Code No: R05010302 **Set No. 4**

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]

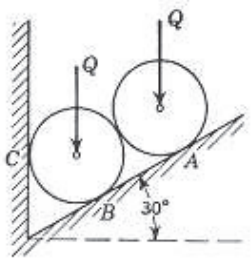

Figure 1b

2. (a) Define the following:
      i. Friction
      ii. Angle of friction
      iii. Limiting friction
      iv. Cone of friction
   (b) A ladder 5 m long and of 250 N weight is placed against a vertical wall in a position where its inclination to the vertical is 30^0. A man weighing 800 N climbs the ladder. At what position will he induce slipping? The co-efficient of friction for both the contact surfaces of the ladder viz. with the wall and the floor is 0.2. [8+8]

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 170^0 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) From the first principles determine product of inertia for right angle triangle of base ' b' and altitude ' h'.
   (b) State and prove transfer formula for product of inertia. [8+8]

5. Derive the expression for the moment of inertia of a cylinder length 'l', radius 'r' and density 'w' about longitudinal centroidal axis and about the centroidal transverse axis. [16]

6. (a) A train is uniformly accelerated and passes successive kilometer stones with velocities of 18 km/hr and 36 km/hr respectively. Calculate the velocity when it passes the third kilometer stone. Also find the time taken for each of the two intervals of one kilometer.

   (b) A ball projected vertically upwards attains a maximum height of 400 metres. Calculate the velocity of projection and compute the time of flight in air. At what altitude will this ball meet a second ball projected vertically upwards 4 seconds later with a speed of 120 metres per second? [8+8]

7. (a) A body weighing 20 N is projected up a 20^0 inclined plane with a velocity of 12 m/s, coefficient of friction is 0.15. Find

      i. The maximum distance S, that the body will move up the inclined plane

      ii. Velocity of the body when it returns to its original position.

   (b) Find the acceleration of the moving loads as shown in figure 7b. Take mass of P=120 kg and that of Q=80 Kg and coefficient of friction between surfaces of contact is 0.3. Also find the tension in the connecting string. [8+8]

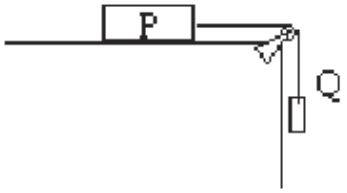

Figure 7b

8. A gun is so designed that on firing, the barrel recoils against a spring. A dashpot, at the end of the recoil, allows the barrel to come back to its initial position within the minimum time without any oscillation. A gun barrel has a mass of 500kg and a recoil spring of 300 N/mm. The barrel recoils 1m on firing. Determine

   (a) the initial recoil velocity of the gun barrel and

   (b) the critical damping coefficient of the dashpot engaged at the end of the recoil strike. [16]

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