

Total No. of Questions : 6]

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[4061]-112

F. E. Examination - 2011

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) Answer should be written in **one** answer book.
- (3) Figures to the right indicate full marks.
- (4) Neat diagram should be drawn wherever necessary.
- (5) Assume suitable data if necessary.
- (6) Use of cell phone is prohibited in examination hall.
- (7) Use of electronic non-programmable pocket calculator is permitted.

Q.1) (A) Knowing that the tension in the cable BC is 145N, determine the resultant of the three forces exerted at point 'B' of beam AB. Refer Figure 1.1.

[06]

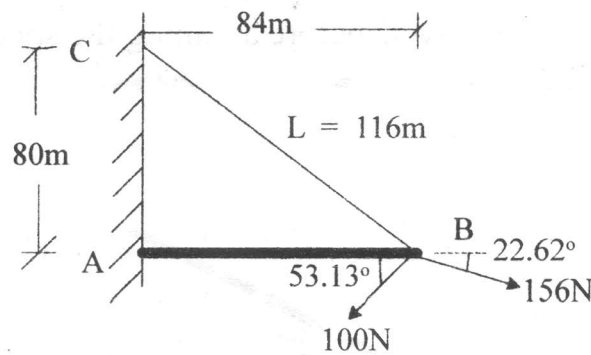


Fig. 1.1

(B) The motion of the particle is defined by the relation $x = t^2 - (t - 3)^3$ m where 'x' and 't' are in meters and seconds respectively. Determine :

- the time when velocity is maximum.
- the position and maximum velocity.
- the distance traveled at $t = 12$ seconds.

[06]

OR

Q.2) (A) Two quarter circular areas are removed from a rectangular plate AEFG as shown in figure 2.1. Locate the centroid of the remaining area.

[06]

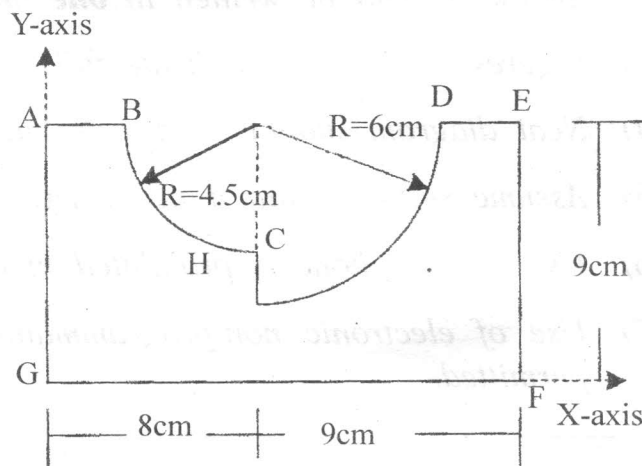


Fig. 2.1

(B) A 50 kg body is initially at rest on a 20° inclined plane with coefficient of kinetic friction $\mu = 0.25$. Find the distance and the time body travels before attaining the speed of 15 m/s. Refer figure 2.2.

[06]

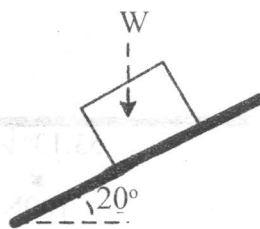


Fig. 2.2

- Q.3) (A)** A compound beam is loaded as shown in figure 3.1. Find the reactions at the supports 'A', 'D' and 'E'. [06]

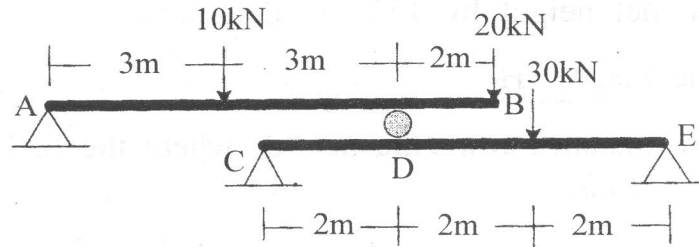


Fig. 3.1

- (B)** Three cylinders are piled in a rectangular ditch as shown in figure 3.2. The weight of cylinder P, Q and R are 130N, 400N and 200N respectively. The radii of cylinder P, Q and R are 100mm, 150mm and 125mm respectively. Assuming all surfaces smooth, determine reactions at all points of contact 'A', 'B', 'C' and 'D'. [07]

