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**AG203**

# B. Tech.

## (SEM. II) THEORY EXAMINATION, 2014-15
### ENGG. MECHANICS

Time : **3** Hours]                    [Total Marks : **100**

## SECTION A

**1**    Answer all questions.                    **10x2=20**

a.    Three forces $\sqrt{3}$ P, P and 2P acting on a particle are in equilibrium. If the angle between the first and second force is 90°, then find the angle between second and third force.

b.    State Varignon's theorem.

c.    Determine the least force to drag a body of 600 N along a rough horizontal plane having angle of friction of 30°.

d.    Explain the relationship between load, shear force and bending moment.

e.    Define angle of repose and angle of friction.

f.   Find the moment of inertia of a plane triangular area of base 5 cm and height 8 mm about its base.

g.   Find the mass moment of inertia of a circular disc of diameter 10 mm about any one diagonal.

h.   Find the area moment of inertia of a triangle having base as 12 mm and height of 18 mm about its base.

i.   Define bending stress with help of bending equation.

j.   Explain the bulk modulus of elasticity.

## SECTION B

2   Attempt any three parts of the following:        10x3=30

a.   Two slender rods of negligible weight are pin connected at C and attached to two blocks A and B each of weight 100 N as shown in figure. If coefficient of friction is 0.3 at all surfaces of contact, find largest value of P for which equilibrium is maintained.
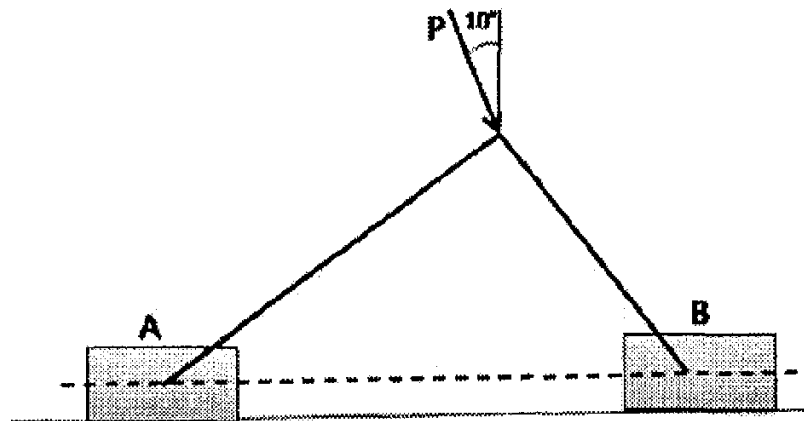
b. Use the method of composite areas to calculate the area moment of inertia of the plane region shown about the given axes.
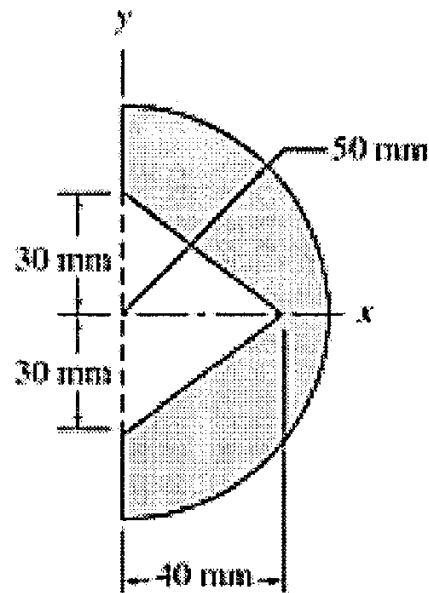


