PES UNIVERSITY

PES University, Bangalore
(Established under Karnataka Act 16 of 2013)

UE17CV101

END SEMESTER ASSESSMENT (ESA) B. Tech., II SEMESTER – May 2018

UE17CV101 – Engineering Mechanics

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

1.a.	Determine general expression for the n- and t- components of the tension T which is applied to point A of the bar OA as shown in figure 1.a. Neglect the effect of the small pulley at B. Evaluate your expressions for the T = 100 N and Θ = 35^0.	05
1.b.	Elements of the lower arm are shown in the figure 1.b. The mass of the forearm is 2.3 kg with mass centre at G. Determine the combined moment about the elbow pivot O of the weights of the forearm and the 3.6 kg homogeneous sphere. What must the biceps tension force be so that the overall moment about O is zero?	05
1.c.	Explain the term Force –Couple System with the help of neat sketches.	05
1.d.	As part of a design test, the camshaft-drive sprocket is fixed and then the two forces shown in figure 1.d. are applied to a length of belt wrapped around the sprocket. Find the resultant of this system of two forces and determine where its line of action intersects y- axes.	05

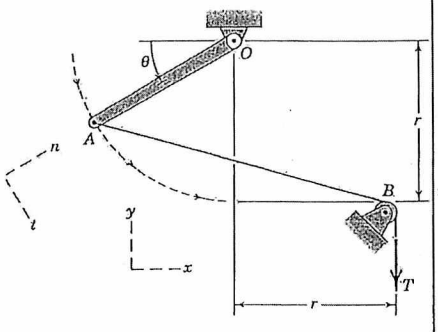


Figure 1.a.

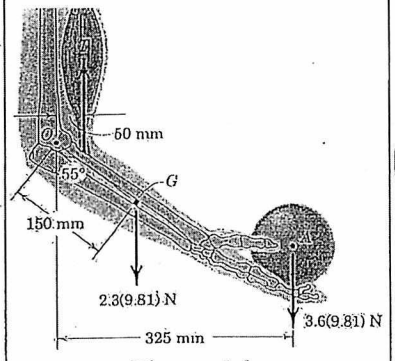


Figure 1.b.

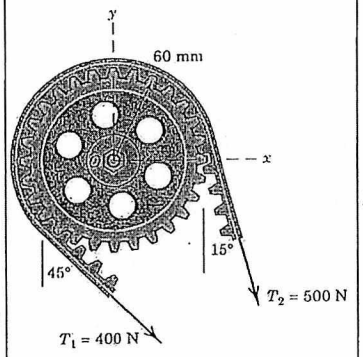


Figure 1.d.

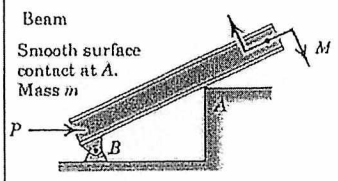


Figure 2.a.1.

2.a.	Draw the free body diagram of the Beam and the rigid system of interconnected bodies analysed as a single unit as shown in figure 2.a.1 and 2.a.2.	05
2.b.	Find the angle of tilt Θ with the horzontal so that the contact force at B will be one-half that at A for the smooth cylinder as shown in figure 2.b.	05
2.c.	In a procedure to evaluate the strength of the triceps muscle, a person pushes down on a load cell with the palm of his hand as indicated in the figure 2.c. If the load-cell reading is 160 N, determine the vertical tensile force F generated by the triceps muscle. The mass of the lower arm is 1.5 kg with mass centre at G.	05
2.d.	Determine the external reaction at A for the roof truss loaded as shown figure 2.d. The vertical loads represent the effect of the supported roofing materials, while the 400-N force represents a wind load.	05

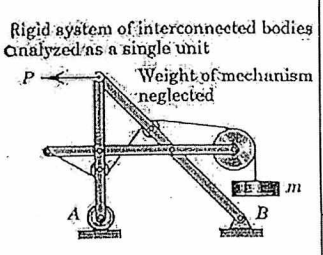


Figure 2.a.2.

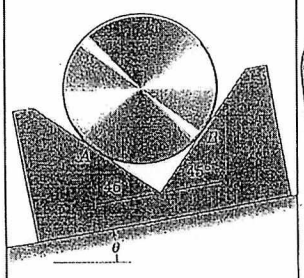


Figure 2.b.

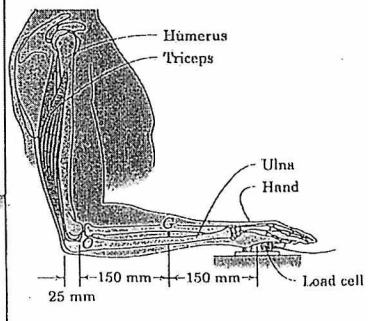


Figure 2.c.

