

**I B. Tech I Semester Supplementary Examinations, December- 2021**  
**ENGINEERING MECHANICS**  
 (Com. to CE, Auto E, Min E)

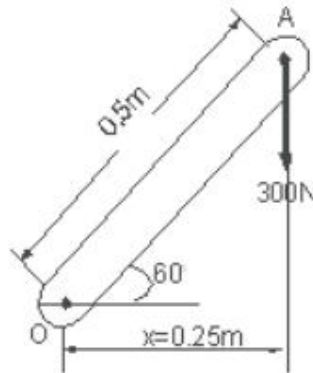
Time: 3 hours

Max. Marks: 75

**Answer any five Questions one Question from Each Unit**  
**All Questions Carry Equal Marks**

**UNIT-I**

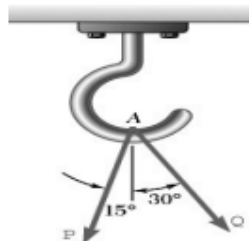
- 1 a) A 300 N vertical force is applied at the end of a lever which is attached to shaft at O as shown in ure.1 Determine the moment of the 300 N force about O and the magnitude of the horizontal force applied at A which creates the same moment about O. (8M)



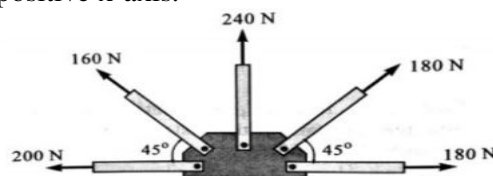
- b) A block weighing 100 N is resting on a rough plane inclined  $20^{\circ}$  to the horizontal. (7M)  
 It is acted upon by a force of 50N directed upward at angle of  $14^{\circ}$  above the plane. Determine the friction. If the block is about to move up the plane, determine the co-efficient of friction.

**Or**

- 2 a) Two forces P and Q are applied as shown in .2 at point A of a hook support. (8M)  
 Knowing that  $P = 15 \text{ lb}$  and  $Q = 25 \text{ lb}$ , determine the magnitude and direction of their resultant.

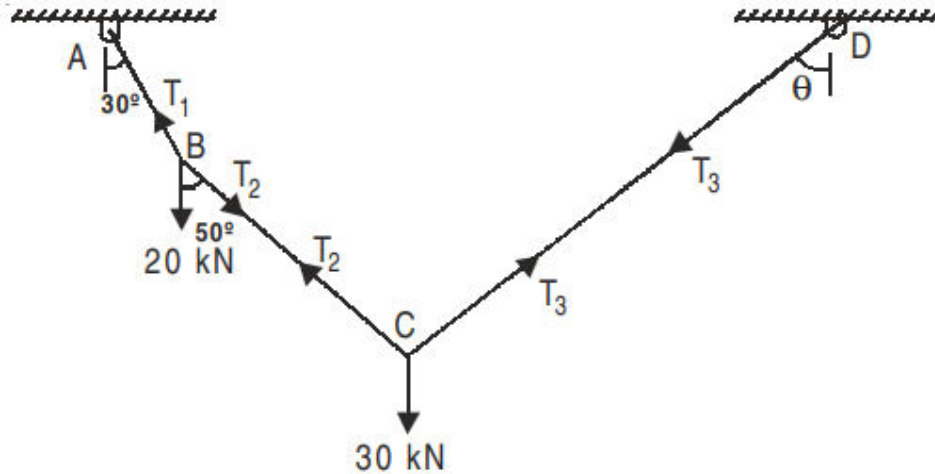


- b) A gusset plate of roof truss is subjected to forces as shown in Figure Determine the magnitude of the resultant force and its orientation measured counter clockwise from the positive x-axis. (7M)



## UNIT-II

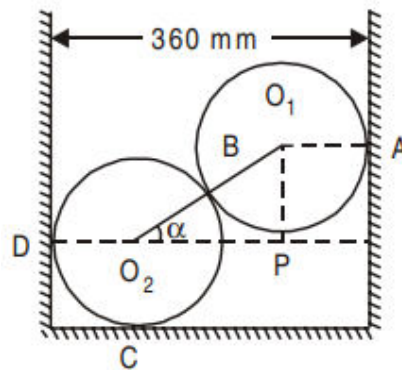
- 3 a) A wire rope is fixed at two points A and D as shown in Figure. Two weights 20 kN and 30 kN are attached to it at B and C, respectively. The weights rest with portions AB and BC inclined at angles  $30^\circ$  and  $50^\circ$  respectively, to the vertical as shown in figure. Find the tension in the wire in segments AB, BC and CD and also the inclination of the segments CD to vertical. (9M)