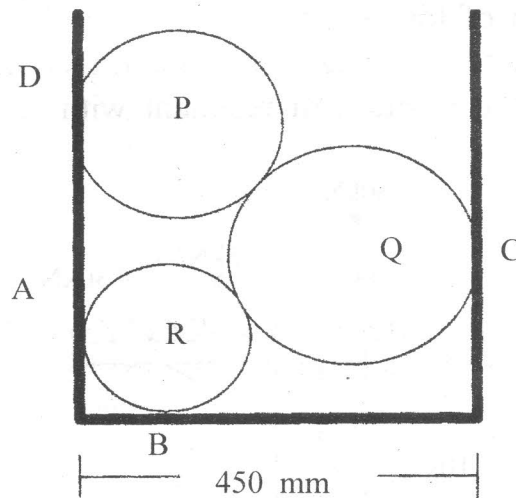


Fig. 3.2

- (C) The tennis player serves the ball from height 'H' with an initial velocity of 40m/s at an angle of 4° with the horizontal as shown in figure 3.3. Knowing that the ball clears the 0.914m net height by 152mm , determine : [06]

- (a) the height 'H'
 (b) the distance from the net 'd' where the ball will strike the floor.

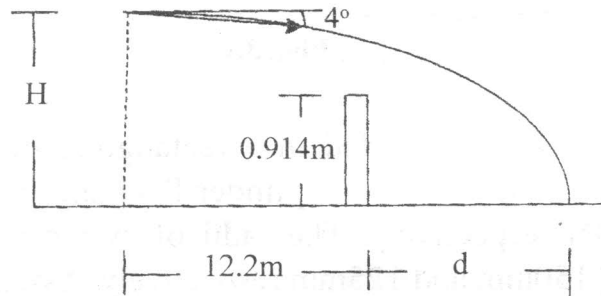


Fig. 3.3

OR

- Q.4) (A) The system of forces acting on a frame is as shown in figure 4.1. Calculate the magnitude and direction of the resultant. Also find the position of resultant with respect to point 'A'. [06]

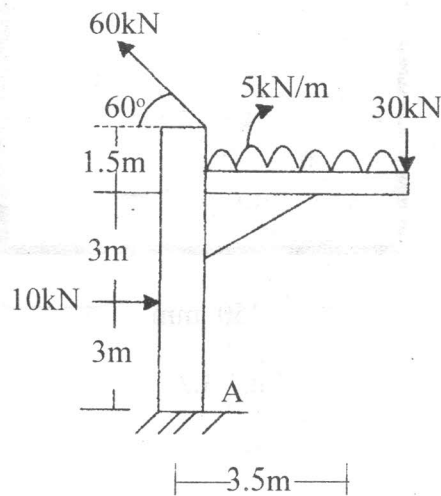


Fig. 4.1

- (B) The support assembly shown in figure 4.2 is bolted in place 'B', 'C' and 'D' supporting a downward force of 45N applied at 'A'. Determine the forces in the members AB, AC and AD. [07]

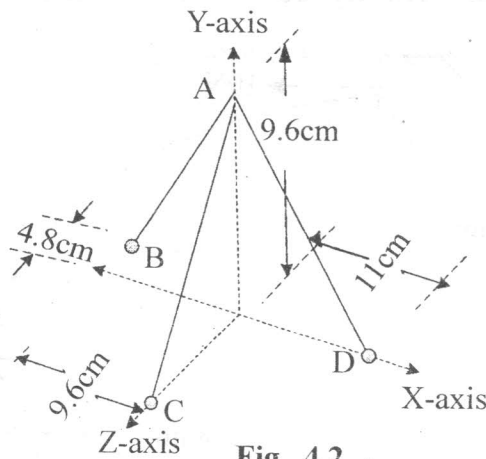


Fig. 4.2

- (C) The bob of 2m pendulum describes an arc of circle in vertical plane. If the tension in the cord is 2.5 times the weight of bob for position shown in figure 4.3, find velocity and acceleration of bob in that position. [06]

