(Library) Sem-I [Rev] / All branches 27/12/08
Engg. Mechanics.

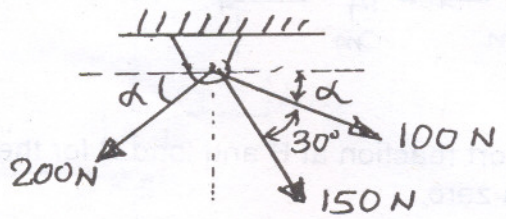
Con. 3724-08. **(REVISED COURSE)** **RC- 5600**

(3 Hours) **[Total Marks : 100**

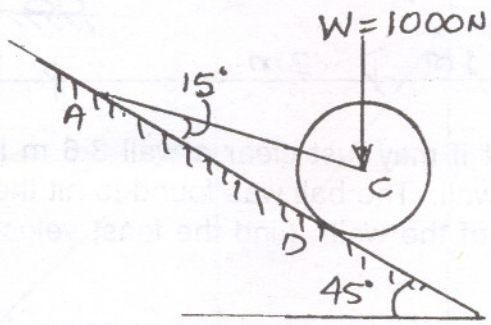
N.B. (1) Question No. **1** is **compulsory**.
(2) Attempt any **five** questions.
(3) Assume **suitable** data if **necessary**.
(4) **Figures** to **right** indicate marks.
(5) Take g = 9·81 m/s².

1. Solve any **four** of the following :— **20**

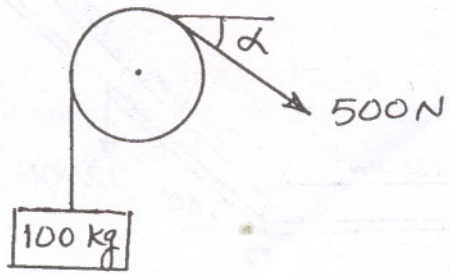
(a) For the system shown, determine —
(i) The required value of α if resultant of three forces is to be vertical.
(ii) The corresponding magnitude of resultant.



(b) A roller of weight W = 1000 N rest on a smooth incline plane. It is kept from rolling down the plane by a string AC. Find the tension in the string and reaction at the point of contact D.



(c) For given arrangement, find the angle α for which load begins to slip. Take μ = 0·3 between fixed drum and rope.



(d) A stone is released from top of the tower, during the last second of its motion, it covers ¼th of the height of the tower. Find the height of the tower.

(e) A ball drops from the ceiling of a room. After rebounding twice from the floor it reaches a height equal to half that of ceiling find the coefficient of restitution.

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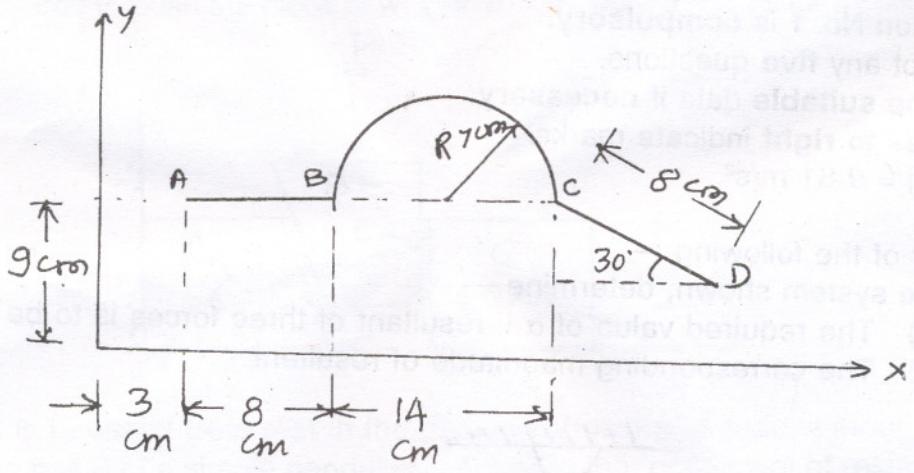
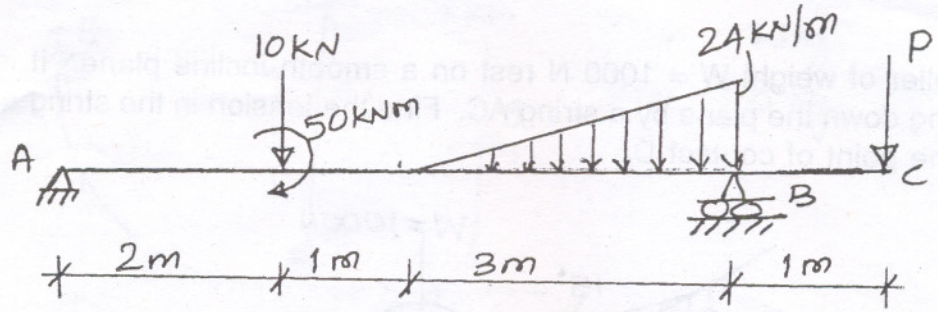
(f) Find the centroid of bent wire shown in the **figure** :—

