

B. Tech I Year Examinations, May/June -2012

## ENGINEERING MECHANICS

(Common to CE, ME, CHEM, MCT, MMT, MEP, AE, AME, MIE, MIM, PTME)

Time: 3 hours

Max. Marks: 75

Answer any five questions  
All questions carry equal marks

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1. a) State and prove Varignons theorem.  
b) A roller of radius  $r = 0.3$  m. and weight  $Q = 2000$  N is to be pulled over a curb of height  $h = 0.15$  m. by a horizontal force  $P$  applied to the end of a string wound around the circumference of the roller (Ref. Figure 1). Find the magnitude of  $P$  required to start the roller over the curb. [5+10]

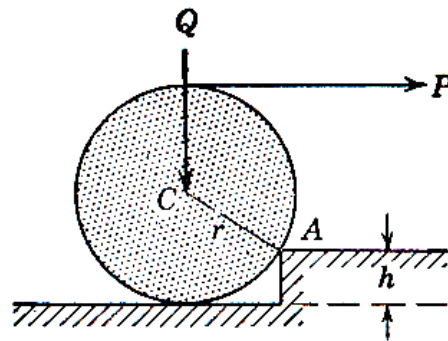


Figure: 1

2. Find the moment of the inertia of the section shown in the figure 2 about horizontal and vertical centroidal axes. All dimension in cm  $R = 8$ . [ 15]

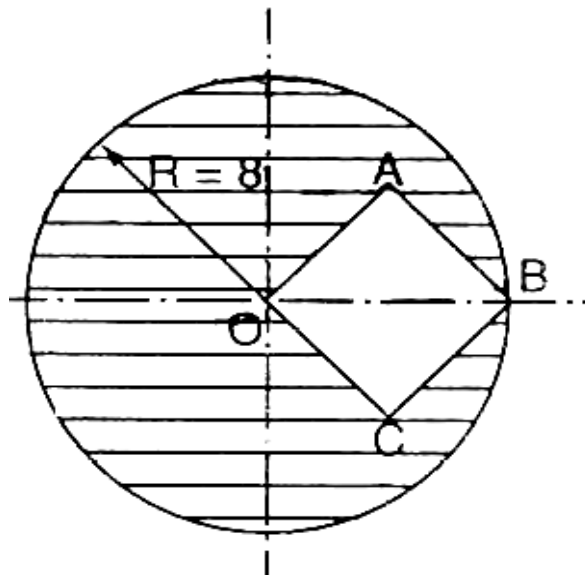


Figure: 2

3. Locate the centroid of the wire bent as shown in figure 3. [15]

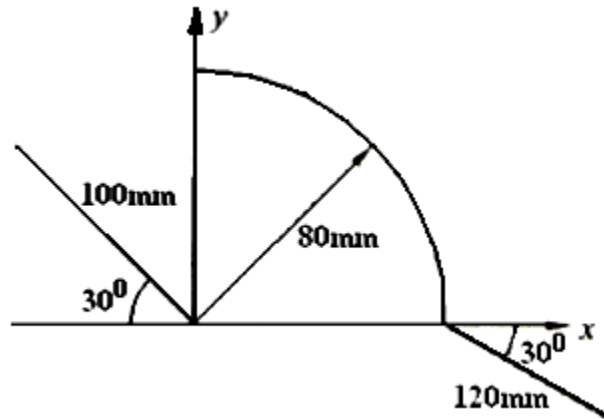


Figure: 3

4. Calculate the magnitude of the clockwise couple  $M$  required to turn the 50 kg cylinder in the supporting block shown in figure 4. The coefficient of kinetic friction is 0.30. [15]

