(b) Two bodies A and B of masses 5 kg. and 20 kg. are connected by an inclined string. A horizontal force P of 100 N is applied to block B. Calculate the tension in the string and acceleration of the system. Take coefficient of friction for all surfaces as 0.25. Refer figure-(9).

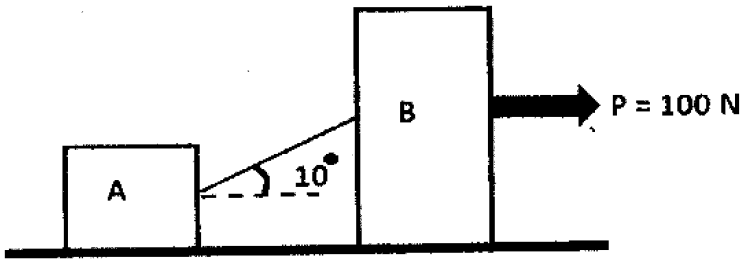

Figure 9

7. Attempt any one part: (10×1=10)

(a) Derive the Bending equation for pure bending in beams with assumptions. Also define the neutral axis & section modulus for a beam.

(b) Calculate the suitable diameter for a solid circular shaft to transmit 60 kW power at 200 rpm, if the twist is not to exceed 2° in 3 m length of the shaft and maximum shear is limited to 70 MN/m². Take shear modulus G=90 GPa.

* * *

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

PAPER ID : 199132

Roll No.

B.Tech.(Sem.-I) ODD Semester
SPL. THEORY EXAMINATION, 2014-15
ENGINEERING MECHANICS

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

Note: (1) This paper is in 3 sections. Section A carries 20 marks. Section B carries 30 marks & Section C carries 50 marks.

(2) Attempt all questions. Marks are indicated against each question.

(3) Assume suitable data if necessary.

Section - A

1. Write short notes on the following: (2×10=20)

(a) Define a force system and list various types of force systems.

(b) Define coefficient of friction and angle of friction.

(c) What is truss? Explain its types.

(d) Define the types of loads & supports in a beam.

(e) Define Mass Moment of Inertia & Area Moment of Inertia.

(f) What do you mean by types of motion?

(g) Explain D'Alembert's principle with suitable example.

(h) Define the longitudinal & lateral strain.

(i) What do you mean by pure bending in beams?

(j) Define a shaft & torsional rigidity.

Section - B

2. Attempt any three parts in this section: (10×3=30)

(a) Four forces act tangentially to a circle of radius 2m as shown in figure (1). Find the magnitude, inclination & distance of the resultant from centre of circle.

(b) Draw the shear force & bending moment diagram for a loaded beam shown in figure (2).

(c) Calculate the Moment of Inertia about X-X axis for given area shown in figure (3).

(d) A flywheel rotates for 5 seconds with constant angular acceleration and describes 90 radians this time. It than rotates with constant angular velocity and during the next 6 seconds describes 80 seconds. Find the initial angular velocity and the angular acceleration.

(e) Determine the total extension of the bar loaded as shown in figure (4). Take E = 2.5 MPa.

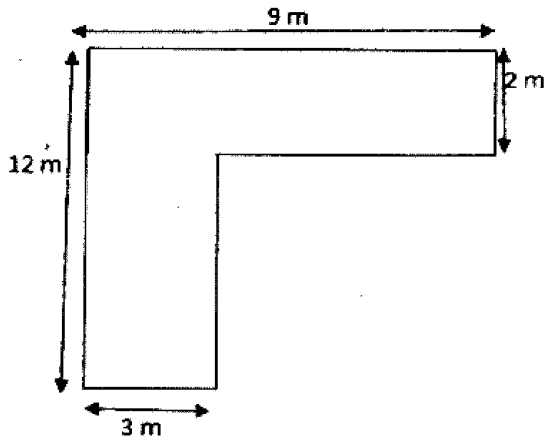

Figure 8

6. Attempt any one part: (10×1=10)

(a) The equation of motion of a particle moving in a straight line is given by: $s = 9t + 7t^2 - 1.5t^3$, where s is the total distance covered from the starting point in meters at the end & time t in seconds. Find the following:

(i) The velocity & acceleration at start.

(ii) The time, when the particle reaches its maximum velocity and

(iii) The maximum velocity of the particle

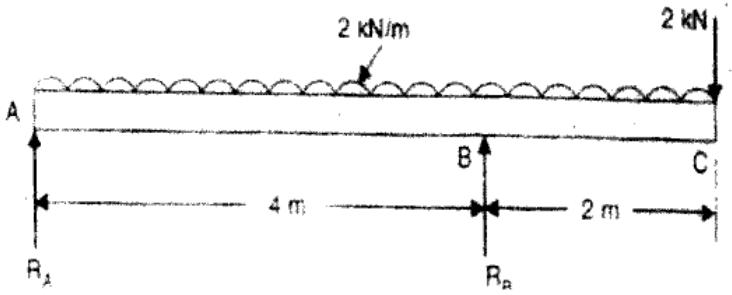

Figure 6

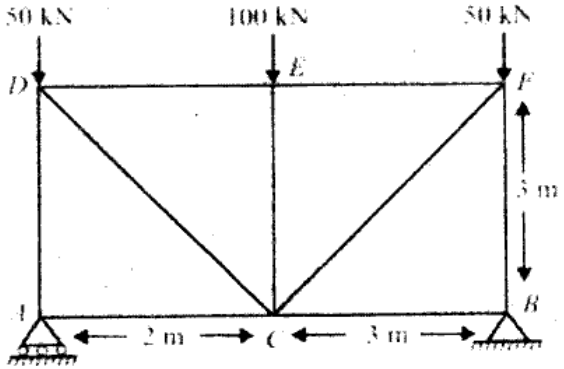

Figure 7

5. Attempt any one part: (10×1=10)

(a) Determine the moment of inertia of the 'L' section with respect to centroidal X-X and Y-Y axis. Section as shown in figure (8). Also find its radius of gyration from both Centroidal axes.

