

Bachelor of Civil Engg 1<sup>st</sup> year 1<sup>st</sup> Semester Supplementary Examination, 2017

Jadavpur University

Subject : Engineering Mechanics

Full Marks : 100

Time : 3 hrs

Answer any five questions :

- 1 (a) Refer to Fig A and find out the moment of the force P about point O and also about X axis.  
(b) Refer to Fig B and replace the system of forces and moments with a single force-moment system to be applied at O. 10+10
2. (a) Refer to Fig. C and find out the angle  $\alpha$  if the system is in equilibrium. Mass of two rollers A, B are 50 kg and 30 kg respectively and they, connected with a cable, rest on two smooth inclined planes.  
(b) Refer to Fig D and find out the minimum value of force P required to maintain equilibrium. Coefficient of friction for all surfaces is 0.2 and mass of the rod is 4.5 kg. 10+10
3. (a) Find out the x and y coordinate of the centroid of the area bounded by  $y = x$  and  $y = x^2$ .  
(b) Refer to Fig E and find out  $I_{xx}$ ,  $I_{yy}$  and polar moment of inertia. 10+10
- 4 (a) A projectile is thrown up an inclined plane (Fig F) with a velocity 30m/s. Find out the distance along the slope at which it will strike the inclined plane.  
(b) Starting from a certain position M, a particle moves along the circumference of a circular path (Fig G) with radius  $r = 6$  cm. At any instant t, angle  $\Theta = 0.6 t^2$  where t is in seconds and angle in radian. Find out the velocity and acceleration of the particle when it comes back to position after completing one revolution. 10+10
- 5 (a) Refer to Fig H and find out the velocity of the collar when it reaches the position B from initial position A. Mass of the collar is 15 kg, the rod is smooth, F is a constant force of magnitude 600N. Spring constant is 3 N/mm and unstretched length of the spring is 1 m.

(b) What do you mean by impulse ? Write down the impulse momentum principle.

(c) Deduce the expressions of velocity and acceleration in case of polar coordinate system. 10+4+6

6. Refer to Fig I and find out the support reactions at O and tensions in the cables AB and AC. Take the mass of the rod as 240 kg and consider ball and socket joint at point O. 20

7. Write short notes on any four.

4X5=20

(a) Two force and three force member

(b) Free body diagram

(c) Structure and frame

(d) Theorems of Pappus Guldinus

(e) Coulomb's laws of dry friction.

