**[4261] – 110**

| Seat No. | |
|---|---|

## F.E. (Semester – II) (Common) Examination, 2012
## ENGINEERING MECHANICS
## (2008 Pattern)

Time : 2 Hours Max. Marks : 50

***Instructions*** *: 1) Attempt Q.**1** or Q.**2**, Q.**3** or Q.**4** and Q.**5** or Q.**6**.*

*2) **Neat** diagram must be drawn **wherever** necessary.*

*3) Figure to the **right** indicates **full** marks.*

*4) Assume suitable data, **if** necessary and clearly state.*

*5) Use of cell phone is prohibited in the examination Hall.*

*6) **Use** of electronics pocket calculator is **allowed**.*

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**

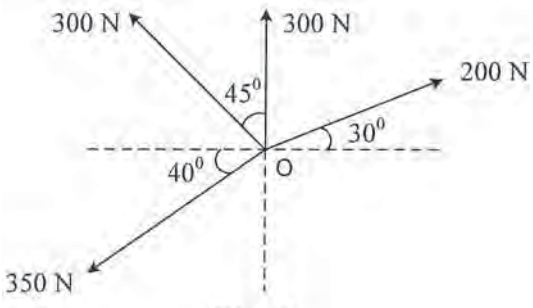

Fig. 1 a

b) A Particle starts with an initial velocity of 2.5 m/s and uniformly accelerates at the rate 0.5 m/s$^2$. Determine the displacement in 2 s, time required to attain the velocity of 7.5 m/s and the distance travelled when it attain a velocity of 7.5 m/s. **6**

OR

2. a) Determine the position of centroid of the shaded area as shown in Fig. 2a with respect to origin O. **6**

**P.T.O.**

b) Two weights 100 N and 30 N are connected by a string and move along a rough horizontal plane under the action of force 50 N applied to the first weight 100 N as shown in Fig. 2 b. The coefficient of friction between the sliding surfaces of the weights and plane is 0.25. Determine the acceleration of weights and the tension in the string using Newton's second law. **6**

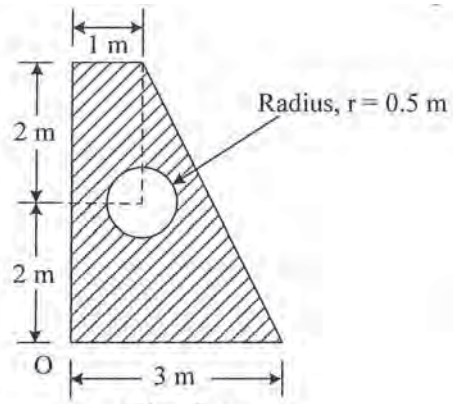

Fig. 2 a

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) Two sphere P and Q each of weight 50 N and a radius of 100 mm rest in horizontal channel of width 360 mm as shown in Fig. 3 b. Determine the reaction at the point of contact A, B and C. **7**

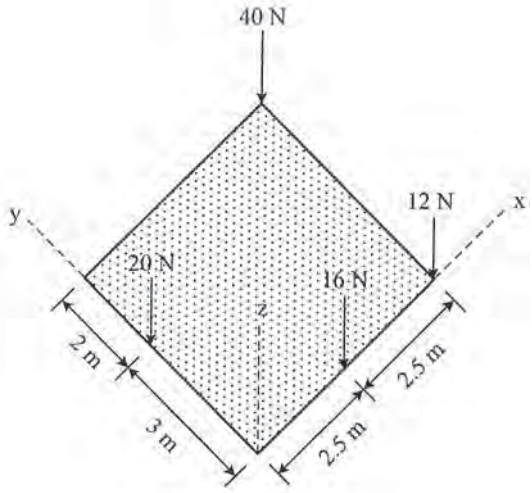

Fig. 3 a

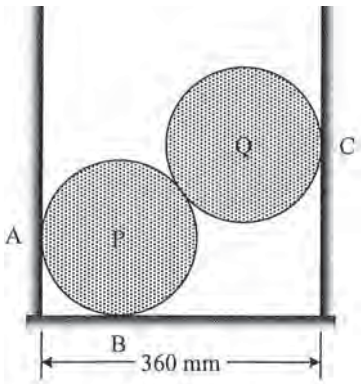

Fig. 3 b

c) A particle is projected at an angle of 30° to the horizontal with a velocity of 100 m/s. Determine the range of radius of curvature of the path followed by the particle. **6**

