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

PAPER ID : 199217   **Roll No.** | | | | | | | | | | |

B.Tech.

(SEM. II) THEORY EXAMINATION 2013-14

ENGINEERING MECHANICS

Time : 3 Hours   *Total Marks : 100*

Note :– Attempt **all** questions.

1.   Attempt **all** parts of this question. Each part carries **2** marks.

(10×2=20)

(a)   If the square of the resultant of two equal forces is equal to three times of their product, find the angle between the forces.

(b)   Define and explain coplanar and non-coplanar force system.

(c)   Find the maximum bending moment in a Cantilever beam of length 5 m carrying a UDL of 10 kN/m over its span.

(d)   Define angle of repose.

(e)   Describe the method of section for analysis of truss.

(f)   State the perpendicular axis theorem.

(g)   Define impulse momentum principle.

(h) Define instantaneous center of zero velocity.

(i) What is a beam of uniform strength ?

(j) Find the polar modulus of a circular shaft of diameter 20 mm.

2. Attempt any **three** parts of this question. Each part carries 10 marks. $(10\times3=30)$

(a) Calculate the tensions in various segments of cable :
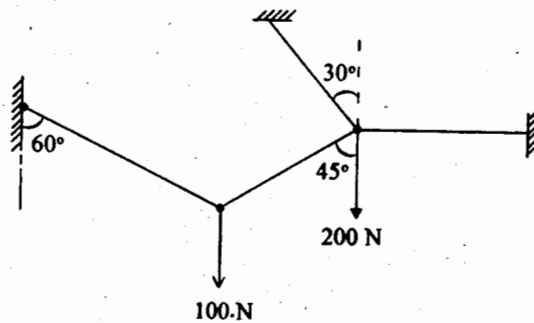
(b) Find the shear force and moment equation for simply supported beam as shown in Figure. Also sketch the shear force and bending moment diagram :
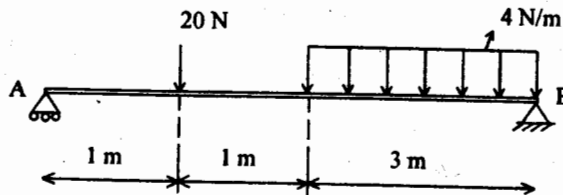

(c) Prove that centre of gravity of a right circular cone lies at h/4 from the base.

(d) A particle moving along a line has an acceleration given by $a = \sqrt{v}$ where v is the velocity in m/s. At t = 4 seconds its velocity is 36 m/s and its displacement is 72 m. Find the displacement and acceleration of particle at t = 6 seconds.

(e) A simply supported beam of I section (as shown in fig.) carries a uniformly distributed load of 120 kN/m over its entire span. If value of flexural stress is limited to 10 Pa, find the maximum possible length of beam :
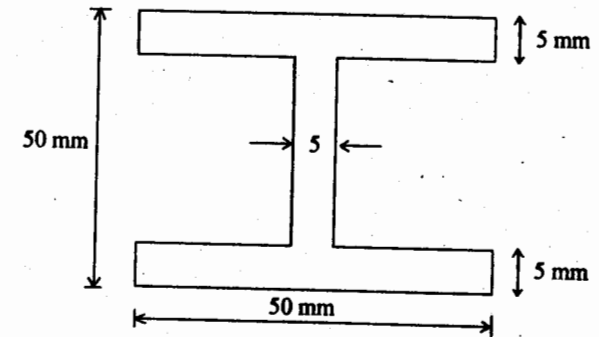
3. Attempt any **one** part of the following : (10)

(a) Refer to the system of cylinders arranged as shown in figure. Determine the forces exerted at all the contact points

if diameter of each cylinder is 200 mm.
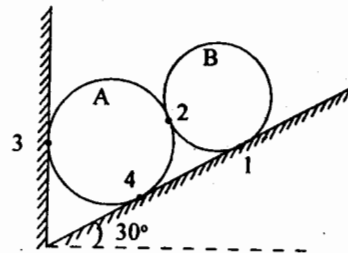
$W_a = 300$ N

$W_b = 300$ N

(b) A ladder is 6 m long and is supported by horizontal floor and vertical wall. The coefficient of friction between the floor and ladder is 0.3 and between wall and ladder is 0.15. Weight of ladder is 300 N. The ladder supports a vertical load of 800 N at a point which is at a distance of 1 m from top of ladder. Determine the least value of angle of inclination of ladder with floor at which ladder may be placed without slipping.

4. Attempt any **one** part of the following : **(10)**

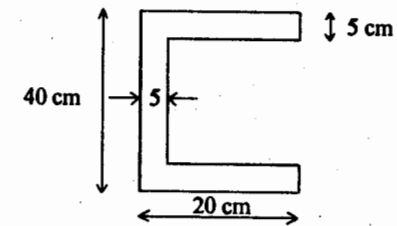(a) Draw shear force and bending moment diagram of cantilever beam.
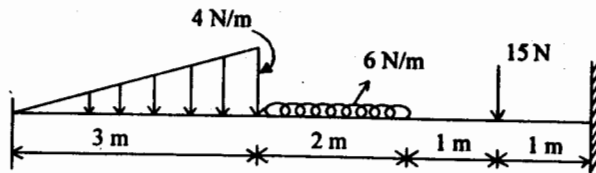
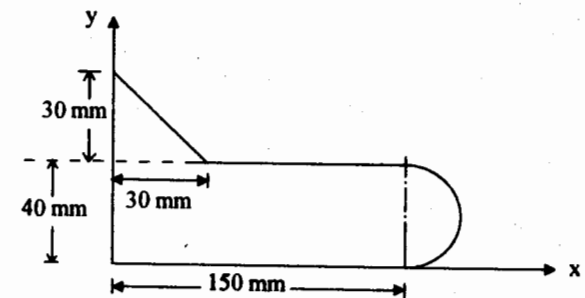(b) Determine the forces in various members of truss by method of joints :
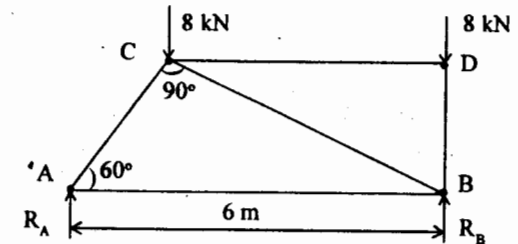
5. Attempt any **one** part of the following : **(10)**

(a) Calculate the moment of Inertia of section about the centroidal axis :
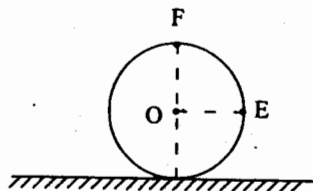

(b) Determine the centroid of given figure (Lamma) about the given axis :

6. Attempt any one part of the following : (10)

(a) A cylinder of diameter 1 m rolls without slipping along a horizontal plane AB. Its centre has a uniform velocity of 20 m/sec. Find the velocity of the points E and F on the circumference of the cylinder shown in Figure.

F

O E

(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 :

30 kg
A
B
20 kg
40°
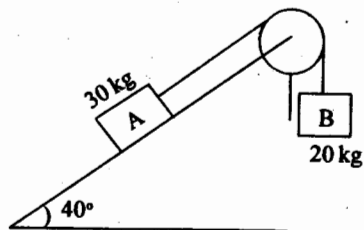
7. Attempt any one part of the following : (10)

(a) State the assumptions made in theory of pure bending. Derive the bending formula.

(b) A hollow shaft having outside diameter 1.5 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 and percentage saving in material (by using hollow shaft). Assume that the same material is used in both the cases.

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