

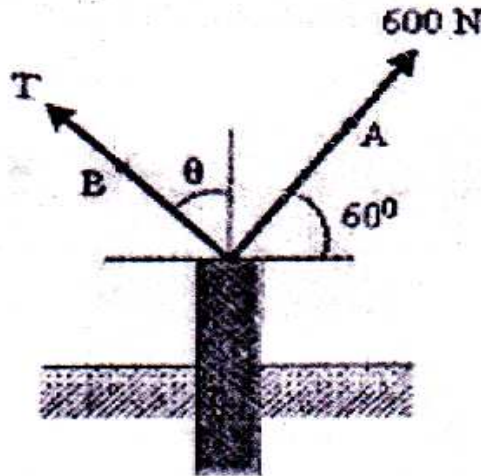
[5251]-1009

**First Year Engineering (Semester - II)**  
**ENGINEERING MECHANICS**  
**(2015 Pattern)**

*Time : 2 Hours]**[Max. Marks : 50**Instructions to the candidates:*

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Assume suitable data, if necessary and clearly state.
- 5) Use of electronic pocket calculator is allowed.

- Q1) a)** The post is to be pulled out of the ground using two ropes A and B as shown in Fig. Rope A is subjected to a force of 600 N and is directed at  $60^\circ$  from the horizontal. If the resultant force acting on the post is to be 1200 N vertically upward, determine the force T in rope B and the corresponding angle  $\theta$ . [6]

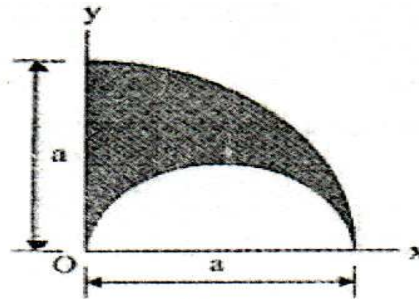


- b) Two ships leave a port at the same time. The first, ship A steams  $30^\circ$  North-East at 16 kmph & the second ship B steams  $40^\circ$  South of East at 12 kmph. Determine the relative velocity of ship B with respect to ship A. [6]

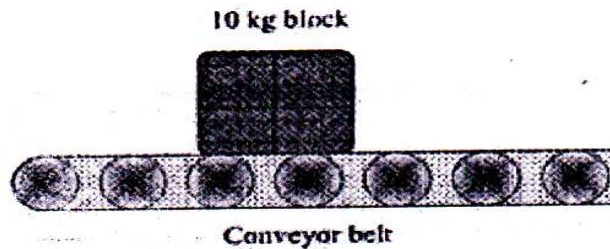
**P.T.O.**

OR

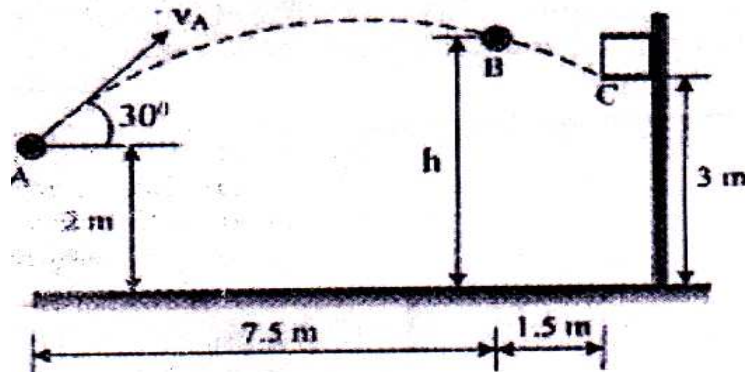
- Q2) a)** Locate the centroid  $C$  of the shaded area obtained by cutting a semicircle of diameter  $a$  from the quadrant of a circle of radius  $a$  as shown in Fig. with respect to origin  $O$ . [6]



- b)** The conveyor belt is designed to transport packages of various weights shown in Fig. Each 10kg package has a coefficient of kinetic friction  $\mu_k = 0.15$ . If the speed of the conveyor is 5m/s, and then it suddenly stop, determine the distance the package will slide on the belt before coming to rest. [6]



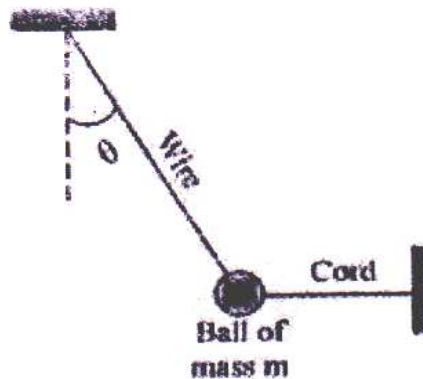
- Q3) a)** Measurements of a shot recorded on a videotape during a basketball game are shown in Fig. The ball passed through the hoop even though it barely cleared the hands of the player B who attempted to block it. Neglecting the size of the ball, determine the magnitude  $v_A$  of its initial velocity and height  $h$  of the ball when it passes player B. [6]



