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PES UNIVERSITY

PES University, Bengaluru

(Established under Karnataka Act No. 16 of 2013)

UE20CV101

AUGUST 2021: END SEMESTER ASSESSMENT B Tech II SEMESTER

UE20CV101 - ENGINEERING MECHANICS - STATICS

Time: 3 Hrs | Answer All Questions | Max Marks: 100

1	a)	With a neat sketch explain the Transmissibility of a force	03
	b)	The y-component of the force F which a person exerts on the handle of the box wrench is known to be 320 N. Determine the x-component and the magnitude of F as shown in figure 1.b	04
	c)	The force F acts along line MA, where M is the midpoint of the radius along the x-axis. Determine the equivalent force- couple system at O if θ = 40° as shown in figure 1.c	06
	d)	Four people are attempting to move a stage platform across the floor. If they exert the horizontal forces shown, determine (a) the equivalent force- couple system at O and (b) the points on the x- and y-axes through which the line of action of the single resultant force **R** passes as shown in figure 1.d	07

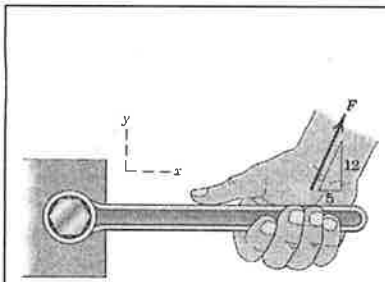

Figure 1. b

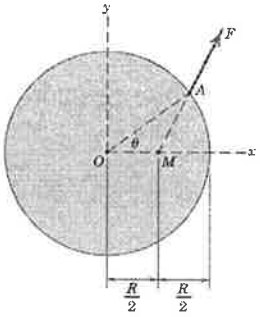

Figure 1. c

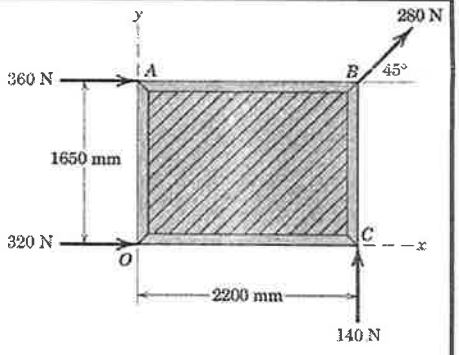

Figure 1. d

2	a)	State and explain the conditions of equilibrium required for a system of coplanar, non- concurrent forces	04
	b)	A woman is holding a 3.6-kg sphere in her hand with the entire arm held horizontally as shown in the figure 2.b. A tensile force in the deltoid muscle prevents the arm from rotating about the shoulder joint 0; this force acts at the 21^0 angle shown. Determine the force exerted by the deltoid muscle on the upper arm at A and the x and y-components of the force reaction at the shoulder joint 0. The mass of the upper arm is mu = 1.9 kg, the mass of the lower arm is m_L = 1. 1 kg, and the mass of the hand is m_H = 0.4 kg; all the corresponding weights act at the locations shown in the figure.	08

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	c)	The right-angle uniform slender bar AOB has mass m. If friction at the pivot O is neglected, determine the magnitude of the normal force at A and the magnitude of the pin reaction at O as shown in figure 2.c	08

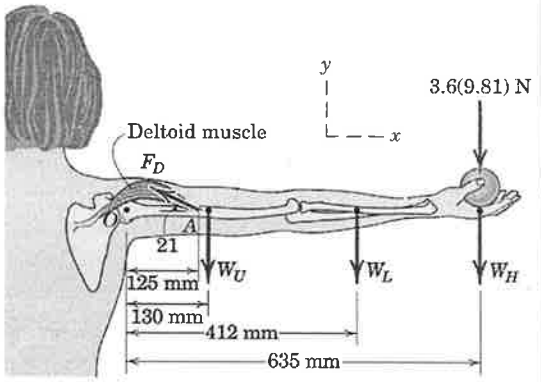

Figure 2. b

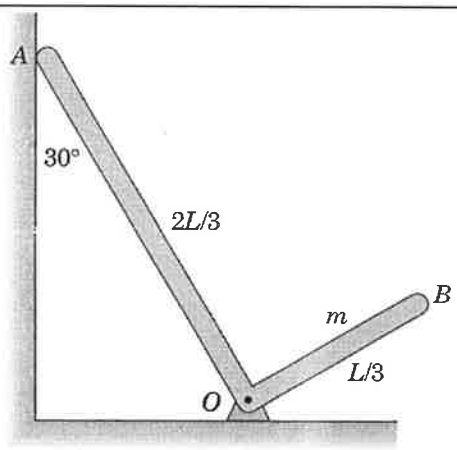

Figure 2. c

3	a)	Differentiate between statically determinant and statically indeterminant beam with examples.	04
	b)	Determine the force in each member of the loaded truss as shown in figure 3.b	08
	c)	Determine the force and moment reactions at A for the cantilever beam subjected to the loading as shown in figure 3.c	08