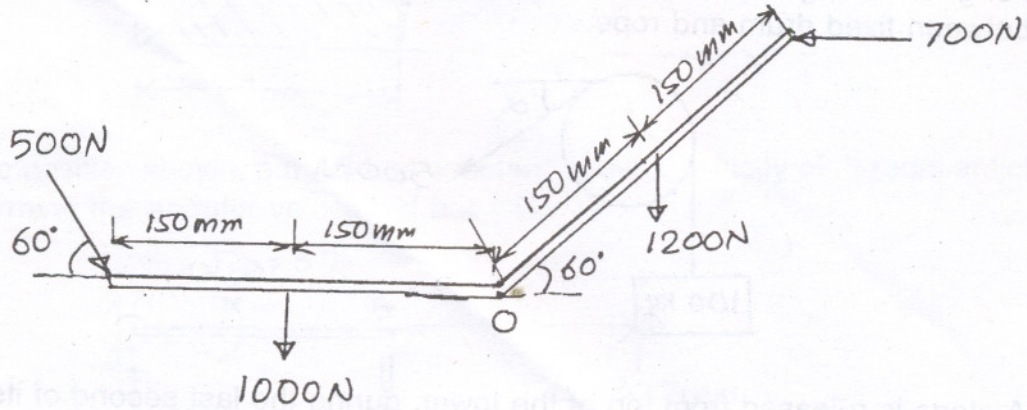


2. (a) Find analytically the support reaction at B and load P for the beam shown in **figure** if reaction at support A is zero. **10**



(b) A boy throws a ball so that if may just clear a wall 3·6 m high. The boy is at a distance of 4·8 m from the wall. The ball was found to hit the ground at a distance of 3·6 m on the other side of the wall. Find the least velocity with which the ball can be thrown. **10**

3. (a) A system of forces acting on a bell crank as shown. Determine the magnitude, direction and the point of application of the resultant w.r.t. 'O'. **10**



(b) A rocket follows a path such that its acceleration is given by $\bar{a} = (4i + tj)$ m/s^2 at $\bar{r} = 0$, it starts from rest. **10**

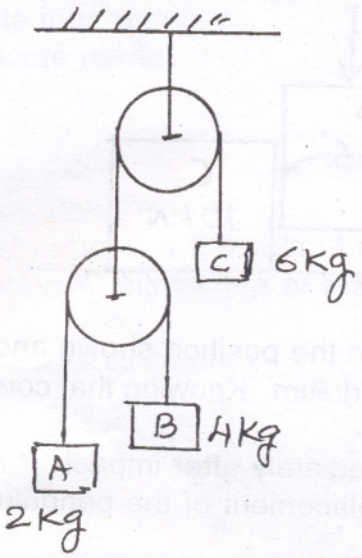
At t = 10 sec. Determine —

(i) Speed of the rocket

(ii) Radius of curvature of its path

(iii) Magnitude of normal and tangential components of acceleration.

