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PES University, Bangalore

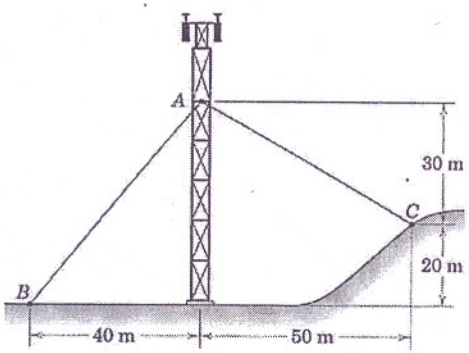
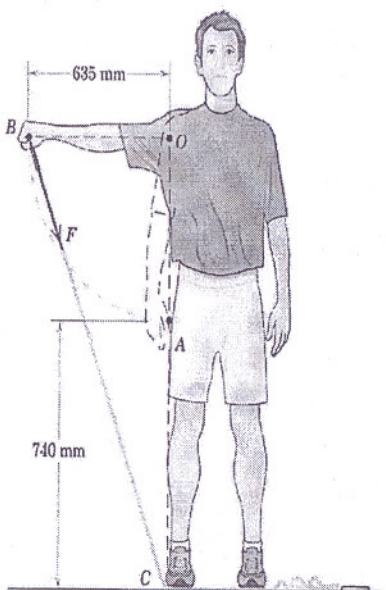
(Established under Karnataka Act 16 of 2013)

UE15CV101

MAY 2016: END SEMESTER ASSESSMENT (ESA) B.TECH. II SEMESTER

UE15CV101- ENGINEERING MECHANICS

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

1.	a)	State and prove the Varignon's theorem as applied to a concurrent force system.	5
	b)	The guy cables AB and AC are attached to the top of the transmission tower. The tension is cable AB is 8 kN. Determine the required tension T in cable AC as shown in Fig 1(b) such that the net effect of the two cable tensions is a downward force at point A. Determine the magnitude R of this downward force.	7
	c)	An exerciser begins with his arm in the relaxed vertical position OA, at which the elastic band is unstreched as shown in Fig 1(c).He then rotates his arm to the horizontal position OB.The elastic modulus of the band is k=60N/m-that is 60N of force is required to stretch the band each additional meter of elongation. Determine the moment about O of the force which the band exerts on the hand B.	8
		 Fig 1(b)  Fig 1(c)	
2.	a)	State and explain the conditions of equilibrium required for a system of coplanar non concurrent forces with a neat sketch.	4
	b)	The two light pulleys are fastened together and form an integral unit. They are prevented from turning about their bearing at O by a cable wound securely around the smaller pulley and fastened to point A. Calculate the magnitude R of the force supported by the bearing O for the applied 2- kN load as shown in Fig 2(b)	8
	c)	The device shown is designed to apply pressure when bonding laminate to each side of a countertop near an edge. If a 120-N force is applied to the handle, determine the force which each roller exerts on its corresponding surface. as shown in Fig 2(c)	8

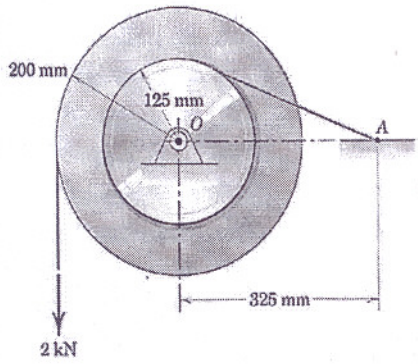


Figure 2(b)

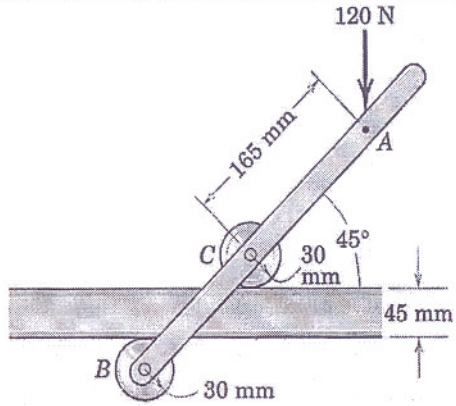


Figure 2(c)