- b) What is a free body diagram? Discuss the procedure for drawing free body diagrams. (6M)

Or

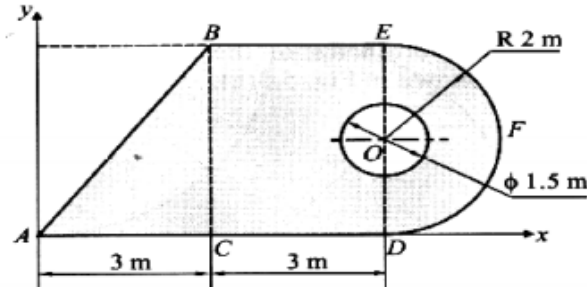
- 4 a) Two smooth spheres each of radius 100 mm and weight 100 N, rest in a horizontal channel having vertical walls, the distance between which is 360 mm. Find the reactions at the points of contacts A, B, C and D shown in Figure. (8M)



- b) Explain the equilibrium conditions of coplanar force system (7M)

## UNIT-III

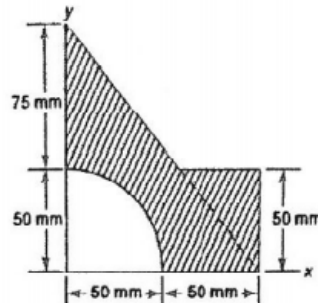
- 5 a) Three plates ABC and BCDE and DEF are welded together as shown in Figure. (8M)  
Circle of diameter 1.5 m is cut from the composite plate. Determine the centroid of the remaining area.



- b) A hemisphere of 60 mm diameter is placed on the top of the cylinder having 60 mm diameter. Find the center of gravity of the body from the base of the cylinder if its height is 100 mm. (7M)

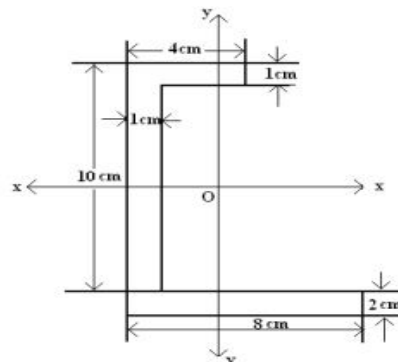
Or

- 6 a) State the laws of dry friction. (6M)  
b) With respect to coordinate axes x and y, locate the centroid of the shaded area as shown in Figure. (9M)



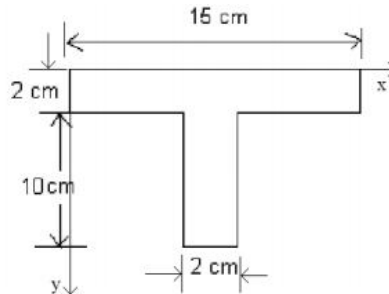
## UNIT-IV

- 7 a) Explain the terms: (i) Moment of inertia (ii) Polar moment of inertia (iii) Product of inertia. (7M)  
b) Find the moment of inertia of the plane area shown in Figure about X and Y axes through its centroid. (8M)



Or

- 8 a) Find the product of inertia about the X and Y axes shown in Figure. (8M)



- b) A cylinder of length 750 mm and diameter 150 mm is standing on its base. Determine the mass moment of inertia of the cylinder about longitudinal axis. Take the density of the material as  $7830 \text{ kg/m}^3$ . (7M)

## UNIT-V

- 9 a) A motor moving with a uniform acceleration covers a distance of 20m in 4seconds and 40 m in 6 seconds. Find the uniform acceleration of the motor? (8M)
- b) An elevator is moving upwards with a constant speed of 10m/s. If a man standing inside the elevator drops a coin from a height of 2.45m, find the time taken by the coin to reach the floor of the elevator. ( $g=9.8\text{m/s}^2$ ). (7M)

Or

- 10 a) A bullet fired at a speed of 300 m/sec penetrates a log of wood to a depth of 450 mm. If the bullet moving at the same speed is fired into a similar piece of wood 200mm thick. Determine the velocity of emergence of the bullet. Assume the resistance to be uniform in both the cases. (8M)
- b) A truck of weight 20 kN is travelling at 45 km/hr on a level road. It is brought to rest in 20 meter, what is the average force of resistance acting on the truck. (7M)