

I B.Tech Supplementary Examinations, Aug/Sep 2008
ENGINEERING MECHANICS
 (Common to Mechanical Engineering, Mechatronics, Metallurgy &
 Material Technology, Production Engineering, Aeronautical Engineering
 and Automobile Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
 All Questions carry equal marks

1. (a) Two forces equal to $2P$ and P respectively act on a particle. If first be doubled and the second increased by $12N$ the direction of the resultant is unaltered, find the value of 'P'?
- (b) A $675 N$ man stands on the middle rung of a $225 N$ ladder, as shown in Figure 1b. Assuming a smooth wall at B and a stop at A to prevent slipping, find the reactions at A and B. [8+8]

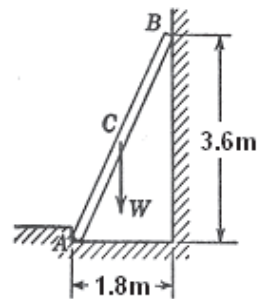


Figure 1b

2. (a) Find the least horizontal force 'P' to start motion of any part of the system of three blocks resting upon one another as shown in figure 2a. The weights of the blocks are $A = 3000N$, $B = 1000N$, $C = 2000N$. Between A and B $\mu = 0.3$, between B and C, $\mu = 0.2$ and between C and the ground $\mu = 0.1$.

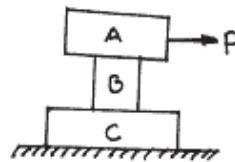


Figure 2a

- (b) A block overlying a 10° wedge on a horizontal floor and leaning against a vertical wall and weighing $1500N$ is to be raised by applying a horizontal force to the wedge. Assuming the coefficient of friction to be 0.3 , determine the minimum horizontal force to be applied to raise the block. As shown in the Figure 2b.

[8+8]

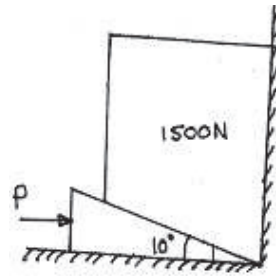


Figure 2b

3. (a) Deduce an expression for centrifugal tension of belt drive.
 (b) The maximum allowed tension in a belt is 1500 N. The angle of lap is 170° and coefficient of friction between the belt and material of the pulley is 0.27. Neglecting the effect of centrifugal tension, calculate the net driving tension and power transmitted if the belt speed is 2 m/s. [6+10]
4. (a) Determine the centroid for a semicircular arc about its diametral base.
 (b) Determine the volume generated by the shaded area as shown in figure 4b. about X - axis. [8+8]

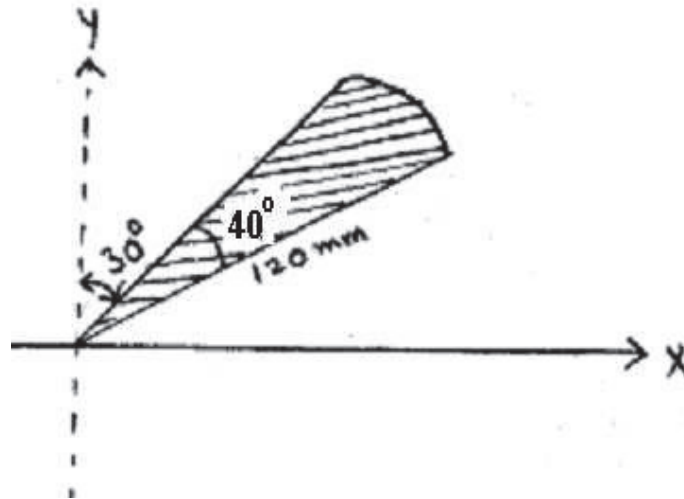


Figure 4b

5. (a) Show that the moment of inertia of a thin circular ring of mass 'M' and mean radius 'R' with respect to its geometric axis is MR^2 .
 (b) Find out the mass moment of inertia of a right circular cone of base radius 'R' and mass 'M' about the axis of the cone. [8+8]
6. (a) A railway car is moving with a velocity of 20m/s. The diameter of the wheel is 1 m. 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 600 mm diameter flywheel is brought uniformly from rest to a speed of 350 rpm in 20 seconds. Determine the velocity and acceleration of a point on the rim 2 seconds after starting from rest. [8+8]
7. (a) A homogeneous sphere of radius of $a=100$ mm and weight $W=100$ N can rotate freely about a diameter. If it starts from rest and gains, with constant angular acceleration, an angular speed $n=180$ rpm, in 12 revolutions, find the acting moment. .
- (b) A block starts from rest from 'A'. If the coefficient of friction between all surfaces of contact is 0.3, find the distance at which the block stop on the horizontal plane. Assume the magnitude of velocity at the end of slope is same as that at the beginning of the horizontal plane. As shown in the Figure7b [8+8]

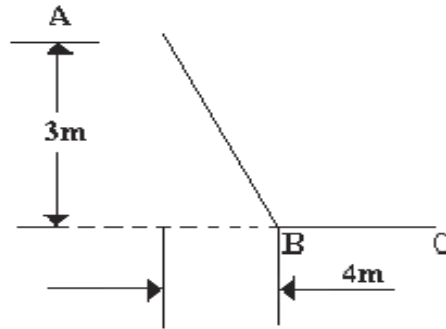


Figure 7b

8. In a mechanism, a cross-head moves in straight guide with simple harmonic motion. At distances of 125 mm and 200 mm from its mean position, it has velocities of 6 m/sec and 3 m/sec respectively. Find the amplitude, maximum velocity and period of vibration. If the cross-head weighs 2N, calculate the maximum force on it in the direction of motion. [16]