c Determine the force in various members of truss loaded as shown in fig.
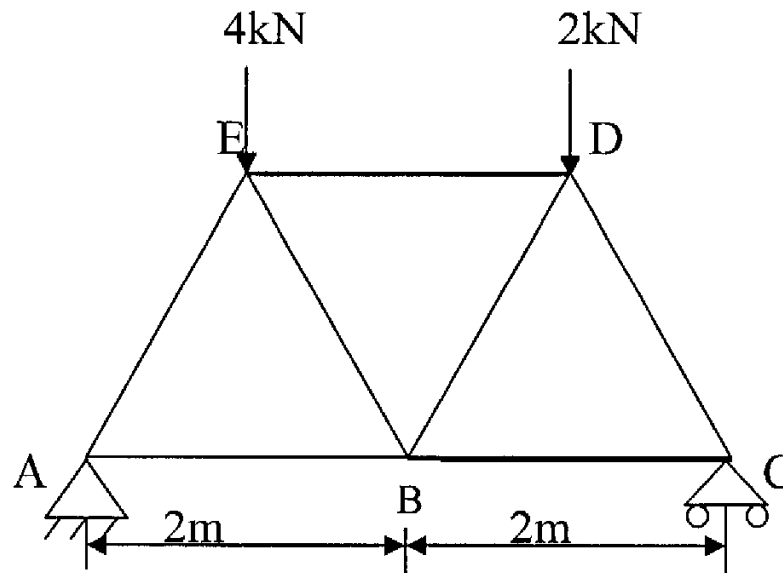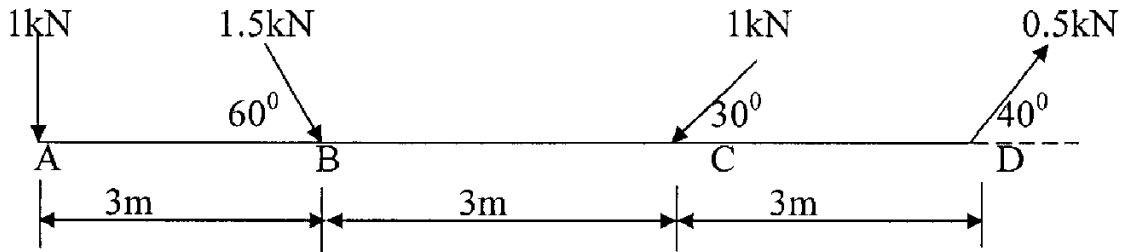(Each angle is of 60°)



**Fig. 2**

(d) A horizontal beam AD of length 12 m is acted by a set of forces as shown in fig. Determine the magnitude, direction and position of the resultant.



(e) A Ladder, 4 m long leans against a smooth vertical wall at an angle of 60° with the horizontal. The weight of ladder is 800 N. When a person weighing 700 N stand at 1.2 m from the bottom of the ladder, the ladder is just about to slide. Calculate the coefficient of friction between the ladder and the floor.

## SECTION C

3 Attempt any one part of the following: **10x1=10**

a. Calculate the moment of 90 N force about point O for the condition $\theta = 15°$. Also, determine the value of $\theta$ for which the moment about O is zero.
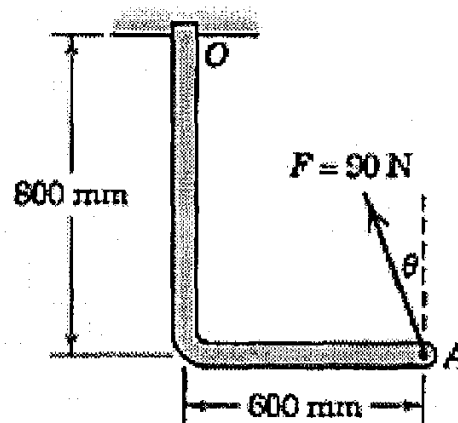
b.    Two forces one of which is double the other has resultant of 260 N. If the direction of the larger force is reversed and other remains unaltered, the resultant reduces to 200N. Determine the magnitude of the forces and angle between them.

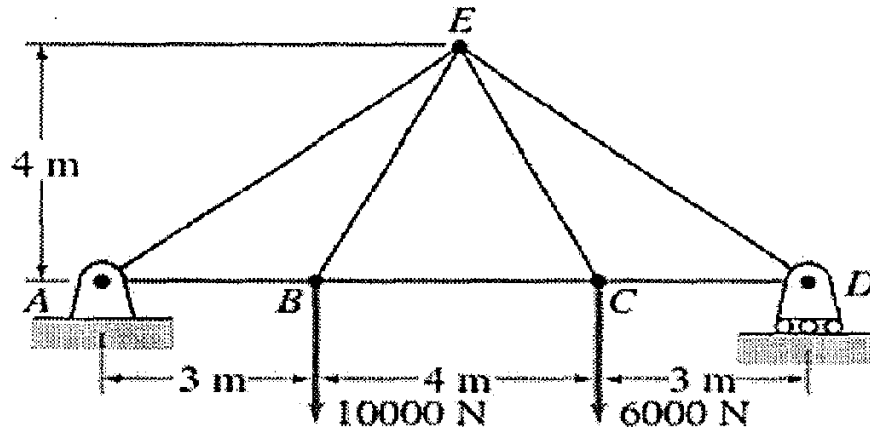4    Attempt any one part of the following:    **10x1=10**