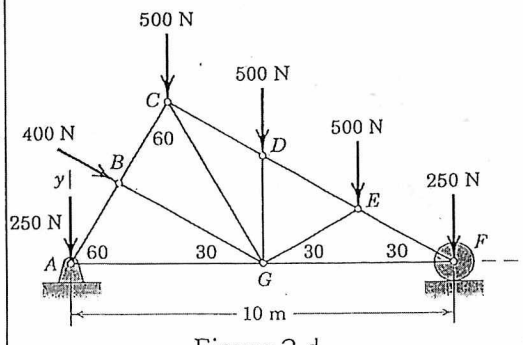
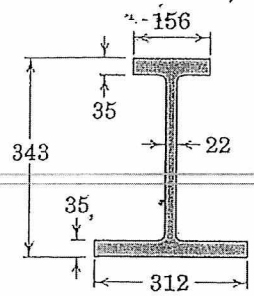


Figure 2.d.

3.a.	Derive an expression to determine the centroid of "area of a circular sector".	0
3.b.	Determine the height above the base of the centroid of the cross-sectional area of the beam as shown in figure 3.b. Neglect the fillets.	0
3.c.	Determine the moment of inertia of the shaded area about the x- and y- axes as shown in figure 3.c.	0



Dimensions in millimeters

Figure 3.b.

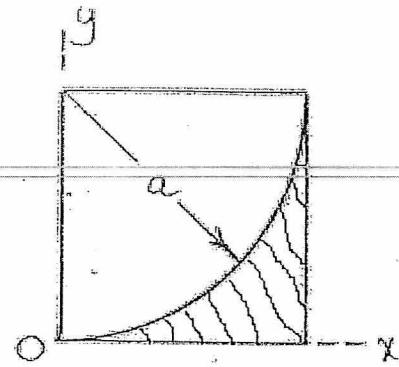


Figure 3.c.

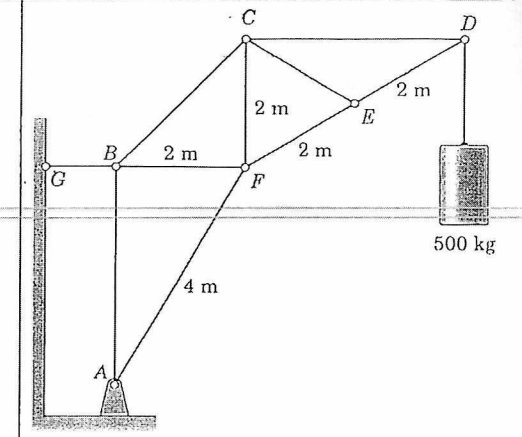


Figure 4.b.

4.a.	Differentiate between statically determinate and statically indeterminate beam with sketch and example.	0
4.b.	Determine the support reaction at A and force in members DC, DE, EF and EC of the truss as shown in figure 4.b. Note the presence of any zero-force members.	0
4.c.	Determine the force [redacted] reactions [redacted] for the beam which is subjected to the load combination as shown in figure 4.c.	0
5.a.	Derive an expression for Belt Friction.	0
5.b.	Determine the minimum co-efficient of static friction μs which will allow the drum with fixed inner hub to be rolled up the 15° incline at a steady speed without slipping as shown in figure 5.b. What are the corresponding values of the force P and the friction force F?	0
5.c.	Determine the range of cylinder mass m for which the system is in equilibrium as shown in figure 5.c. The coefficient of friction between the 50- kg block and the incline is 0.20 and that between the cord and cylindrical support surface is 0.30.	0

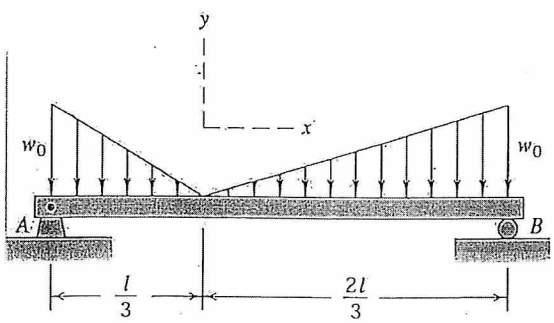


Figure 4.c.

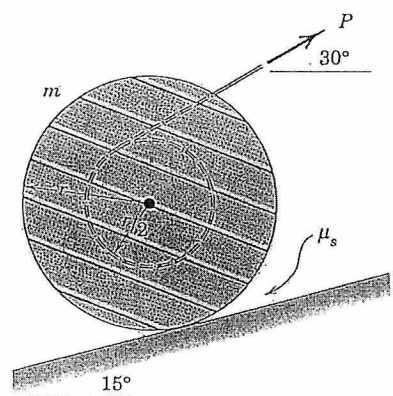


Figure 5.b.

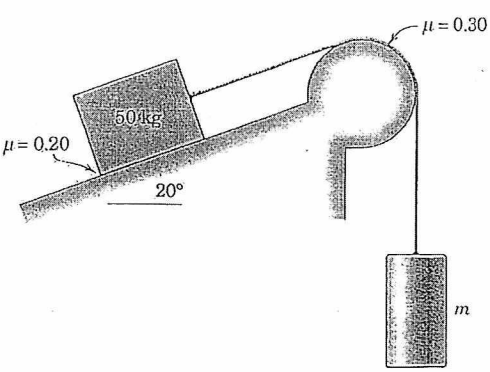


Figure 5.c.