- b) A woman having a mass of 70 kg stands in an elevator which has a downward acceleration of  $4 \text{ m/s}^2$  starting from rest. Determine work done by her weight and the work of the normal force which the floor exerts on her when the elevator descends 6 m. [6]

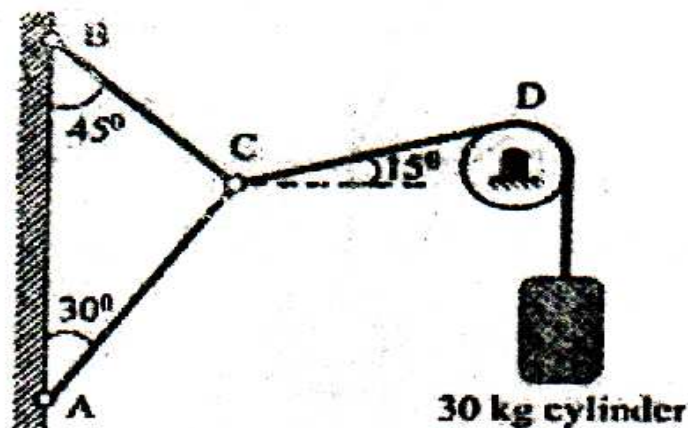
OR

- Q4) a) The small ball of mass  $m$  and its supporting wire becomes a simple pendulum when the horizontal cord is served. Determine the ratio of the tension  $T$  in the supporting wire immediately after the cord is cut to that in the wire before the wire is cut. [6]

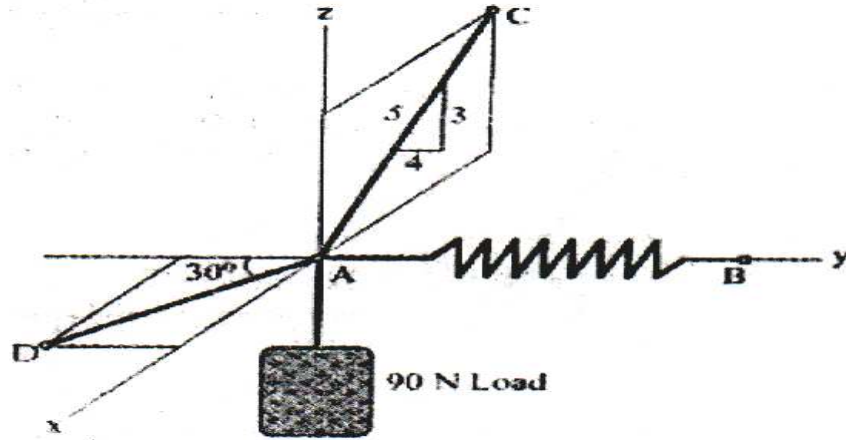


- b) A ball has a mass of 30 kg and is thrown upward with a speed of 15 m/s. Determine the time to attain maximum height using impulse momentum principle. Also find the maximum height. [6]

- Q5) a) Three cables are joined at the junction C as shown in Fig. Determine the tension in cable AC and BC caused by the weight of the 30 kg cylinder. [6]

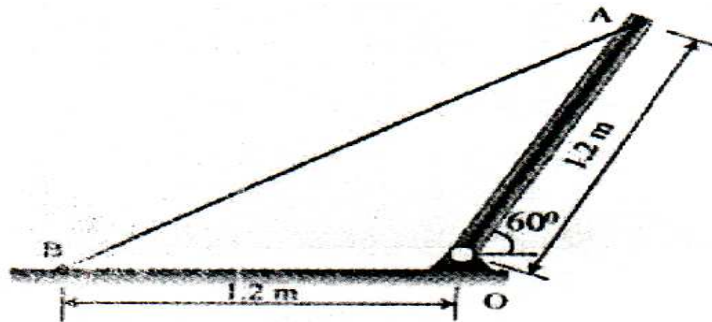


- b) A 90 N load is suspended from the hook shown in Fig. The load is supported by two cables and a spring having stiffness  $k = 500 \text{ N/m}$ . Determine the force in the cables and the stretch of the spring for equilibrium. Cable AD lies in the  $x$ - $y$  plane and Cable AC lies in the  $x$ - $z$  plane. [7]

