Con. 5902-09.



F-E-CAIL branch Sem I (R) Engineering (3 Hours) Mechanics

SP-8447

[Total Marks : 100 11/1/10

- N.B. (1) Question No. 1 is compulsory.
  - (2) Attempt any four questions from the remaining six questions.
  - (3) Figures to the right indicate full marks.
  - (4) Assume **suitable** additional data if **necessary** and state the same **clearly** in your answer.
  - (5) Take  $g = 9.81 \text{ m/s}^2$ .
- 1. Solve any four of the following :--
  - (a) Five concurrent coplanar forces act on a body as shown in figure. Find the 5 forces P and Q such that the resultant of the five forces is zero.



(b) For the truss loaded as shown in figure find the force in members CE and CF 5 by method of sections only.



(c) A block of weight 200 N rests on a horizontal surface. The co-efficient of friction between the block and the horizontal surface is 0.4. Find the frictional force acting on the block if a horizontal force of 40 N is applied to the block.



- (d) Prove that the path travelled by a projectile is a parabola.
- (e) A wheel of radius 0.75 m rolls without slipping on a horizontal surface to the right. Determine the velocities of the points P and Q shown in **figure** when the velocity of centre of the wheel is 10 m/s towards right.



A vertical lift of weight 10 kN moving from rest with constant acceleration 5 acquires an upward velocity of 4 m/s over a distance of 5 m. Determine the tension in the cable supporting the lift.

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2. (a) Determine the resultant of the system of forces shown in **figure**. Locate the point **10** where the resultant cuts the base AB.



(b) Two blocks A and B of weight 500 N and 750 N respectively are connected by a 10 cord that passes over a frictionless pulley as shown in figure. The coefficient of friction between the block A and the inclined plane is 0.4 and that between the block B and the inclined plane is 0.3. Determine the force P to be applied to block B to produce the impending motion of block B down the plane.



3. (a) Find the forces in the members of the pin jointed truss loaded as shown in **figure**. **8** Tabulate the forces.



(b) A slider crank mechanism is shown in figure. The crank OA rotates anticlockwise 12 at 100 rad/s. Find the angular velocity of rod AB and the velocity of the slider at B.



(a) A smooth spherical ball A of mass 5 Kg is moving in a horizontal plane from left to right with a velocity of 10 m/s. Another ball B of mass 6 Kg traveling in a perpendicular direction with a velocity of 20 m/s collides with A in such a way that the line of impact is in the direction of motion of ball B. Assuming e = 0.7, determine the velocities of balls A and B after impact.

(b) Two cylinders each of diameter 100 mm and each weighing 200 N are placed as 12 shown in figure. Assuming that all the contact surfaces are smooth find the reactions at A, B and C.



- 5. (a) A lever CD is connected to cylindrical drum A through a belt as shown in figure 10 such that the drum does not rotate. The coefficient of friction between the belt and the drum is 0.3. A boy exerts a 100 N upward push on the lever at C. Determine -
  - (i) the maximum weight W that the boy can lift
    - (ii) the maximum weight W that the boy can hold.



- (b) A stone is dropped from the top of a tower. When it has fallen a distance of 10m, 10 another stone is dropped from a point 38 m below the top of the tower. If both the stones reach the ground at the same time calculate -
  - (i) the height of the tower
  - (ii) the velocity of the stones when they reach the ground.
- 6. (a) A particle starting from rest at the position (5, 6, 2) maccelerates at  $\bar{a} = 6t\bar{i} - 24t^2\bar{i} + 10\bar{k}m/s^2$ . Determine the acceleration, velocity and displacement of the particle at the end of 2 seconds.
  - (b) Find the centroid of the area shown in figure. Also find the moment of inertia of the 10 same area about x axis.



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7. (a) Two blocks A of weight 500 N and B of weight 300 N are 10 m apart on an inclined 12 plane as shown in figure. The coefficient of friction for blocks A and B with the inclined plane are 0.2 and 0.3 respectively. If the blocks begin to slide down simultaneously calculate the time and distance traveled by each block when block A touches block B.

X

8

4



B

40°