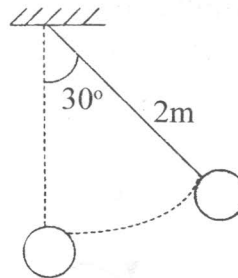


Fig. 4.3

- Q.5 (A) Find the magnitude and nature of the forces in the members of the truss loaded as shown in figure 5.1. [12]

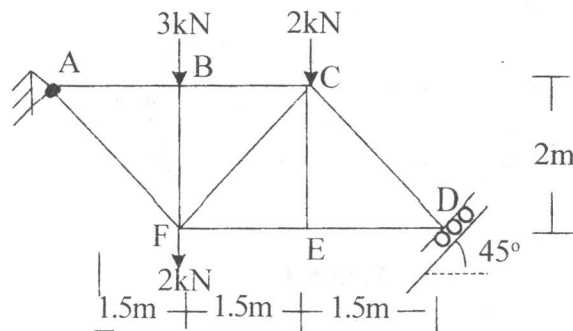


Fig. 5.1

- (B) A collar of mass 1.2 kg slides along a smooth path AB in vertical plane as shown in figure 5.2. The collar starts from rest 'A' under the action of constant horizontal force of 10N. Calculate its velocity as it hits at 'B'. [07]

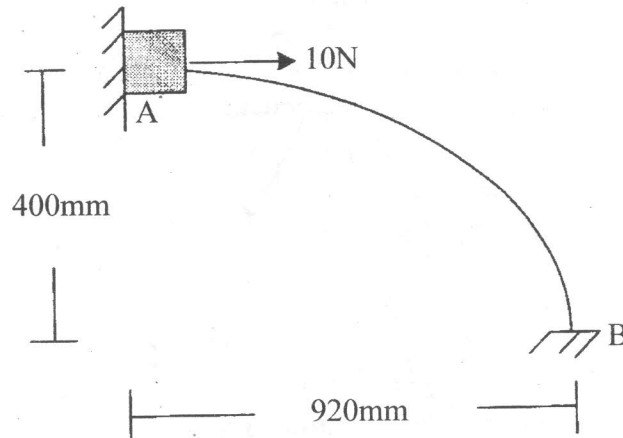


Fig. 5.2

OR

- Q.6) (A) Block 'A' supports a pipe column and rests on a wedge 'B' as shown in figure 6.1. Knowing the coefficient of static friction at all surfaces of contact is 0.25 and that $\theta = 45^\circ$, determine the smallest force 'P' required to raise the block 'A'. [08]

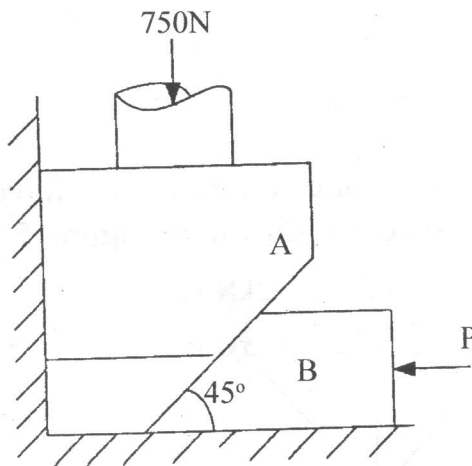


Fig. 6.1

(B) Two loads are suspended as shown in figures 6.2 from a cable ABCD. Knowing that $d_c = 0.75$, determine :

- (a) Distance ' d_B '
- (b) The reaction components at 'A' and 'D'.
- (c) Maximum tension in cable.

[05]

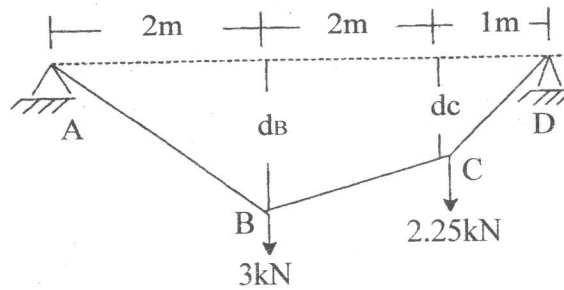


Fig. 6.2

(C) A 900 kg car travelling at 48 km/h couples to a 680 kg car travelling at 24 km/h in the same direction. Determine the common velocity of the cars after coupling. Also find the amount of energy lost.

[06]