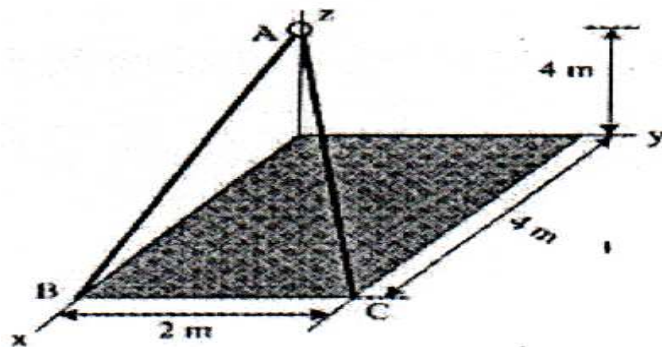


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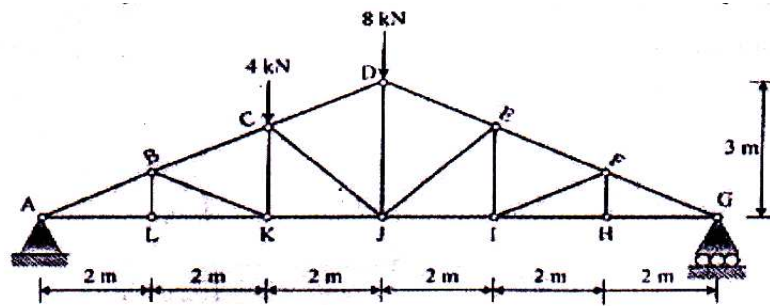
- Q6) a) The uniform 18 kg bar OA is held in position shown in Fig. by the smooth pin at O and the cable AB. Determine the tension  $T$  in the cable and the magnitude and direction of the external pin reaction at O. [7]



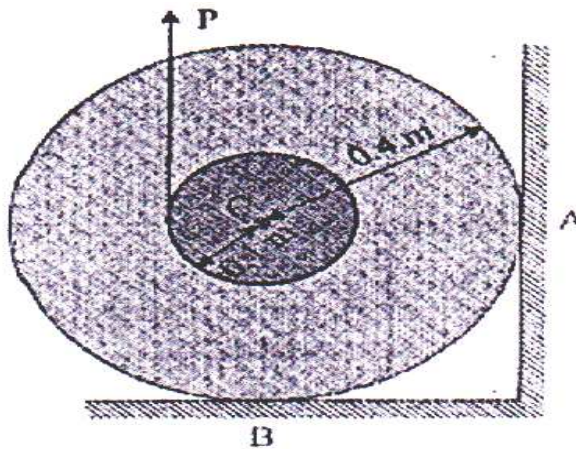
- b) The cables exert forces  $F_{AB} = 100 \text{ N}$  and  $F_{AC} = 120 \text{ N}$  on the ring at A as shown in Fig. Determine the magnitude of the resultant force acting at A. [6]



- Q7) a) The roof truss support the vertical loading shown in Fig. Determine the force in members BC, CK and KJ and state if these members are in tension or compression. [7]

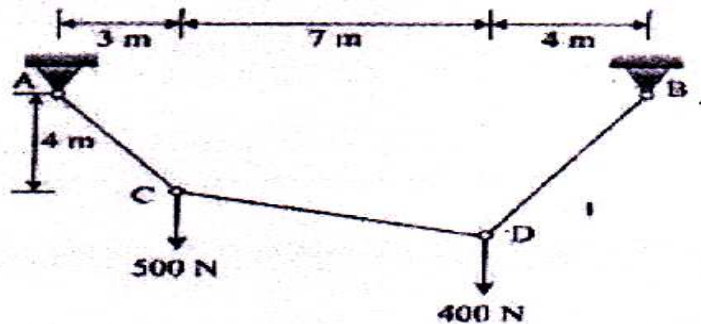


- b) The spool has a mass of 200 kg and rest against the wall and on the beam shown in Fig. If the coefficient of static friction at B is  $\mu_B = 0.3$  and the wall is smooth, determine the friction force developed at B when the vertical force applied to the cable is  $P = 800$  N. [6]



OR

- Q8) a) The cable segment support the loading as shown in Fig. Determine the support reaction and maximum tension in segment of cable. [7]



- b) A cable is passing over the disc of belt friction apparatus at a lap angle  $180^\circ$  as shown in Fig. If coefficient of static friction is 0.25 and the weight of block is 500 N, determine the range of force  $P$  to maintain equilibrium. [6]

