

I B.Tech Supplementary Examinations, November/December 2005
ENGINEERING MECHANICS

(Common to Civil Engineering, Mechanical
 Engineering, Mechatronics, Metallurgy & Material Technology and
 Production Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. Find the reactions R_a and R_b induced at the supports A and B of the right-angle bar ACB supported as shown in figure 1, and subjected to a vertical load P applied at the mid-point of AC. [16]

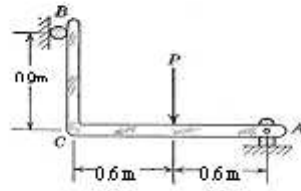


Figure 1:

2. (a) Two blocks, connected by a horizontal link AB are supported on two rough planes as shown in Figure 2. The coefficient for friction of block A on the horizontal plane is $\mu = 0.4$. The angle of friction for block B on the inclined plane is $\varphi = 15^\circ$. What is the smallest weight W of block A for which equilibrium of the system can exist?
- (b) Two blocks of weight W_1 and W_2 rest on a rough inclined plane and are connected by a short piece of string as shown in Figure3. If the coefficients of friction are $\mu_1 = 0.2$ and $\mu_2 = 0.3$, respectively, find the angle of inclination of the plane for which sliding will impend. Assume $W_1 = W_2 = 5$ N. [8+8]
3. (a) What are the assumptions to be made to derive an expression for the limiting ratio of tension?
- (b) In flat belt, the initial tension is 1800N. The angle of lap on the smaller pulleys is 170° . The coefficient of friction between the belt and pulley surface is 0.25. Diameter of pulley is 900mm and it runs at 450 r.p.m. Determine the power that can be transmitted at the above speed Neglect the effect of centrifugal

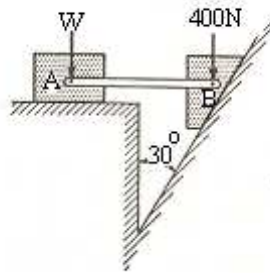


Figure 2:

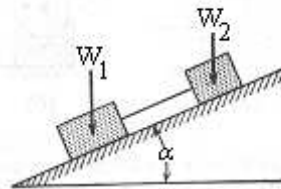


Figure 3:

tension.

[8+8]

4. (a) Locate the centroid of given parabola bounded by x- axis the line $x = a$. as shown in the figure 4

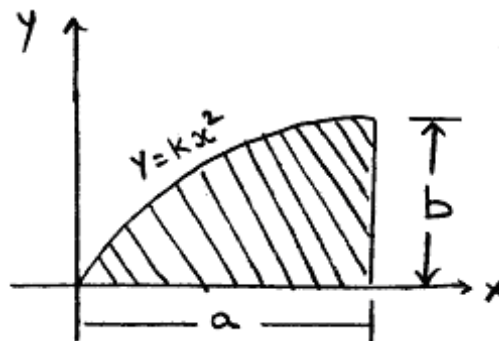


Figure 4:

- (b) Locate the centroid of the wire bent as shown in figure 5. [8+8]
5. (a) Determine mass moment of inertia of slender rod of length 'L' about its centroidal axis normal to the rod.
- (b) Derive the expression for mass moment of inertia of a cone of height 'h' and base radius 'r' and mass density 'w' with respect to its geometric axis. [8+8]

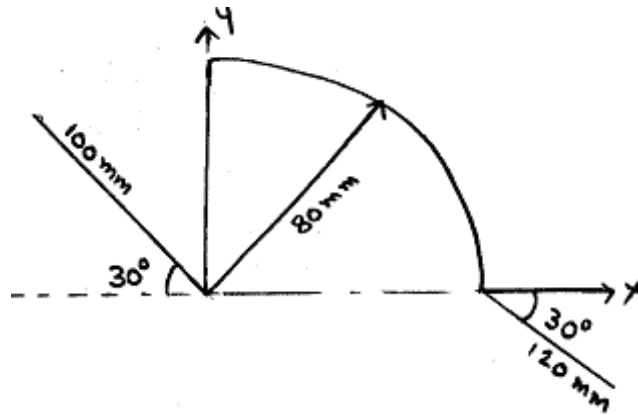


Figure 5:

6. (a) A railway car is moving with a velocity of 20m/s. The diameter of the wheel is 1m. The wheel is running on a straight rail without slipping. Find the velocity of the point on the circumference at 60° in the clockwise direction from the top at any instant
- (b) A 600mm diameter flywheel is brought uniformly from rest to a speed of 350rpm in 20 seconds. Determine the velocity and acceleration of a point on the rim 2 seconds after starting from rest. [8+8]
7. (a) An automobile moving with a uniform velocity of 40Kmph is accelerated by increasing the traction force by 20%. If the resistance to motion is constant, find the distance traveled before it acquires 50Kmph. Use work-energy method.
- (b) A solid cylinder and a sphere are started top of an inclined plane, at the same time, and both roll without slipping down the plane. If, when the sphere reaches the bottom of incline, the cylinder is 12m, what is the total length 'S' of the incline? [8+8]
8. Two springs of stiffness k_1 and k_2 are connected in series. Upper end of the compound spring is connected to a ceiling and lower end carries a load 'W'. Find the equivalent spring stiffness of the system. If the above two springs are connected in parallel then find the equivalent spring stiffness of the system also. [16]
