Code: R5 100305

R5

B.Tech I Year (R05) Supplementary Examinations, May 2012

ENGINEERING MECHANICS

(Mechanical Engineering)

Time: 3 hours Max Marks: 80

Answer any FIVE questions

All questions carry equal marks

*****

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 figure 1. Assuming smooth surfaces, find the reactions induced at the points of support A, B and C.

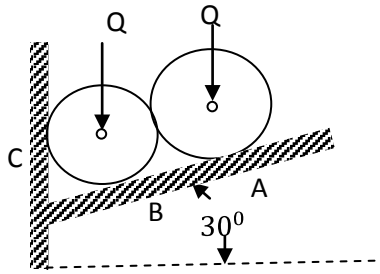

Figure :1

2 (a) Explain the principles of operation of a screw-jack with 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 2000 N
(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.

3 An open belt drive connects two pulleys 120 cm and 40 cm diameter on parallel shafts 4 m apart. The maximum tension in the belt is 1855 N. The coefficient of friction is 0.3. The driver pulley of diameter 120 cm runs at 200 rpm. Calculate:
(i) The power transmitted.
(ii) Torque on each of the two shafts.

4 A steel ball of diameter 150 mm rests centrally over a concrete cube of size 150 mm. Determine the center of gravity of the system, taking weight of concrete = 25,000 N/m^2 and that of steel 80,000 N/m^2.

Contd. in Page 2

Code: R5 100305

R5

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 the mass moment of inertia of a right circular cone of base radius 'R' and mass 'M' about the axis of the cone.

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

(b) A homogeneous sphere of radius of a = 100 mm and weight W = 10 N can rotate freely about a diameter. If it starts from rest and gains with constant angular acceleration, angular speed N = 180 rpm, in 12 revolutions, find the action moment.

7 (a) An automobile moving with a uniform velocity of 40 kmph is accelerated by increasing the traction force by 20%. If the resistance to motion is constant, find the distance traveled before it acquires 50 kmph. 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 12 m behind it, what is the total length 'S' of the incline?

8 A particle with a simple harmonic motion has an amplitude of 375 mm and a period of $\pi/2$ sec. Find the velocity and acceleration of the particle when it has travelled 225 mm to the right of the center of its path. What time is required for this displacement?

*****