3.	a)	Determine the Centroid for an "area of a triangle" shown in Fig 3(a).Use direct integration method.	5
	b)	Determine the coordinates of the centroid of the shaded area as shown in Fig 3 (b)	7
	c)	The cross section area of an I beam has the dimensions shown in Fig 3(c). I section is symmetrical about x and y axes. Determine the moment of inertia of this I section about the centroidal x axis. Use composite area method to solve the problem.	8

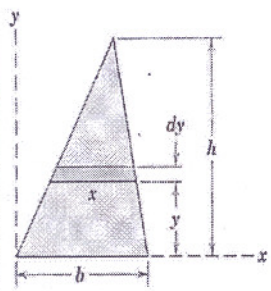


Fig 3(a)

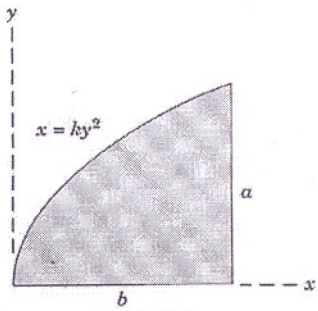


Fig 3(b)

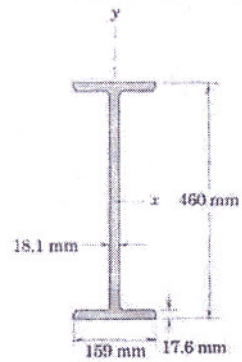


Fig 3(c)

4.	a)	Explain the different types of loadings on a beam with neat sketch.	5
	b)	Determine the reactions at A and B for the beam subjected to a combination of distributed and point loads as shown in Fig 4(b)	7
	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 Fig 4(c)	8

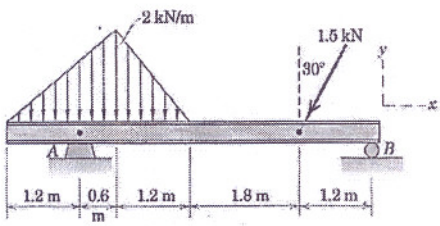


Fig4(b)

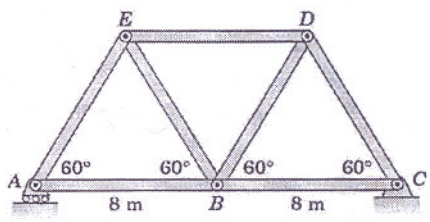


Fig4(c)

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5.	a)	Derive an expression for Belt Friction.	5
	b)	Determine the force P required to (a) raise and (b) lower the 40-kg cylinder at a slow steady speed. The coefficient or friction between the cord and its supporting surface is 0.30 as shown in Fig 5(b)	7
	c)	The force P is applied to the 50-kg block when it is at rest. Determine the magnitude and direction of the friction force exerted by the surface on the block if (a) P=0, (b) P= 200 N, and (c) P= 250 N.(d) What value of P is required to initiate motion up the incline? The static and kinetic coefficients of friction between the block and the incline are μs=0.25 and μk = 0.20, respectively as shown in Fig 5(c)	8

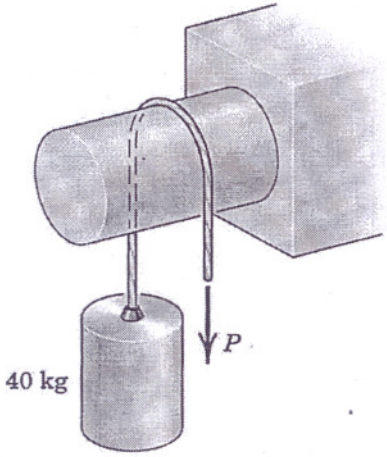

Fig 5(b)

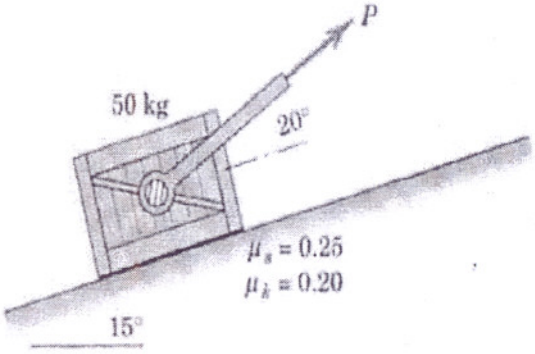

Fig 5(c)