PES UNIVERSITY

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

UE16CV101

END SEMESTER ASSESSMENT (ESA) B. Tech., I SEMESTER – December' 16
UE16CV101 – Engineering Mechanics

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

1.a.	Define with example Free, Sliding and fixed vectors.	06
1.b.	At what angle Θ must the 400-N force as shown in figure 1.b. be applied in order that the resultant R of the two forces has a magnitude of 1000 N? For this condition what will be the angle β between R and the horizontal?	04
1.c.	The device shown in figure 1.c. is a part of an automobile seat-back-release mechanism. The part is subjected to the 4-N force exerted at A and a 300-N.mm restoring moment exerted by a hidden torsional spring. Determine the y-intercept of the line of action of the single equivalent force.	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 with x-axis.	05

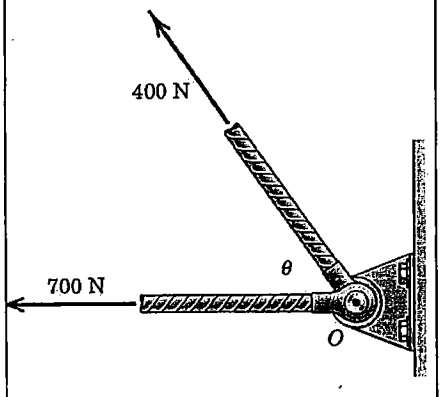


Figure 1.b.

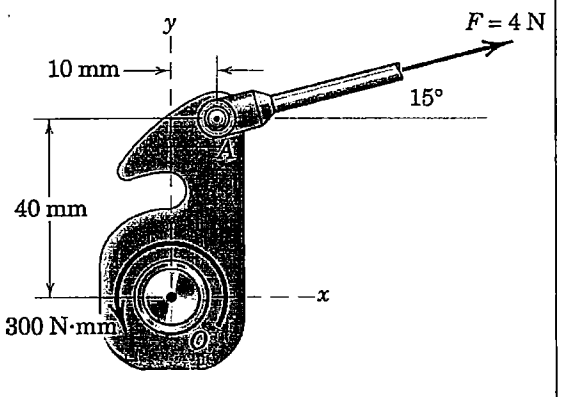


Figure 1.c.

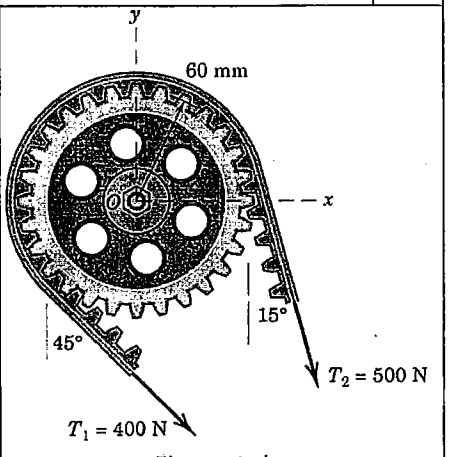


Figure 1.d.

2.a.	What is meant by Free Body Diagram? Why are they important?	04
2.b.	When the 0.05-kg body is in the position shown in figure 2.b., the linear spring is stretched 10 mm. Determine the force P required to break contact at C. Complete solutions for (a) including the effects of the weight and (b) neglecting the weight.	08

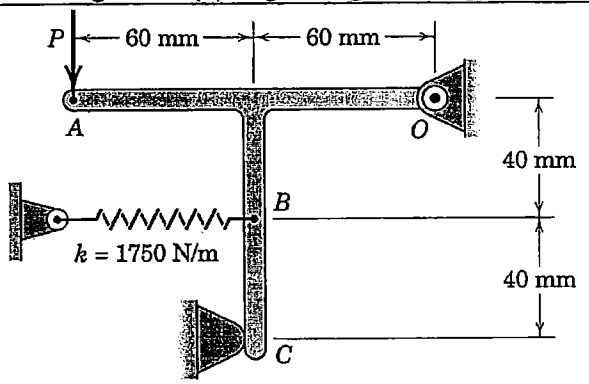


Figure 2.b.

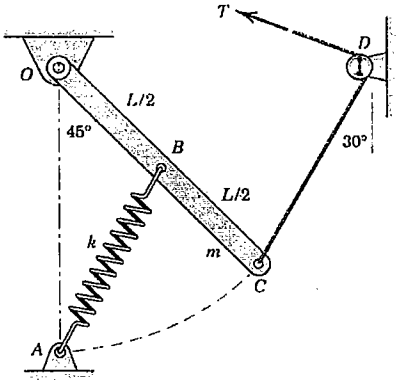
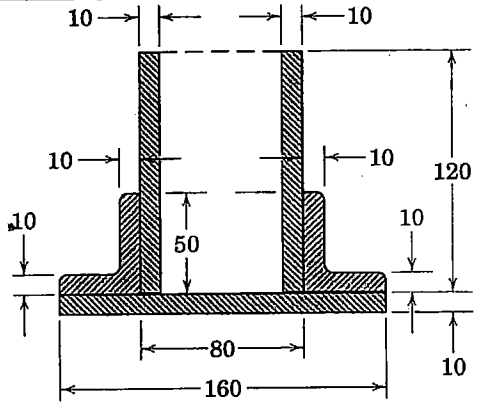


Figure 2.b.

2.c.	The uniform bar OC of length L pivots freely about a horizontal axis through O. If the spring of modulus k is unstretched when C is coincident with A, determine the tension T required to hold the bar in the 450 position shown in figure 2.c. the diameter of the small pulley at D is negligible.	08
3.a.	Determine the Centroid distance of a triangle of base width b, and height h, from its base.	04
3.b.	Determine the distance along the vertical from the bottom of the base plate to the centroid of the built-up structural section shown in figure 3.b.	08

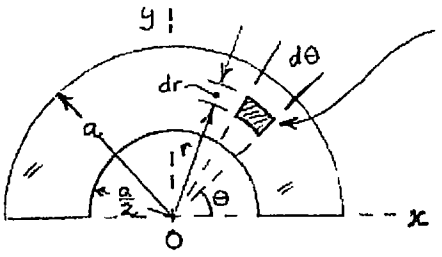
P.T.O.

3.c.	By the direct integration method, determine the rectanglular and polar radii of gyration of the area indicated about the axes shown in figure 3.c.	08



Dimensions in millimeters

Figure 3.b.



$dA = r\,dr\,d\theta$

$A = \frac{1}{2}\left[\pi a^2 - \pi\left(\frac{a}{2}\right)^2\right]$

Figure 3.c.

4.a.	Differentiate between statically determinate and statically indeterminate beam.	04
4.b.	Calculate the support reactions at A and B for the beam subjected to the two linearly distributed loads.	08
4.c.	Determine the forces in each member of the truss shown in figure 4.c.	08

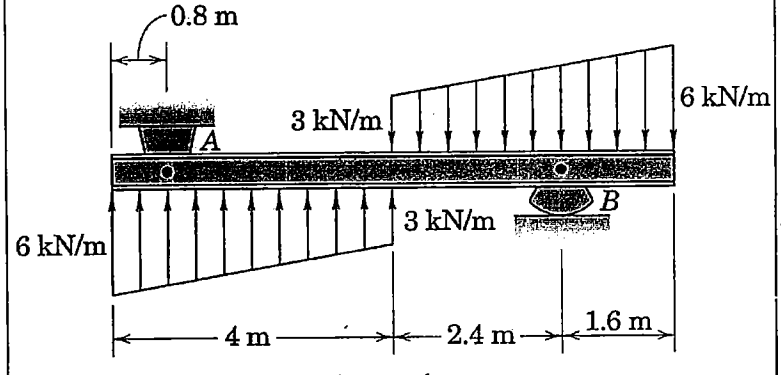


Figure 4.b.

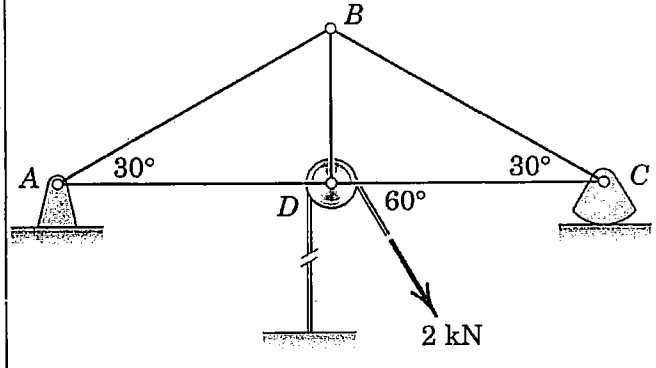


Figure 4.c.

5.a.	Explain the terms a. Angle of friction b. Cone of friction c. Angle of repose	06
5.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 friction which will permit this position to be reached with no slipping?	07
5.c.	The 80-kg tree surgeon lowers himself with the rope over a horizontal limb of the tree. If the coefficient of friction between the rope and the limb is 0.50, compute the force which the man must exert on the roof to let himself down slowly.	07

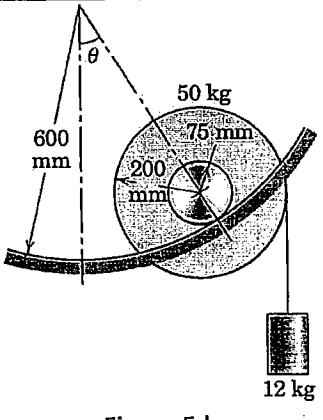


Figure 5.b.

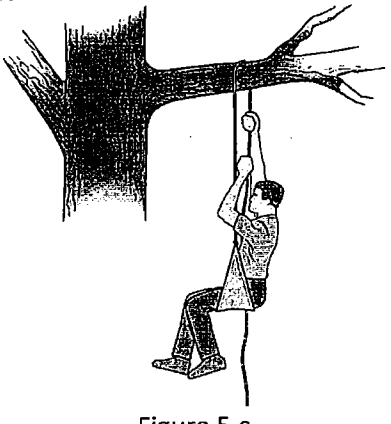


Figure 5.c.