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BME-016

B.Tech. MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING) / B.Tech. AEROSPACE ENGINEERING (BTAE)

Term-End Examination

00243

June, 2018

BME-016 : ENGINEERING MECHANICS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **five** questions. All questions carry equal marks. Use of calculator (non-programmable) is permitted. Assume missing data, if any, suitably.*

1. (a) The coefficient of static friction between a block of mass m and an inclined plane is $\mu_s = 0{\cdot}3$.

(i) What can be the maximum angle θ of the inclined plane with the horizontal so that the block does not slip on the plane ?

(ii) If the inclined plane makes an angle $\theta/2$ with the horizontal, determine the frictional force on the block. *10*

(b) Discuss the laws of friction. *4*

2. (a) Both the springs shown in Figure 1 are unstretched. If the block is displaced by a distance x and released, what will be the initial acceleration ? *4*

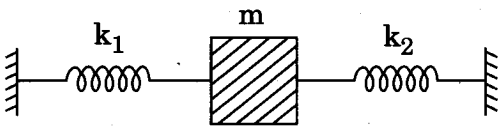

Figure 1

(b) A small block B is placed on another block A of mass 5 kg and length 20 cm. Initially the block B is near the right end of a block A (Figure 2). A constant horizontal force of 10 N is applied to block A. All the surfaces are assumed frictionless. Find the time elapsed before the block B separates from block A. *10*

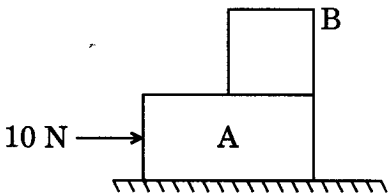

Figure 2

3. (a) Find the moment of inertia of a pair of spheres, each having a mass 'm' and radius 'r', kept in contact about the tangent passing through the point of contact. *7*

(b) A man weighing 'm' is standing on a platform of mass M kept on smooth ice. If the man starts moving on the platform with a speed v relative to the platform, with what velocity relative to the ice does the platform recoil ? 7

4. (a) A ball of mass m hits the floor with a speed v making an angle of incidence θ with the normal. The co-efficient of restitution is e. Find the speed of the reflected ball and the angle of reflection of the ball. 7

(b) A cubical block of ice of mass m and edge L is placed centrally in a large tray of mass M. Discuss the change in centre of mass of the combined system due to melting of ice. 7

5. (a) A body of mass m is suspended by two strings making angles θ and β with the horizontal. Find the tensions in the strings. 7

(b) The distance travelled by a particle in time t is given by $S = (2{\cdot}5\ m/s^2)t^2$. Find (i) the average speed of the particle during the time 0 to 5·0 S, and (ii) the instantaneous speed at t = 5·0 S. 7

6. A simple pendulum is suspended from the ceiling of a car accelerating uniformly on a horizontal road. If the acceleration is a_0 and the length of the pendulum is l, find the time period of small magnitude of oscillations about the mean position. 14

7. (a) A force F acts tangentially at the highest point of a sphere of mass m kept on a rough horizontal plane. If the sphere rolls without slipping, find the acceleration of the centre of the sphere. 7

(b) Determine the force in each member of the truss (Figure 3) and indicate whether the members are in tension or compression. 7

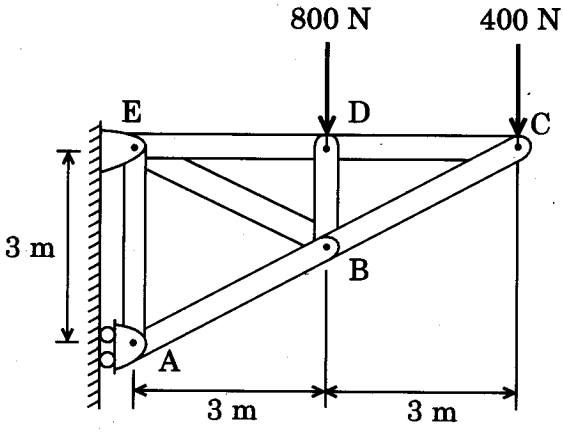

Figure 3