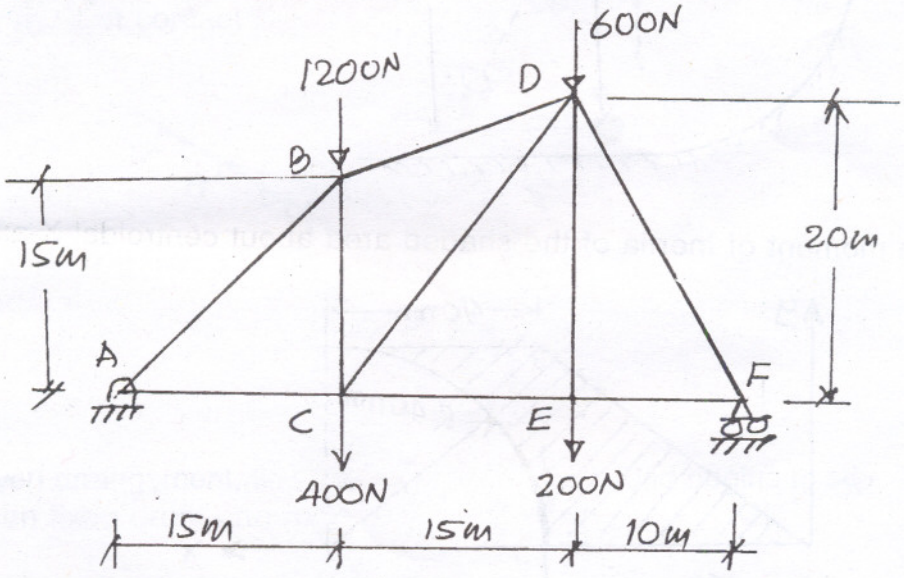
4. (a) The system of pulleys, masses and connecting inextensible cables as shown pulleys are massless and frictionless. If the system is released from rest, Find the acceleration of each of the three masses and tension in the cable. **10**



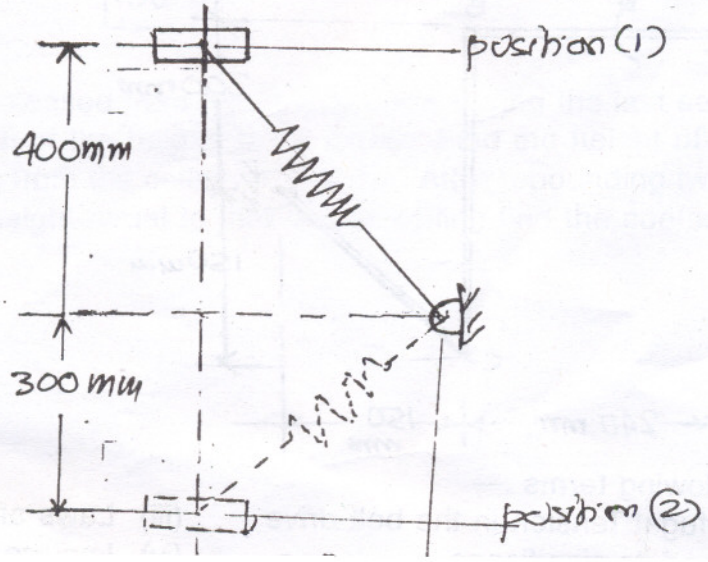
(b) A pin jointed truss is loaded and supported as shown, determine — **10**

(i) Forces in member BD, CD and CE by method of section and

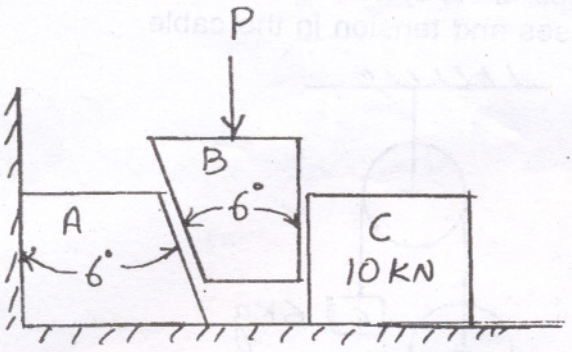
(ii) Forces in remaining members by method of joint.



