Printed Pages: 04 **Sub Code: NME 202**

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B TECH
(SEM II) THEORY EXAMINATION 2017-18
ENGINEERING MECHANICS

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

Note: Attempt all Sections. Assume missing data suitably, if any.

SECTION A

1. Attempt *all* questions in brief. 2 x 10 = 20

a) What do you mean by equilibrium of the body? Explain with suitable examples.
b) State polygon law and triangle law of forces.
c) State and prove Varignon's theorem.
d) Explain the term Angle of Repose and Angle of Friction with neat sketch.
e) Draw the stress strain diagram for mild steel.
f) Define the D'Alembert's principle.
g) State and prove the parallel axis theorem.
h) Define the moment of inertia and its physical significance.
i) State the Work-Energy principle and Impulse momentum principle.
j) What is Instantaneous centre and discuss; how to locate it.

SECTION B

2. Attempt any *three* of the following: 10 x 3 = 30

a) The cross-section of a block is an equilateral triangle as shown in figure 1. It is hinged at A and rests on a roller at B. It is pulled by means of a string attached at C. If the weight of the block is W and the string is horizontal, determine the force P which should be applied through string to just lift the block of the roller.

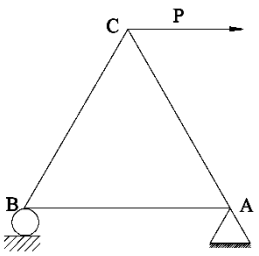

Figure 1

b) Two blocks are connected by a string and rest on an inclined plane and on a horizontal surface as shown in figure 2. The coefficient of friction for all surfaces is 0.2. Find the magnitude and direction of the least force P at which the motion of the blocks will impend.

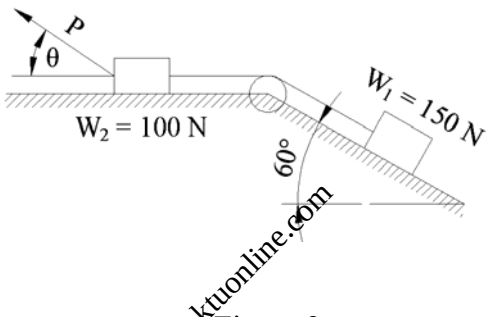

Figure 2

c) Find the moments of inertia about the centroidal axes of section shown in figure 3.

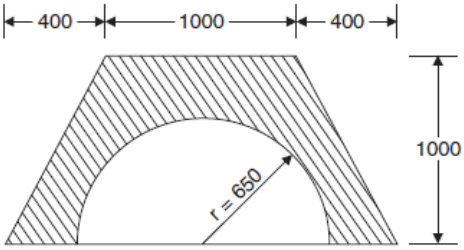

Figure 3

d) A particle starting from rest moves in a straight line whose acceleration is given by relation $a=10-0.006s^2$, where a is in m/ s^2 and s is in m. Determine:

(i) Velocity of the particle when it has travelled 50m.

(ii) Distance travelled by the particle when it comes to rest.

e) Derive the "Bending Equation" **(M/I)=(σ/y)=(E/R)**.What do you mean by Section Modulus?

SECTION C

3. Attempt any *one* part of the following: 10 x 1 = 10

a) A hollow right circular cylinder of radius 800 mm is open at both ends and rests on a smooth horizontal plane as shown in Figure 4. Inside the cylinder there are two spheres having weights 1 kN and 3 kN and radii 400 mm and 600 mm, respectively. The lower sphere also rests on the horizontal plane. Neglecting friction find the minimum weight W of the cylinder for which it will not tip over.

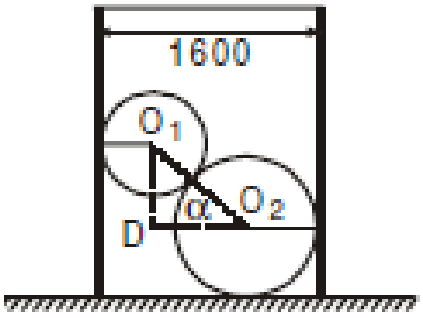

Figure 4

b) Determine the mass moment of inertia of a solid cylinder of radius 'R' and height 'h' about the axis of symmetry.

4. Attempt any *one* part of the following: 10 x 1 = 10

a) Draw the shear force and bending moment diagram for the beam as shown in Figure 5. Also find the point of contra flexure if any.