(b) Derive an expression for mass moment of inertia about axis of symmetry for a right solid circular cone.

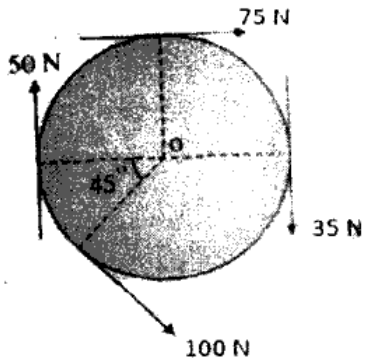

Figure 1

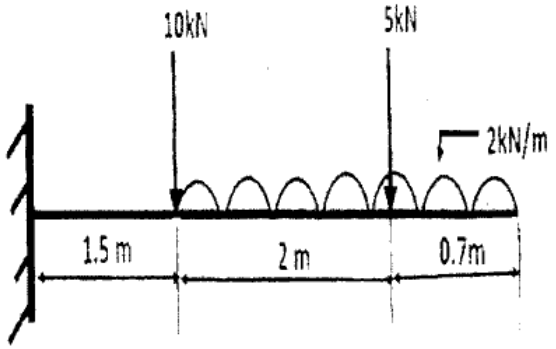

Figure 2

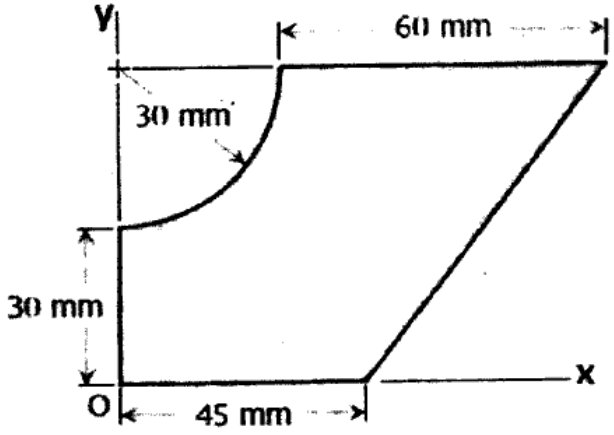

Figure 3

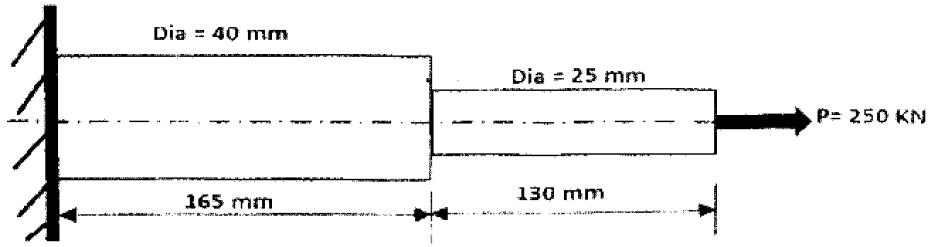

Figure 4

Section - C

Note: Attempt all questions of this section.

3. Attempt any one part: (10×1=10)

(a) The two cylindrical rollers of weight 50 N each are placed inside a cup as shown in figure (5). Find the reactions at points of contact.

(b) A ladder 7m long rests against a vertical wall with which it makes an angle 45° & resting on a floor. If a man whose weight is one half of that the ladder climbs it, at what distance along the ladder will he be, when ladder is about to slip? Take coefficient of friction between all contact surfaces 0.3.

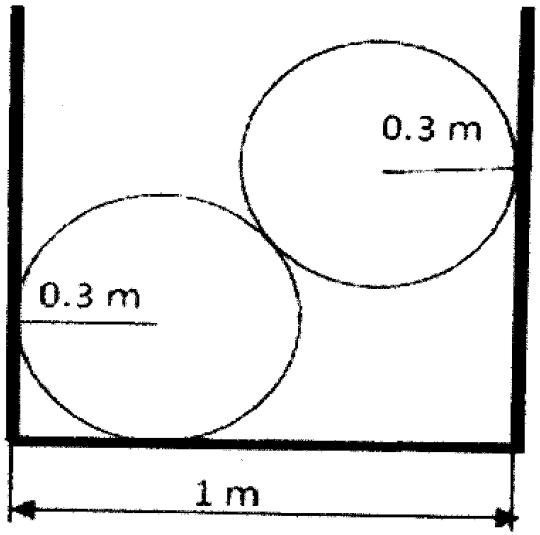

Figure 5

4. Attempt any one part: (10×1=10)

(a) Draw the shear force & bending moment diagram for the beam shown in figure (6) also find out the value of maximum bending moment & position of point of contraflexure.

(b) Determine the magnitude and nature of forces in all members of the truss shown in figure (7).