Printed Pages : 8

BT-203/BT-103

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 154203

Roll No.

B. Tech.

(SEM. II) THEORY EXAMINATION, 2014-15

ENGINEERING 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. State the law of equilibrium for coplanar non concurrent forces.

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.

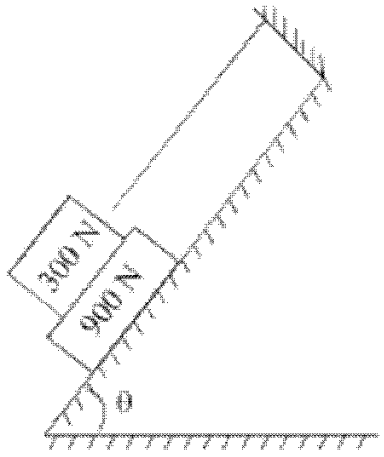
i. State D'Alembert's principle.

j. Explain the basic principle of lifting machines.

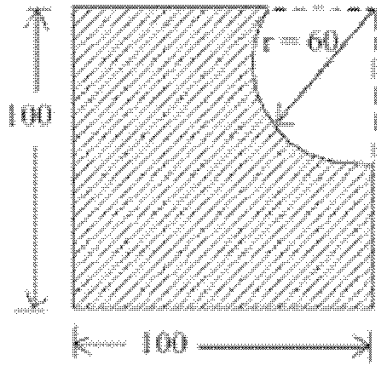
SECTION - B

2. Attempt any three parts of the following: **(10x3=30)**

a. What should be the value of ? in figure which will make the motion of 900 N block down the plane to impend? The coefficient of friction for all contact surfaces is 0.3.



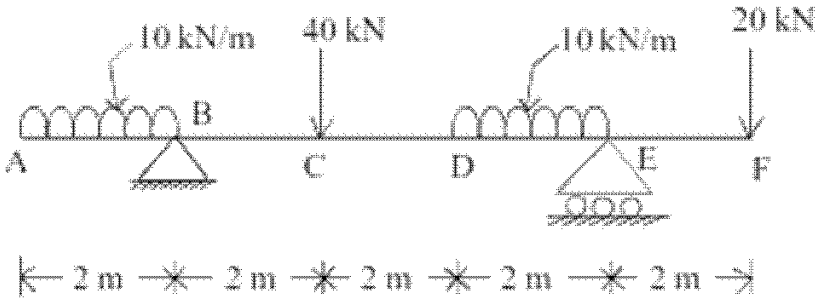
b. The cross section of a machine part is shown in figure. Determine its moment of Inertia and radius of gyration about the horizontal centroidal axis.



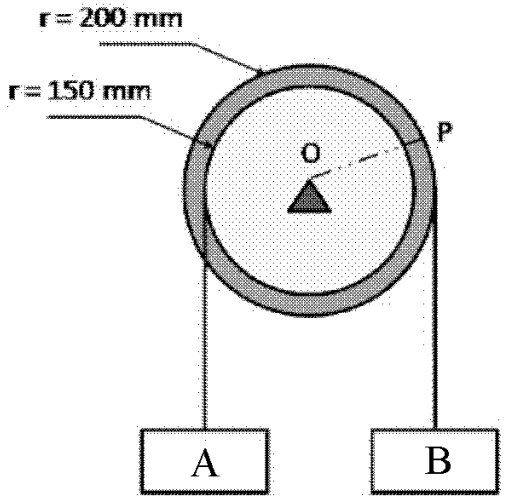
All dimensions in mm

c. A ladder 5 m long rests on a horizontal ground and leans against a smooth vertical wall at an angle of 70° with the horizontal. The weight of the ladder is 300 N. The ladder is on the verge of sliding when a man weighing 750 N stands on a rung 1.5 m high. Calculate the coefficient of friction between the ladder and the floor.

d. Draw the SFD and BMD for the given beam in figure.



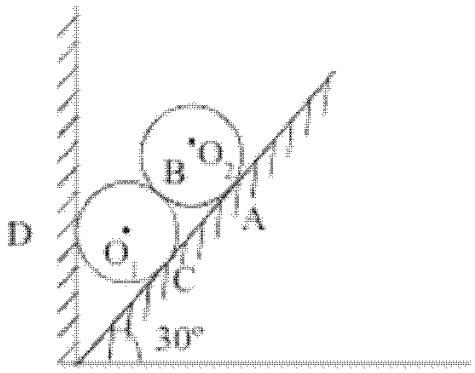
e. A double pulley supports two blocks A and B as shown in figure 1. The block A is moving downwards and has an acceleration of $0.3t$ m/s^2 and an initial velocity of 0.5 m/s. At time t = 5 s, determine (i) the number of revolution made by pulley, (ii) acceleration of point P and (iii) the position, velocity and acceleration of block B.