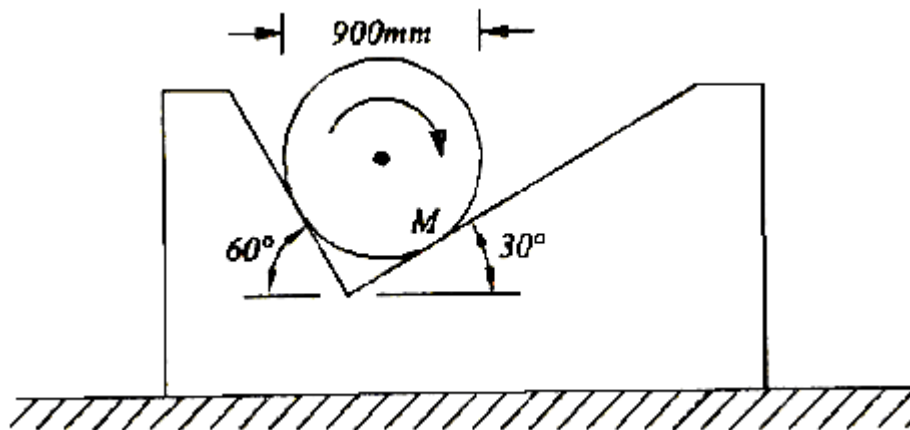


Figure: 4

5. Find the forces in all the members of the truss shown in the figure 5 (All forces are in kN). [15]

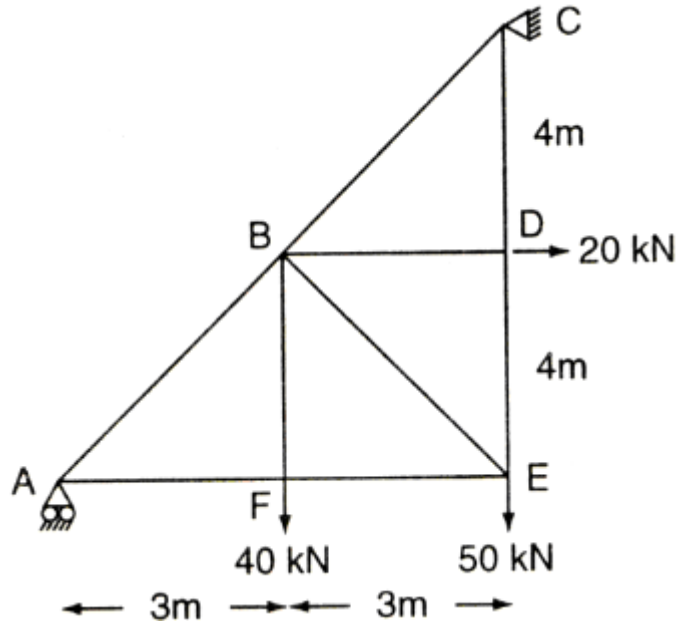


Figure: 5

6. When the angular velocity of a 1.2 m dia pulley is 3 rad/s, the total acceleration of a point on its rim is  $9\text{m/s}^2$ . Determine angular acceleration of the pulley at this instance? [15]
7. The step pulley shown in figure 6 starts from rest and accelerates at  $2\text{ rad/s}^2$ . What time is required for block A to move 20 m. Find also the velocity of A and B at that time. [15]

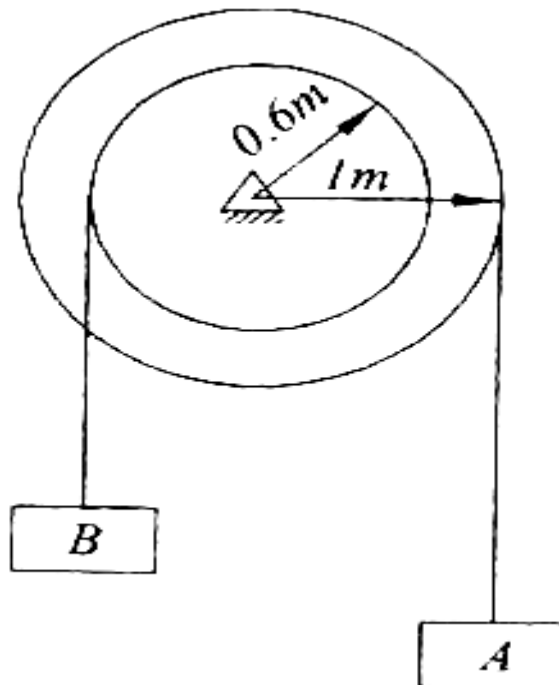


Figure: 6

8. a) Explain the following:
- i) Virtual displacement
  - ii) Virtual work
  - iii) Ideal system.
- b) Determine the magnitude of the couple  $M$  required to maintain the equilibrium of the mechanism, if  $P=2000\text{N}$  as shown in figure 7. [6+9]

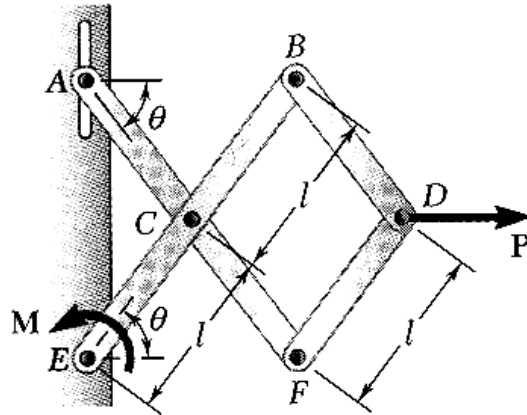


Figure: 7

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