

Seat No.

F.E. Common (Semester – II) Examination, 2014 ENGINEERING MECHANICS (2008 Course) (Old)

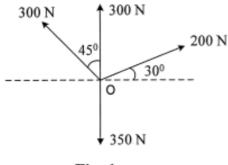
Time : 2 Hours

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.





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

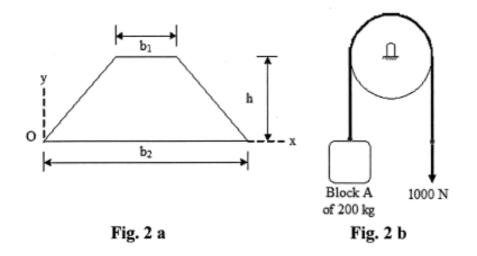
OR

 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

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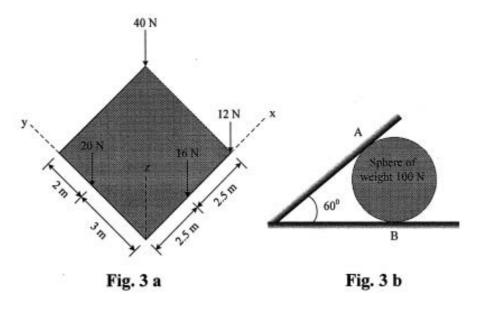
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b) The system shown in Fig. 2 b is initially at rest. Neglecting friction and the mass of pulley, determine the acceleration and the velocity of block A after it has moved through 3 m.



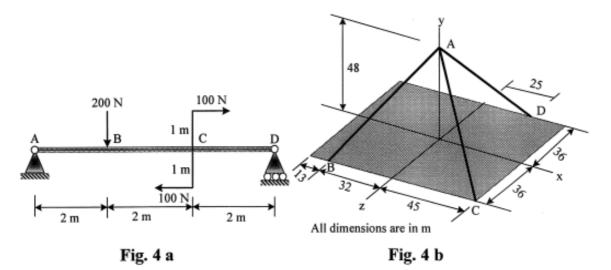
- 3. a) A square foundation supports four loads as shown in Fig. 3 a. Determine magnitude, direction and point of application of resultant of four forces.
 - b) A sphere of weight 100 N and a radius of 200 mm as shown in Fig. 3 b. Determine the reaction at the points of contact.



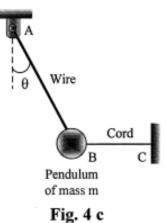


- c) A particle position is describe by the coordinates $r = (2\sin 2\theta)$ m and $\theta = (4t)$ rad, where t is in seconds. Determine the radial and transverse components of its velocity at t = 1 s. OR
- 4. a) Determine the support reaction at A and D for beam AD loaded and supported as shown in Fig. 4 a.

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.
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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.



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

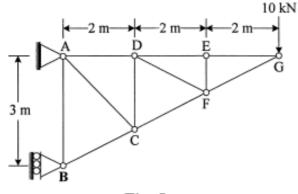
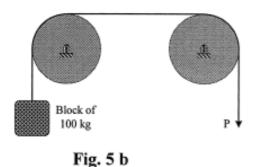


Fig. 5 a

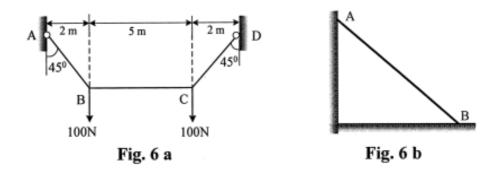
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b) A flat belt passes on the two drums as shown in Fig. 5 b. Determine the value of force P to lift the block of mass 100 kg upward. Take $\mu_s = 0.25$. 6



- 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.
 - 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 $\mu_s = 0.25$.



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.

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