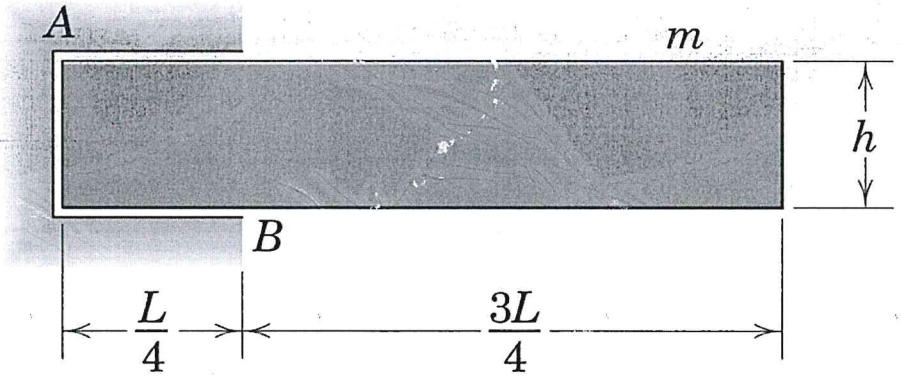
2	a)	The 500-kg uniform beam is subjected to the three external loads shown. Compute the reactions at the support point 0. The x-y plane is vertical. 	06
	b)	The 20-kg homogeneous smooth sphere rests on the two inclines as shown. Determine the contact forces at A and B. 	07
	c)	The uniform rectangular body of mass m is placed into a fixed opening with slight clearances as shown. Determine the forces at the contact points A and B. Do your results depend on the height h? 	07

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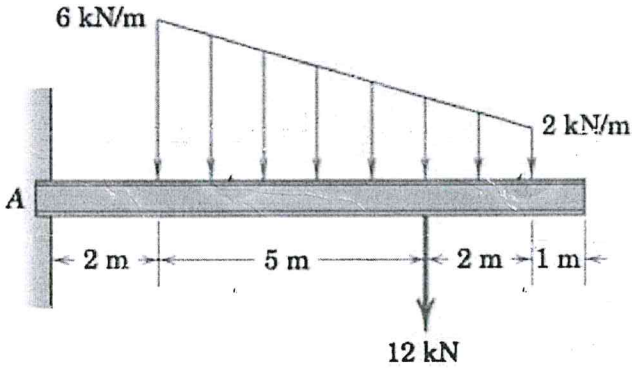
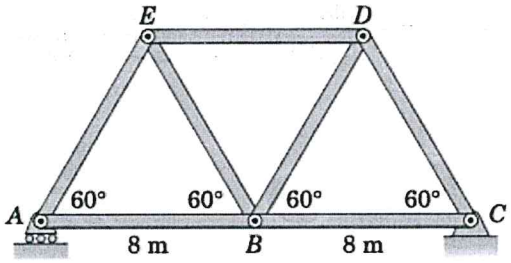
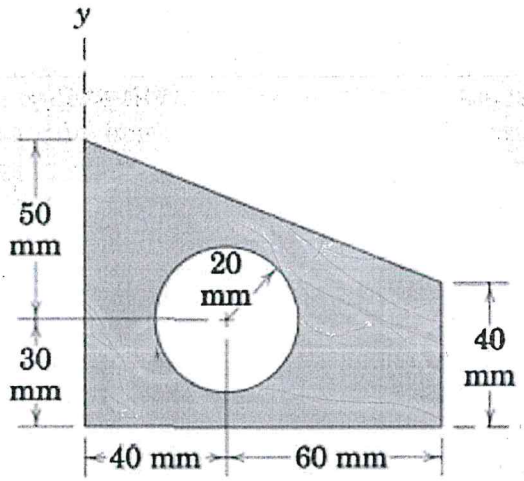
3	a)	Illustrate the various types of beams with a neat sketch.	06
	b)	Determine the force and moment reactions at A for the cantilever beam subjected to the loading shown. 	08
	c)	Each member of the truss is a uniform 8-m bar with a mass of 400 kg. Calculate the average tension or compression in each member due to the weights of the members as shown in figure 	06
4	a)	Determine the x- and y-coordinates of the centroid of the shaded area. 	06
	b)	State and prove parallel axis theorem.	06

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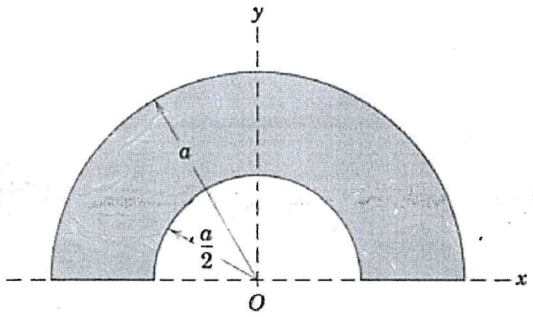
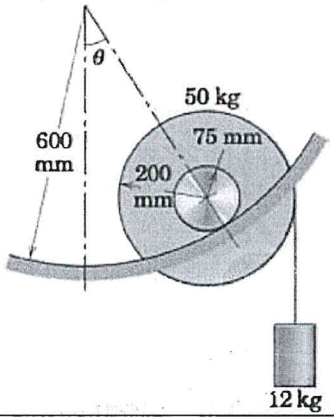
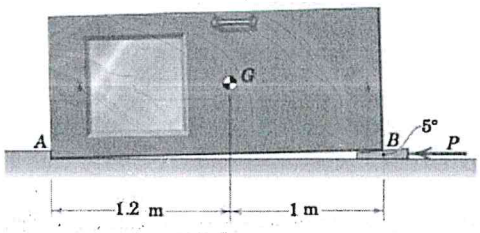
	c)	Determine the rectangular and polar radii of gyration of the shaded area about the axes shown. 	08
5	a)	What are the types of friction? Briefly explain them.	06
	b)	The 50-kg wheel rolls on its hub up the circular incline under the action of the 12-kg cylinder attached to a cord around the rim. Determine the angle θ at which the wheel comes to rest, assuming that friction is sufficient to prevent slippage. What is the minimum coefficient of static friction which will permit this position to be reached with no slipping? 	06
	c)	The 100-kg industrial door with mass center at G is being positioned for repair by insertion of the 5^0 wedge under corner B. Horizontal movement is prevented by the small ledge at corner A. If the coefficients of static friction at both the top and bottom wedge surfaces are 0.60, determine the force P required to lift the door at B. 	08