

Code :R5100305

**B.Tech I Year (R05) Supplementary Examinations, May 2011**  
**ENGINEERING MECHANICS**  
 (Mechanical Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE questions  
 All questions carry equal marks  
 ★ ★ ★ ★ ★

- (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.

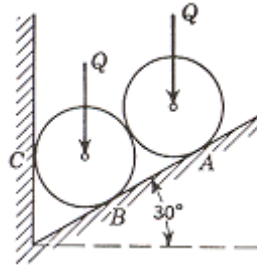


Figure 1:

- (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
  - Force required to be applied at the screw to raise a load of 2000N
  - The efficiency of screw jack
  - Force required to be applied at pitch radius to lower the same load of 2000 N and
  - Efficiency while lowering the load
  - What should be the pitch for the maximum efficiency of the screw? and
  - What should be the value of the maximum efficiency?
- (a) Obtain the conditions for the maximum power transmitted by a belt from one pulley to another.  
 (b) A shaft running at 100 r.p.m drives another shaft at 200 r.p.m and transmits 12 kW. The belt is 100 mm wide and 12 mm thick and  $\mu = 0.25$ . The distance between the shafts is 2.5 meters and the diameter of the smaller pulley is 500 mm. Calculate the stress in
  - An open belt
  - A crossed belt, connecting the two pulleys.
- (a) State and prove parallel axis theorem.  
 (b) Find the centroid of the shaded lamina shown in Figure 2.

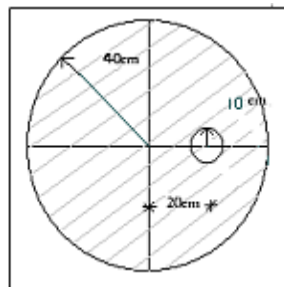


Figure 2:

- (a) Show that the moment of inertia of a homogenous triangular plate of weight 'W' with respect to its base of width b is  $Wb^2/6g$  where g is the acceleration due to gravity.  
 (b) A right circular cone has the radius of base as 200mm and height 500mm. The mass density of the cone is  $7800 \text{ kg/m}^3$ . Find out the mass moment of inertia of this cone about a line which passes through the vertex of the cone and which is parallel to the base of the cone.

6. (a) A train is uniformly accelerated and passes successive kilometer stones with velocities of 18km/hr and 36km/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?
7. (a) A homogeneous solid cylinder of weight 100 N whose axis is horizontal rotates about its axis, in frictionless bearings under the action of the weight of a 10N block which is carried by a rope wrapped around the cylinder. What will be angular velocity of cylinder two seconds after the motion starts? Assume the diameter of cylinder as 100cm.
- (b) A block of mass 5Kg resting on a  $30^\circ$  inclined plane is released. The block after travelling a distance of 0.5m along the inclined plane hits a spring of stiffness 15N/cm. Find the maximum compression of spring. Assume coefficient of friction between the block and the inclined plane is 0.2. As shown in the Figure 3.

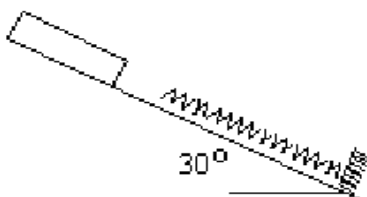


Figure 3:

8. A weight of 10N attached to a spring oscillates at a frequency of 60 oscillations per minute. If the maximum amplitude is 30mm, find the tension induced in the spring. Also find the spring constant and the maximum velocity in the spring.

