



Seat No.	
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**F.E. Common (Semester – II) Examination, 2014
ENGINEERING MECHANICS (2008 Course) (Old)**

Time : 2 Hours

Max. Marks : 50

- Instructions :** 1) Answer Q.1 or Q.2, Q.3 or Q.4 and Q.5 or Q.6.
2) **Neat** sketches must be drawn **wherever** necessary.
3) Figures to the **right** indicate **full** marks.
4) Assume suitable data, **if necessary**.
5) **Use** of electronic pocket calculator is **allowed**.
6) **Use** of cell phone is **prohibited** in the examination hall.

1. a) Find the magnitude of the resultant and its location of the following forces acting at a point O as shown in Fig. 1 a. 6

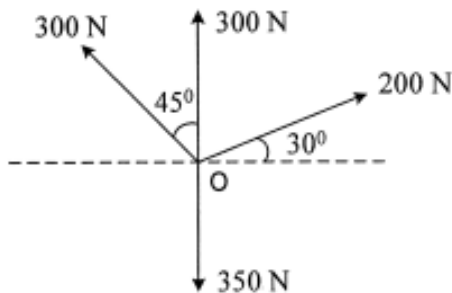


Fig. 1 a

- b) A Particle starts with an initial velocity of 2.5 m/s and uniformly decelerates at the rate 0.5 m/s². Determine the displacement and velocity at t = 2 s. 6

OR

2. a) Determine the y coordinate of the centroid of a trapezoidal area in terms of dimension shown in Fig. 2 a with respect to origin O. 6



- b) The system shown in Fig. 2 b is initially at rest. Neglecting friction and the mass of pulley, determine the acceleration and the velocity of block A after it has moved through 3 m. 6

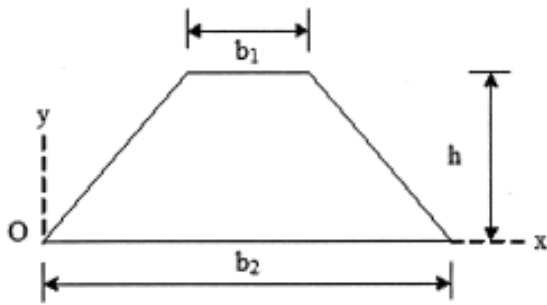


Fig. 2 a

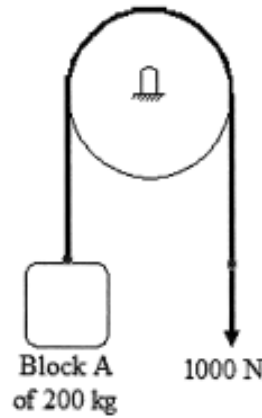


Fig. 2 b

3. a) A square foundation supports four loads as shown in Fig. 3 a. Determine magnitude, direction and point of application of resultant of four forces. 6

- b) A sphere of weight 100 N and a radius of 200 mm as shown in Fig. 3 b. Determine the reaction at the points of contact. 7

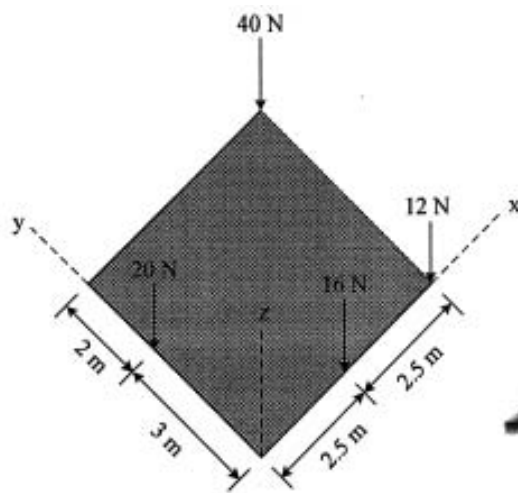


Fig. 3 a

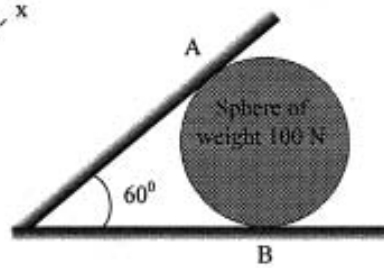


Fig. 3 b

- c) A particle position is describe by the coordinates $r = (2 \sin 2\theta)$ m and $\theta = (4t)$ rad, where t is in seconds. Determine the radial and transverse components of its velocity at $t = 1$ s. 6

OR

4. a) Determine the support reaction at A and D for beam AD loaded and supported as shown in Fig. 4 a. 6



- b) A rectangular plate is supported by three cables at A as shown in Fig. 4 b. Knowing that the tension in cable AD is 120 N, determine the weight of the plate. 7