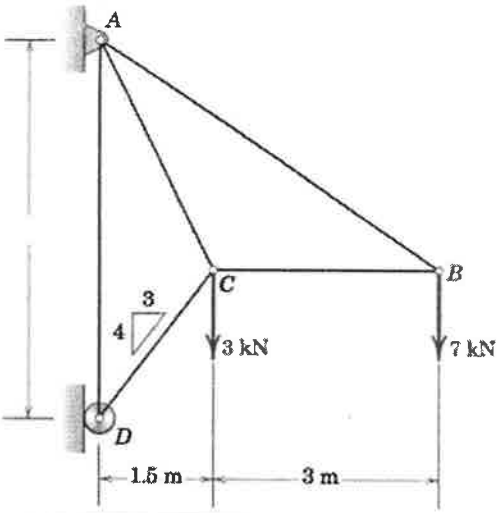

Figure 3. b

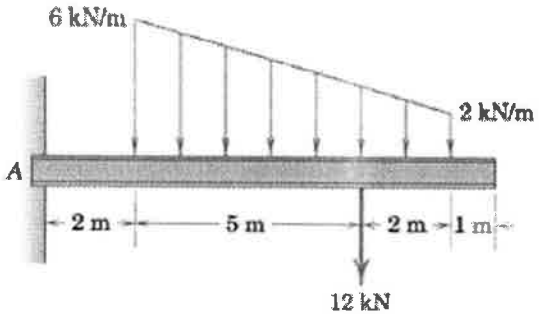

Figure 3.c

4	a)	State and prove the parallel axis theorem.	04
	b)	Determine the x - and y-coordinates of the centroid of the shaded area as shown in figure 4.b	08
	c)	Calculate the moments of inertia of the shaded area about the x- and y-axes as shown in figure 4.c	08

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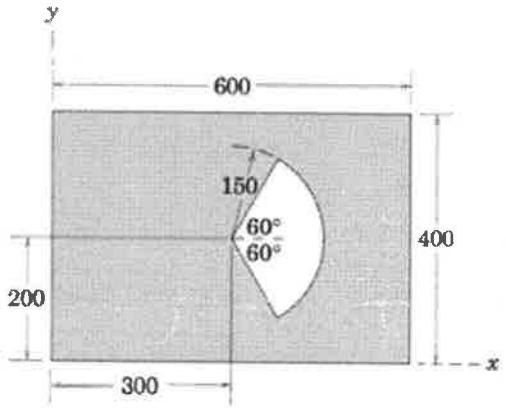

Figure 4. b

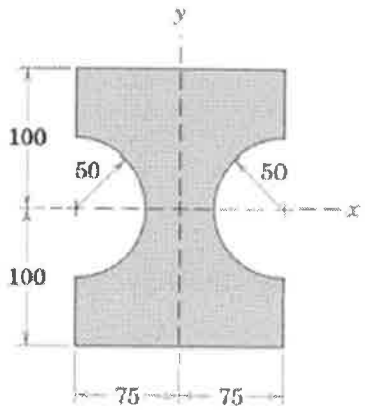

Figure 4. c

5	a)	Explain the theory of Dry (Coulomb) friction, with the help of sketches	**04**
	b)	The rack has a mass m = 75 kg. What moment M must be exerted by the gear wheel in order to (a) lower and (b) raise the rack at a slow steady speed on the greased 60^0 rail? The coefficients of static and kinetic friction are μs = 0.10 and μk = 0.05 as shown in figure 5.b. The fixed motor which drives the gear wheel is not shown.	**08**
	c)	The coefficient of static friction for both wedge surfaces is 0.40 and that between the 27-kg concrete block begins to move down the 20° incline is 0.70. Determine the minimum value of the force P required to begin moving the block down the incline as shown in figure 5.c. Neglect the weight of the wedge.	**08**

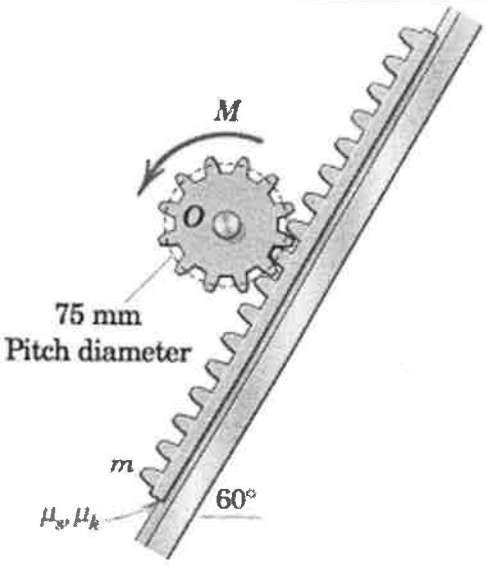

Figure 5.b

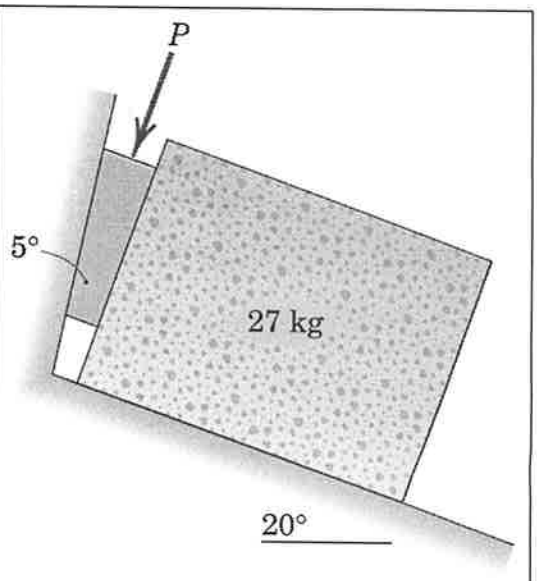

Figure 5.c