SECTION - C

3. Attempt any one parts of the following: **(10x1=10)**

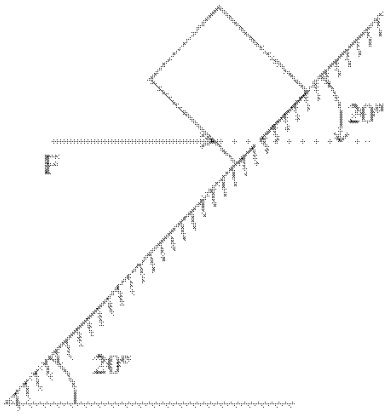
a. Two identical rollers, each of weights 100 N are supported by an inclined plane and a vertical wall as shown in figure. Assume smooth surfaces; find the reactions induced at the points of supports A, B, C and D.



b. Two forces one of which is double the other has resultant of 280 N. If the direction of the larger force is reversed and other remains unaltered, the resultant reduces to 180N. Determine the magnitude of the forces and angle between them.

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

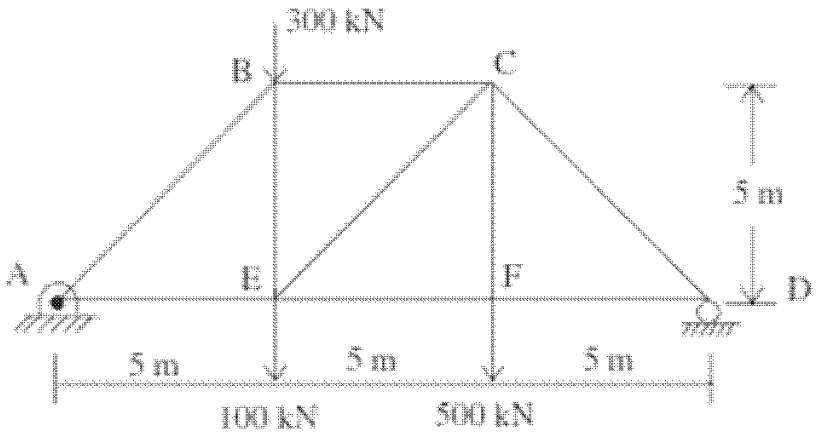
a. Determine the value of the force F needed to get the block just started up the incline as shown in figure. The coefficient of friction is 0•3. The weight of the block is 500 N.



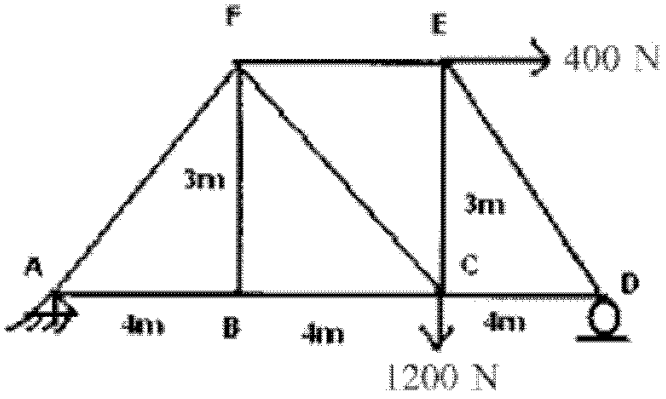
b. A ladder 8 m long rests against a vertical wall with which it makes an angle of 60° and resting on floor. If a man whose weight is one half of that of the ladder, climbs it. At what distance along the ladder will he be when ladder is about to slip? Given that $\mu_s = 0.3$ at wall and $\mu_s = 0.15$ at floor.

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

a. Determine the forces in the each member of the truss shown in figure.

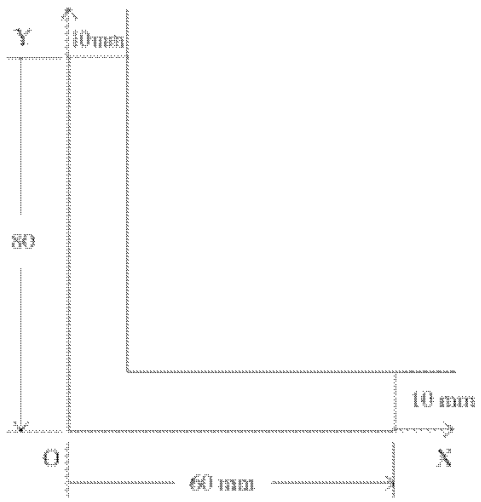


b. Determine the forces in members truss with the loading and support system shown in figure.



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

a. Determine the centroidal area moment of inertia of the composite area given in figure.



b. Determine the mass moment of inertia of a uniform density sphere of radius R about its centroidal axes by integration method.

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

a. A hollow shaft having outer diameter 1.2 times inner diameter is to replace a solid shaft transmitting the same power at the same speed. Determine the outer and inner diameters of the hollow shaft in terms of the diameter of solid shaft and percentage saving in the material (by using hollow shaft). Assume that the same material is used in both the cases.

b. Two blocks are connected by a string. The block of 30 kg lies on a rough plane of slope 40° and the block of 20 kg hangs freely. The coefficient of friction between the plane and the block is 0.2. The 30 kg block is moving down the plane. Determine the acceleration of the masses: