Code No: R05010302

Set No. 3

I B.Tech Supplimentary 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
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1. (a) Define free body diagram, Transmissibility of a force and resultant of a force.

   (b) Two identical rollers, each of weight 100 N, are supported by an inclined plane
       and a vertical wall as shown in Figure1b. Assuming smooth surfaces, find the
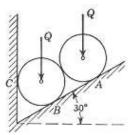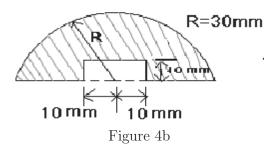   reactions induced at the points of support A, B and C.   [6+10]

Figure 1b

2. (a) Explain the principles of operation of a screw jack with a neat sketch.

   (b) Outside diameter of a square threaded spindle of a screw Jack is 40 mm. The
       screw pitch is 10 mm. If the coefficient of friction between the screw and the
       nut is 0.15, neglecting friction between the nut and collar, determine

       i. Force required to be applied at the screw to raise a load of 2000N
       ii. The efficiency of screw jack
       iii. Force required to be applied at pitch radius to lower the same load of 2000
            N and
       iv. Efficiency while lowering the load
       v. What should be the pitch for the maximum efficiency of the screw? and
       vi. What should be the value of the maximum efficiency?   [6+10]

3. (a) Derive an expression for ratio of tensions of a belt in standard form

   (b) The centre of two pulleys of diameter 120 mm and 240 mm are 300 mm apart.
       They are connected by an open belt. If the coefficient of friction for the larger
       pulley be 0.28, what would be its value for the smaller pulleys simultaneously?
                                                                            [6+10]

4. (a) State and prove parallel axis theorem.

(b) Find the moment of inertia about the horizontal centroidal axis of shaded portion for the Figure 4b. [6+10]

Figure 4b

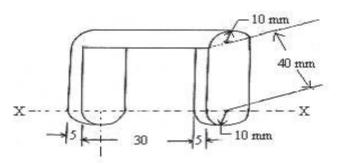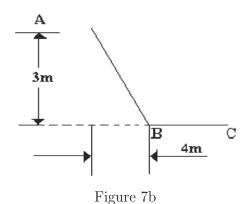5. Compute the mass moment of inertia about the x – axis of the steel link shown in figure5. [16]

Figure 5

6. (a) Maximum range of a field gun is 2000 m. If a target at a distance of 1200 m is to be hit, what should be the angle of projection.

(b) A stone dropped into a well is heard to strike the water in 3.5 seconds. Find the depth of the well assuming the velocity of sound is 335 m/sec. [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=180rpm, 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. A centrifugal pump rotating at 400 rpm is driven by an elastic motor at 1200 rpm through a single stage reduction gearing. The moment of inertia of the pump impeller at the motor are 1500 kg.m² and 450 kg.m² respectively. The lengths of the pump shaft and the motor shaft are 500 and 200 mm, and their diameters are 100 and 50 mm respectively. Neglecting the inertia of the gears, find the frequency of torsional oscillations of the system. G = 85 GN/m². [16]

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