5. (a) A collar A of mass 10 kg moves in a vertical guide as shown. Neglecting friction between guide and the collar, find its velocity when it passes through position (2), after starting from rest in position (1). The spring constant is 200 N/m and the free length of the spring is 200 mm. **10**



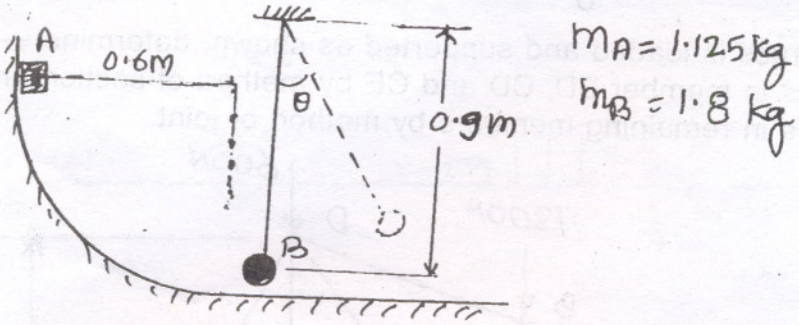
(b) Two 6° wedges are used to push a block horizontally as shown. Calculate the minimum force required to push the block of weight 10 kN. Take $\mu = 0{\cdot}25$ for all contact surfaces. **10**



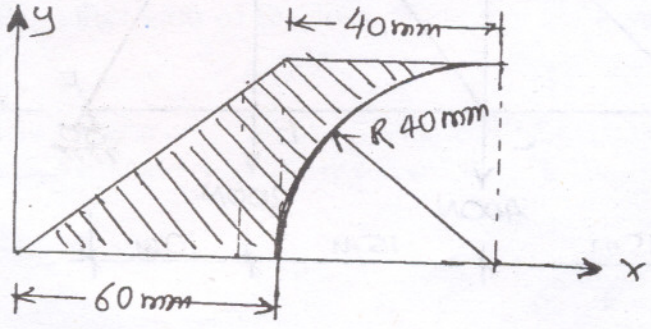
6. (a) Block A is released from rest in the position shown and slide without friction until it strike the ball B of a simple pendulum. Knowing that coefficient of restitution between A and B as 0·9. Determine — **10**

(i) the velocity of B immediately after impact

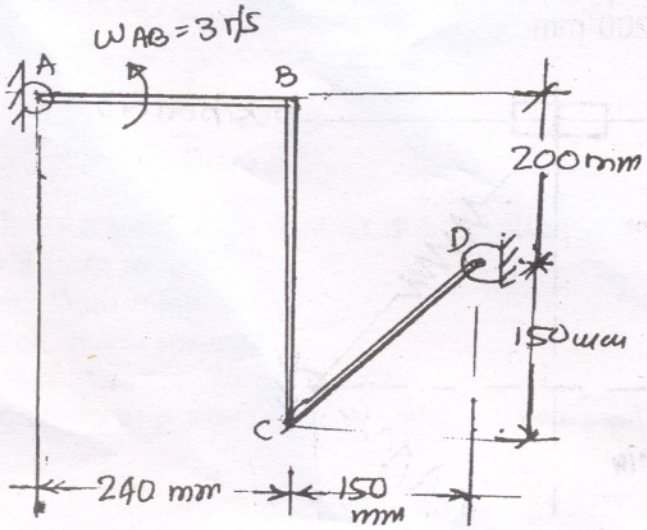
(ii) the max. angular displacement of the pendulum.



(b) Find the moment of Inertia of the shaded area about centroidal X-axis and Y-axis. **10**



7. (a) In the position shown, bar AB has constant angular velocity of 3 rad/s anticlockwise, determine the angular velocity of bar CD. **10**



(b) Explain the following terms :— **10**