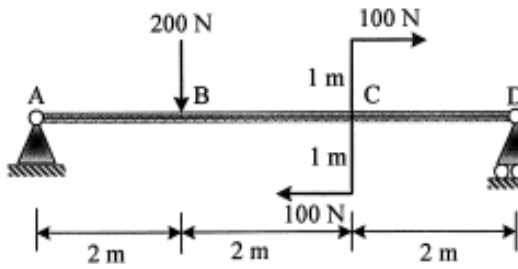


Fig. 4 a

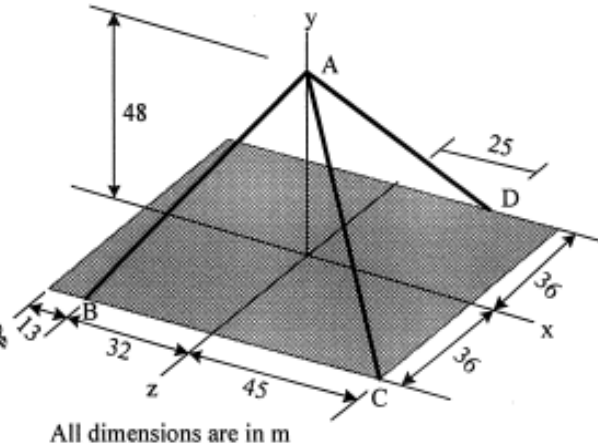


Fig. 4 b

- c) The small ball of mass m and its supporting wire AB become a simple pendulum when the horizontal cord BC is severed. Determine the ratio k of the tension T in the supporting wire immediately after the cord is cut to that in the wire before the cord is cut. Refer Fig. 4c. 6

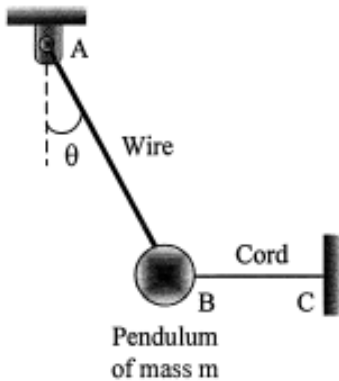


Fig. 4 c

5. a) Identify zero force members and find magnitude and nature forces in remaining members of the truss as shown in Fig. 5 a. 7

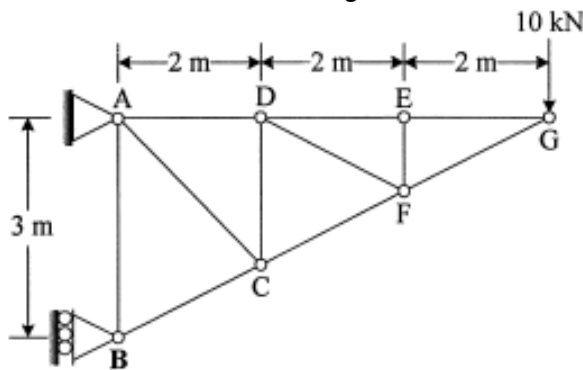


Fig. 5 a



- b) A flat belt passes on the two drums as shown in Fig. 5 b. Determine the value of force P to lift the block of mass 100 kg upward. Take $\mu_s = 0.25$. 6

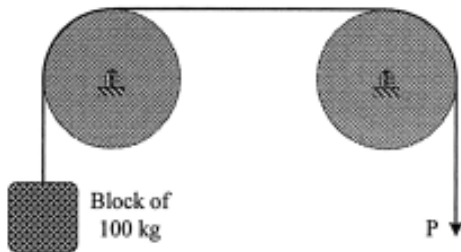


Fig. 5 b

- c) A bullet moving at a speed of 300 m/s has its speed reduced to 270 m/s when it passes through a board. Determine how many such boards the bullet will penetrate before it stops. 6

OR

6. a) Determine the reactions at A, D and tension in BC of the rope ABCD loaded and supported as shown in Fig. 6 a. 6
- b) A ladder of length 6 m rest against a smooth vertical wall and rough horizontal wall as shown in Fig. 6 b. Determine the slope of the ladder with vertical to maintain equilibrium if the coefficient of static friction at all contact surfaces is $\mu_s = 0.25$. 7

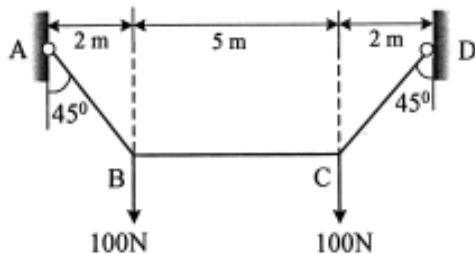


Fig. 6 a

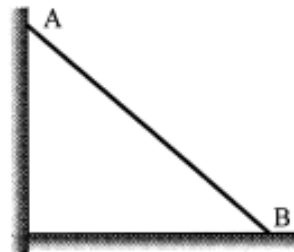


Fig. 6 b

- c) A jet plane has a mass of 250 Mg and a horizontal velocity of 100 m/s when $t = 0$. If the engines provide a resultant horizontal thrust $F = (40 + 0.5 t)$ kN, where t is in seconds. Using impulse-momentum principle determine the time needed for the plane to attain a velocity of 200 m/s. Neglect air resistance and the loss of fuel during the motion. 6