OR

4. a) Three loads are applied as shown in Fig. 4 a. to a light beam supported by cables attached at B and C. Neglecting the weight of the beam, determine the range of values of Q for which neither cable becomes slack when P = 0. **7**

   b) A 200 kg cylinder is hung by means of two cables AB and AC, which is attached to the top of vertical wall. A horizontal force P perpendicular to the wall holds the cylinder in the position shown in Fig. 4 b. Determine the magnitude of P and the tension in each cable. **6**

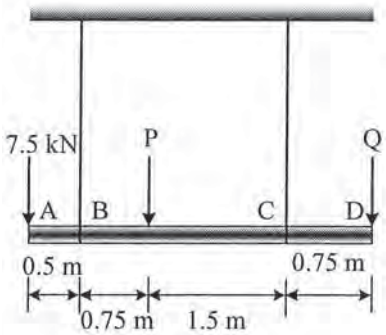


Fig. 4 a

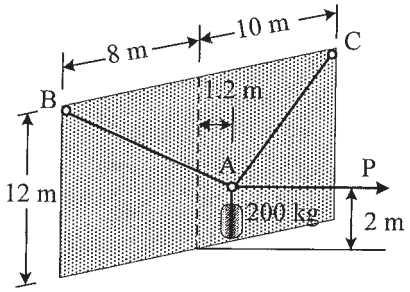


Fig. 4 b

   c) A 150 kg car enters a curved portion of the road of radius 200 m travelling at a constant speed of 36 km/h. Determine the normal and tangential component of force at curved portion. **6**

5. a) A plane truss is loaded and supported as shown in Fig.5 a. Determine the magnitude and nature of forces in all the members. **6**

   b) A body of weight 300 N is kept on a rough horizontal plane and a force P is applied to just move the body horizontally as shown in Fig. 5 b. Find the magnitude of force P required if coefficient of static friction is $\mu_s = 0.4$. **7**

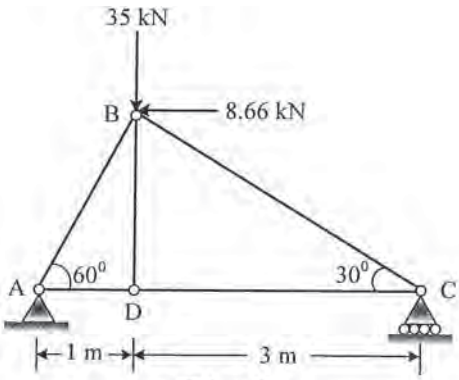


Fig. 5 a

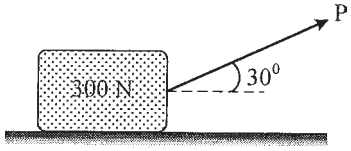


Fig. 5 b

c) A car of mass 1500 kg is moving down a hill having a slope of 15° to the horizontal. At the time, when the car is moving at a speed of 10 m/s, the driver applies the brakes. Calculate the average force applied parallel to the hill slope that will stop the car in a distance of 30 m. Use work energy principle. **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 100 N ladder AB of length 6 m rest against a vertical wall and horizontal floor 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 surface is $\mu_s = 0.25$ . **7**

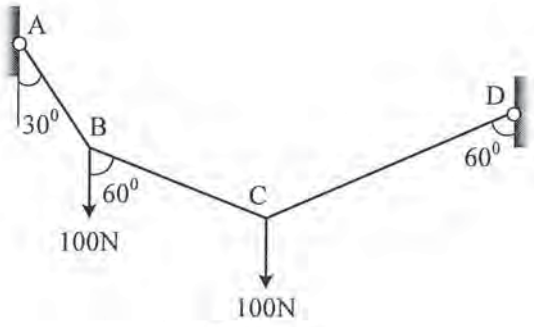


Fig. 6 a

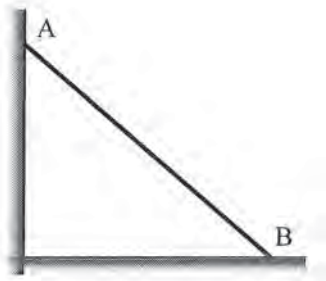


Fig. 6 b

c) Determine the velocities of the two balls shown in Fig. 6 C after impact. Take weight of ball A is 20 N, weight of ball B is 10 N and coefficient of restitution is 0.6. **6**

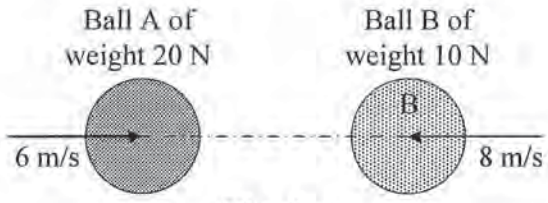


Fig. 6 c

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