a.    Write the shear force and bending moment equations and draw the shear force and bending moment diagrams for the beam shown in the figure.
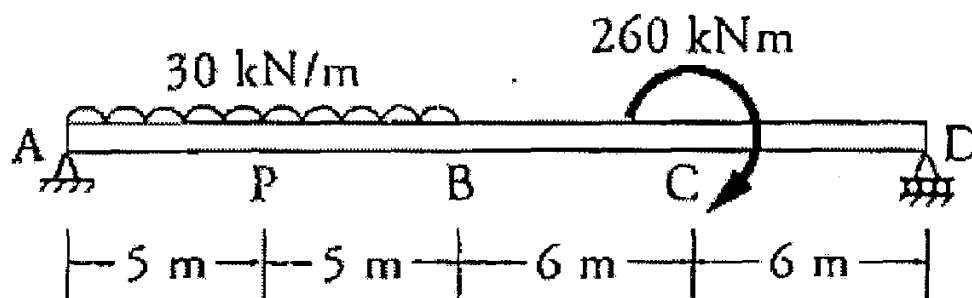


b.    A ladder 10 m long rests against a vertical wall with which it makes an angle of 60° and resting on floor. If a man whose weight is one half of that of the ladder, climbs it. At what distance along the ladder will he be when ladder is about to slip? Given that $\mu_s = 0.25$ at wall and $\mu_s = 0.16$ at floor.

**5**    Answer any one part of the following.            **10×1=10**

a.    Using method of joint determine the forces in the each member of the truss shown in figure.



b.    Determine the forces in members AC and AB of a simple triangular truss with the loading and support system shown in figure. Use the method of section.
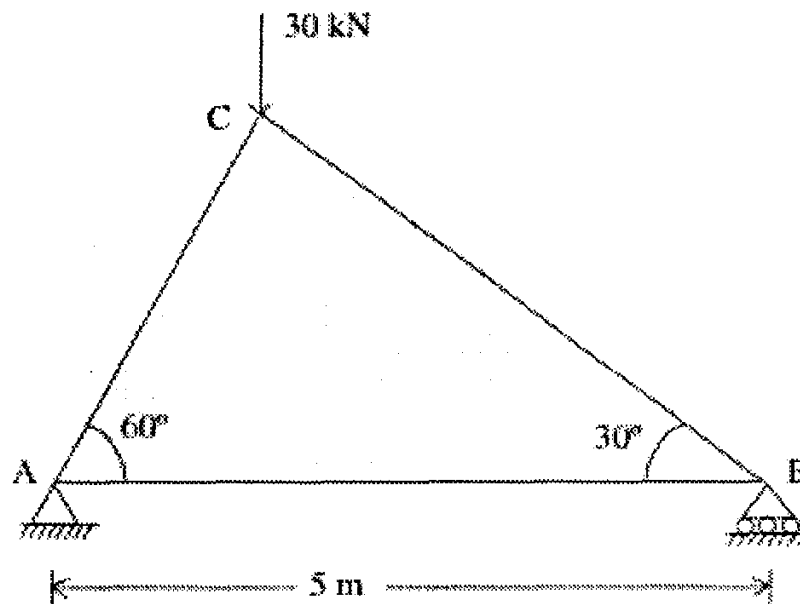
6   Answer any one part of the following.        **10×1=10**

    a.   Determine the area moment of inertia of the composite area ABOC about given x and y axis.
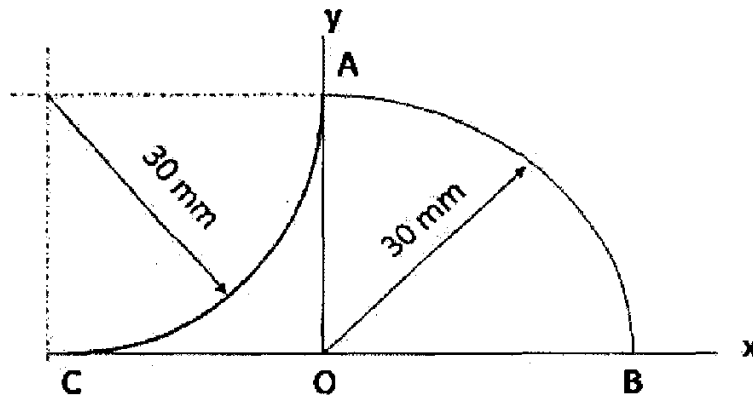


    b.   Determine the mass moment of inertia of a uniform density sphere of radius 5 cm about its centroidal axes.

7   Answer any one part of the following.        **10×1=10**

    a.   Write short notes on the following :—

       (i)    Elastic constants

       (ii)   Strain energy

       (iii)  Poisson's ratio

       (iv)   Axial tensile test.

    b.   An axial tensile test on 15 mm diameter bar of gauge length 200 mm, the load at proportionality limit is found to be 25 kN and correspondingly changes in length and diameter are 0•25 mm and 0•00625 mm, respectively. Determine: (i) Modulus of elasticity. (ii) Percentage volume change.