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Total Number of Pages: 3

**B.TECH**  
**BE2104**

**1<sup>st</sup> Semester Back Examination 2015-16**

**MECHANICS**

**BRANCH: ALL**

**Time: 3 Hours**

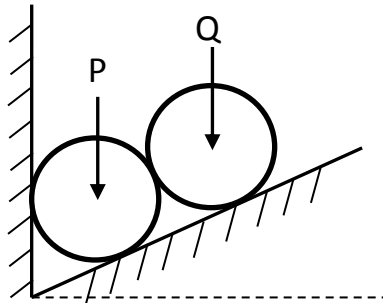
**Max marks: 70**

**Q.CODE: T857**

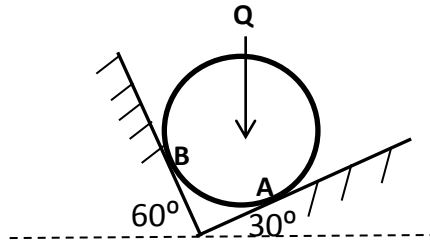
**Answer Question No.1 which is compulsory and any five from the rest.  
The figures in the right hand margin indicate marks.**

**Q1** Answer the following questions: **(2 x 10)**

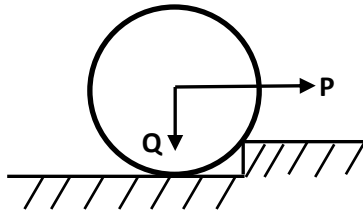
- a) State and explain with a neat sketch the theorem of transmissibility of a force.
- b) Two rollers of weight P and Q are supported by an inclined plane and vertical wall as shown in the figure. Draw the free body diagram of both the rollers taken separately.



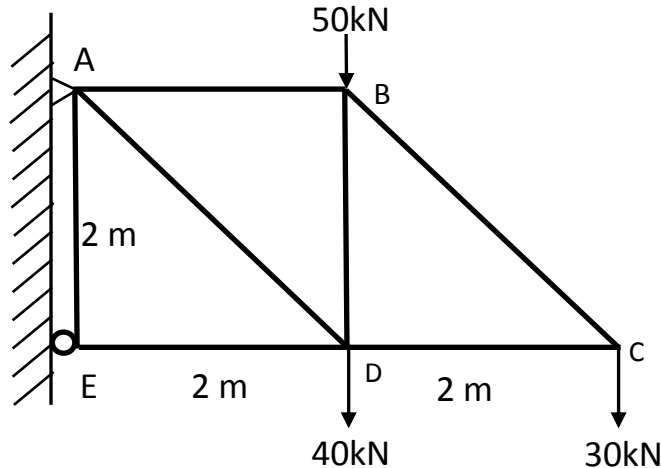
- c) Differentiate between resultant and equilibrant.
  - d) Differentiate limiting friction, static friction and dynamic friction.
  - e) State the two theorems of Pappus and explain its applicability with a neat diagram.
  - f) Explain the term kinematics and kinetics.
  - g) State Newton's Laws of motion.
  - h) What is the advantage of D'Alembert's Principle as compared to Newton's Second Law of motion?
  - i) If the speed of a particle along a circular path is constant, what is the value of tangential acceleration?
  - j) Explain the terms Elastic Impact, Plastic Impact and Semi-elastic Impact.
- Q2** a) A ball of weight  $Q=100$  N rests in a right-angled trough as shown in the figure. Determine the forces exerted on the sides of the trough at A and B if all the surfaces are perfectly smooth. **(5)**



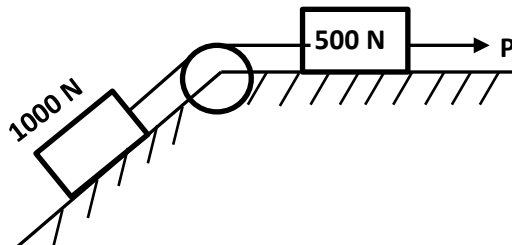
- b) Determine the magnitude of the horizontal force  $P$  applied at the centre  $C$  of the roller of weight  $Q = 500 \text{ N}$  and radius  $r = 400 \text{ mm}$  which will be necessary to pull it over a  $75 \text{ mm}$  curb as shown in the figure. (5)



- Q3 Determine the force in each member of the truss as shown in the Figure. (10)

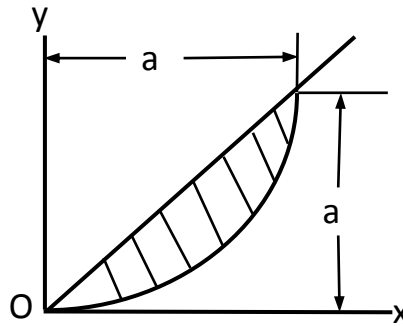


- Q4 a) What is the least value of  $P$  applied horizontally to cause the motion to impend in the direction of the applied force  $P$  for the system as shown in the figure. Assume the coefficient of friction on all contact surfaces as  $0.2$ . The angle of inclination of the plane with horizontal is  $30^\circ$ . (7)

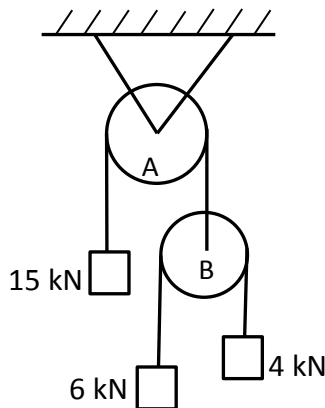


- b) Explain virtual displacement, virtual work and Principle of Virtual Work with a neat sketch. (3)

- Q5 a) State and prove Parallel Axis theorem. (3)  
b) Determine the coordinate  $x_c$  and  $y_c$  of the area between parabola  $y = x^2/a$  and straight line  $y = x$  as shown in the figure. (7)



- Q6 a)** A motorist is travelling at 72 kmph observes a traffic light 600 m ahead of him turns red. The traffic light is timed to stay red for 20 sec. If the motorist wishes to pass the light without stopping, just as it turns green. Determine (i) the required uniform acceleration of the motor, (ii) the speed of the motor as it passes the light **(3)**
- b)** A system of weights connected by strings, passing over pulleys A and B as shown in the figure. Find the accelerations of the three weights assuming weightless strings and ideal conditions for the pulleys. **(7)**



- Q7 a)** A car weighing 50 kN and moving at 54 kmph along the main road collides with a lorry of weight 100 kN which emerges at 18 kmph from a cross road at right angles to the main road. If the two vehicles lock after collision, what will be the magnitude and direction of the resulting velocity. **(5)**
- b)** A projectile is aimed at a target on the horizontal plane and falls 12 m short when the angle of projection is  $15^\circ$ , while it overshoots by 24 m when the angle is  $45^\circ$ . Find the angle of projection to hit the target. **(5)**
- Q8 a)** A block of weight 12 N falls a distance of 0.75 m on the top of a spring. If the block comes to rest momentarily after compressing the spring by 150 mm, find the spring constant. **(3)**
- b)** A pulley weighs 500 N and has a radius of 0.75 m. A block weighing 400 N is supported by inextensible wire wound around the pulley. Determine the velocity of the block 2 sec after it is released from rest. Assume the motion is under constant acceleration. **(7)**