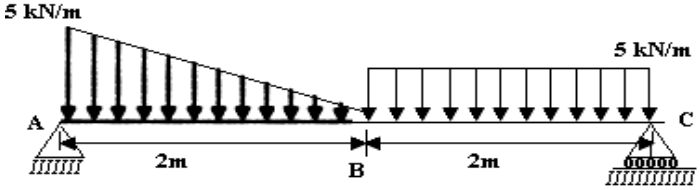

Figure-5

b) Find forces in all members of the truss as shown in figure 6

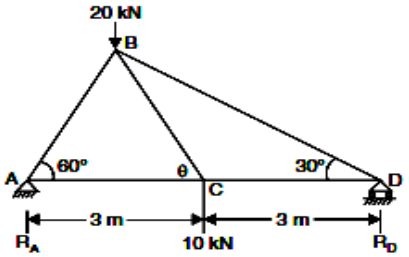

Figure 6

5. Attempt any *one* part of the following: 10 x 1 = 10

a) Find the Centroid of the parabolic spandrel shown in figure 7.

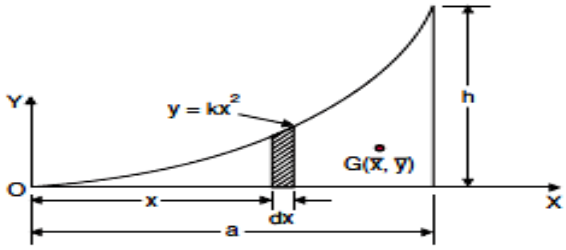

Figure 7

b) Draw the shear force and bending moment diagram of the beam as shown in fig 8 an also find the point of contraflexture.

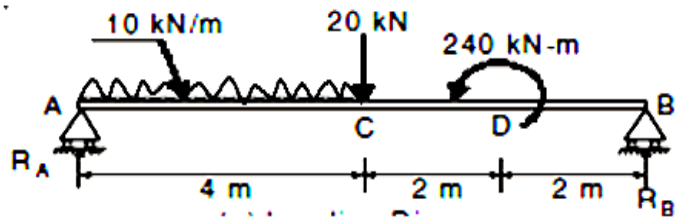

Figure 8

6. Attempt any *one* part of the following: 10 x 1 = 10

a) A cylinder weighing 500N is welded to a 1m long uniform bar of 200N weight as shown in figure 9. Determine the acceleration with which the assembly will rotate about point A, if released from horizontal position. Determine the reaction at A at this instant.

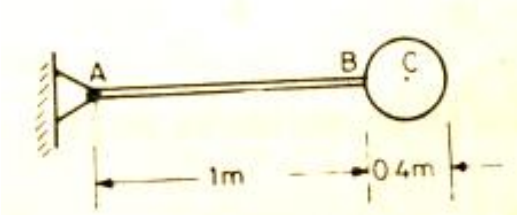

Figure 9

b) A cylinder roller 50 cm in diameter is in contact with two conveyor belts at its top and bottom as shown in figure 10. If the belts run at uniform speed of 5 m/s and 3 m/s. Find the linear velocity and angular velocity of the roller.

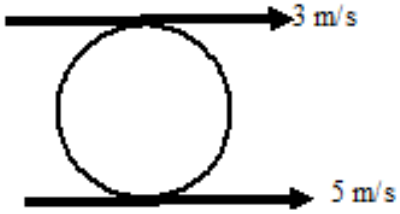

Figure 10

7. Attempt any *one* part of the following: 10 x 1 = 10

a) What do you understand by the term neutral axis and neutral surface? A steel beam of hollow square section of 80 mm outer side and 60 mm inner side is simply supported on a span of 6 meters. Fine the uniformly distributed load that the beam can carry at the middle of the span if the bending stress is not to exceed 125 $N/mm^{2.}$

b) A circular bar having $200mm^2$area is subjected to the axial load as shown in figure 11. Find the value of P and the total elongation. Take E= $200KN/mm^2$**.**

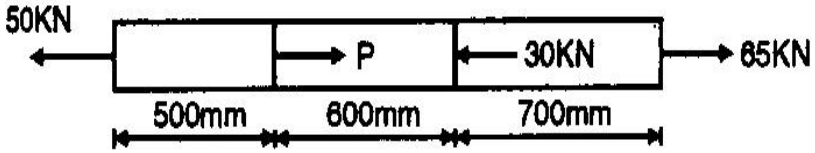

Figure 11