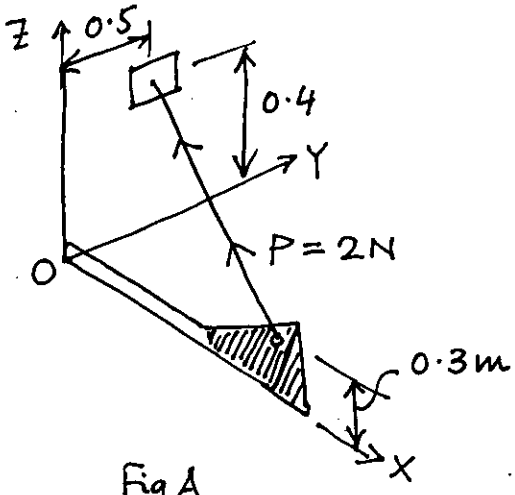


Fig A

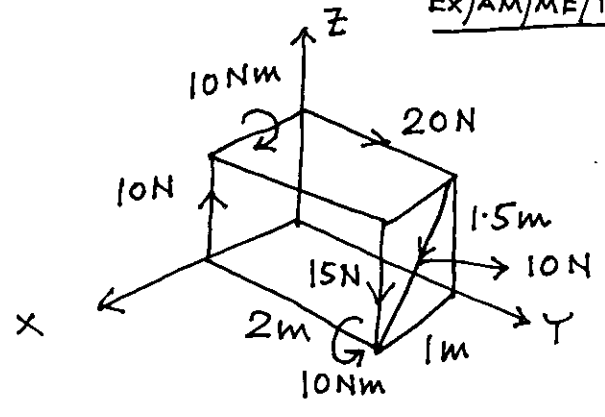


Fig B

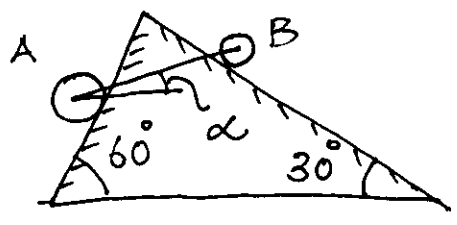


Fig C

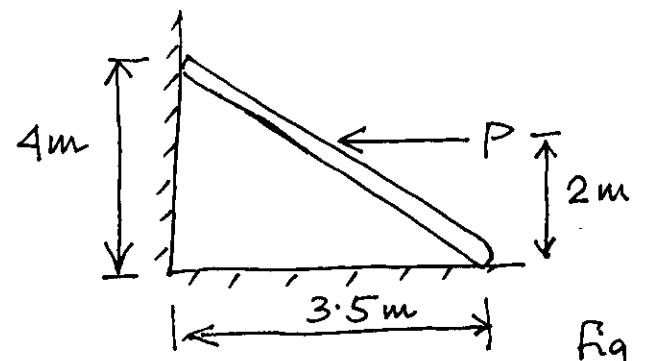


Fig D

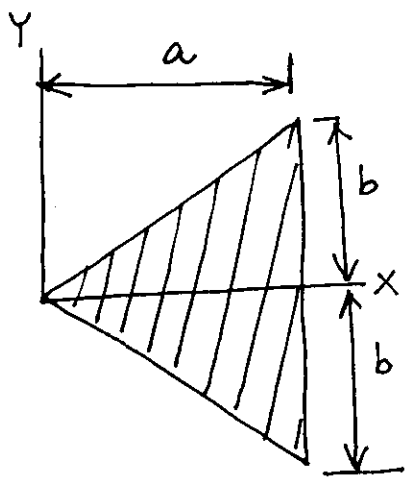


Fig E

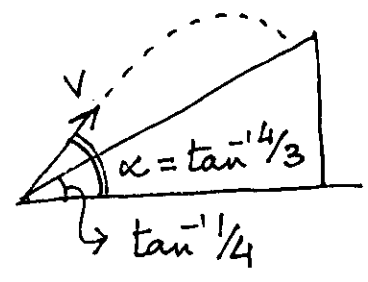


Fig F

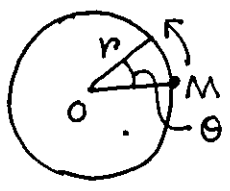
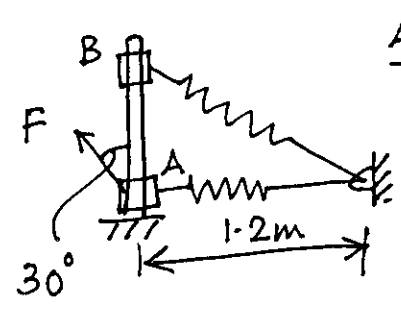


Fig G



AB = 0.9m

Fig H

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$B(0, -3, 5) \text{ m}$

$C(0, 3, 5) \text{ m}$

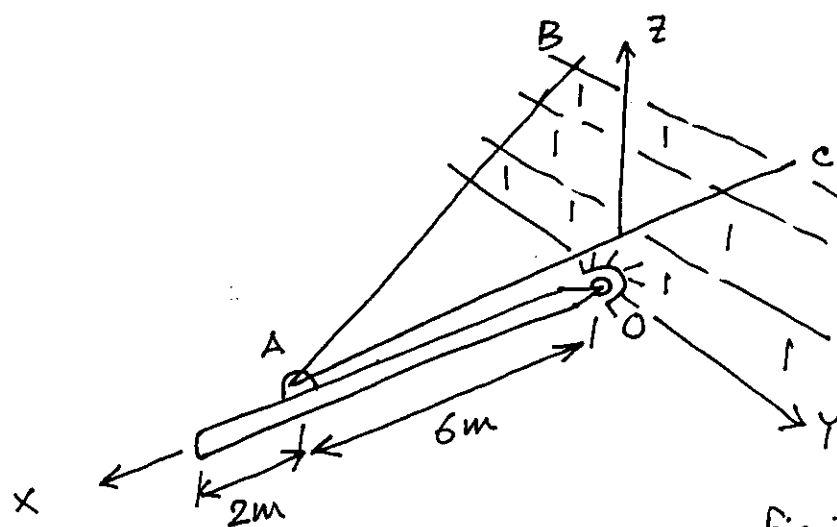


Fig I