Total No. of Questions : 8]

SEAT No. :

P4355

[Total No. of Pages : 4

[5458]-102

F.E. (All)

ENGINEERING MECHANICS

(2015 Pattern)

Time : 2 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) *Answer Q.1 or Q.2, Q.3 or Q.4 , Q.5 or Q.6, Q.7 or Q.8.*
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 in the examination.*
6) *Use of cell phone is prohibited in the examination hall.*

Q1) a) A trolley is acted upon by two forces as shown **Fig. 1a.** If $\theta = 25°$ and the resultant R of the two forces is vertical, then determine the magnitude of the force P and resultant R. **[6]**

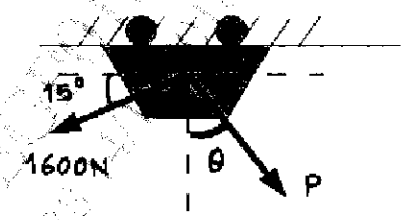

Fig. 1a

b) A stone thrown vertically upward from earth returns to the earth in 5 sec. How high does the stone reached. Also determine the velocity with which it is thrown. **[6]**

OR

Q2) a) Locate the centroid of the plane lamina as shown in **fig. 2a.** **[6]**

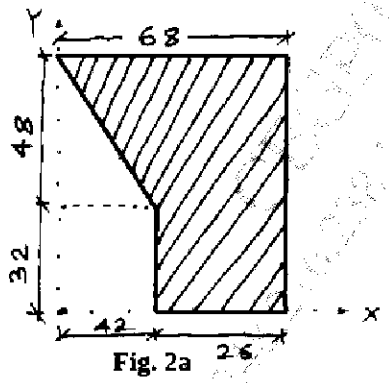

Fig. 2a

P.T.O.

b) An 80 kg block rests on a rough horizontal plane as shown in the **Fig.2b.** Find the magnitude of the force 'P' required to give an acceleration of 2.5 m/s^2 to the right. Take coefficient of kinetic friction as 0.25. **[6]**

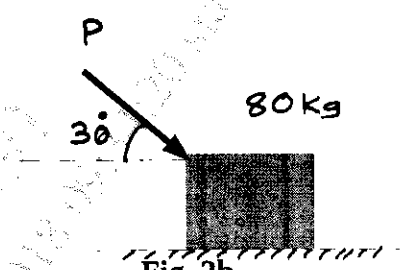

Fig. 2b

Q3) a) A ball is thrown by a player from 5 m above ground level, clears the 25m high wall placed 100 m from the player. If the angle of projection of the ball is 60 degrees, then determine the initial velocity of the ball. **[6]**

b) A 30 kg block dropped from a height of 2 m onto the 10 kg pan of spring scale as shown in the **Fig. 3b.** Assuming the collision to be perfectly plastic. Determine the maximum deflection (Compression of the pan. The spring constant is k = 20 kN/m. **[6]**

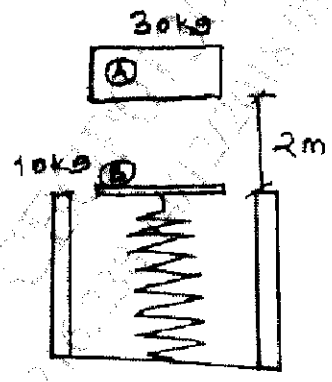

Fig. 3b

OR

Q4) a) The polar coordinates of a particle moving along a plane curve are given by $r = t^3 - 3t + 10$ and $\theta = (0.5r)$, where 'r' is in meters, 'θ' is in radians and 't' is in seconds. Determine the acceleration of the particle at $t = 2$ sec. **[6]**

b) A 20 Mg railroad car moving with 0.5 m/s speed to the right collides with a 35 Mg car which is at rest. If after the collision the 35 Mg car is observed to move right with a speed of 0.3 m/s, determine the coefficient of restitution between the two cars. **[6]**

Q5) a) The beam AB with pin at 'A' and roller at 'B' loaded as shown in the **Fig. 5a.** Determine the reactions at the supports A &B. **[6]**

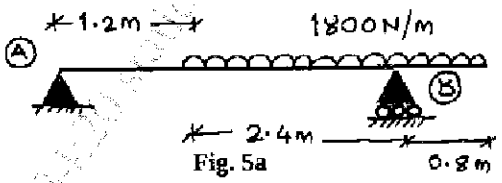

Fig. 5a

b) Three cables are used to support a container as shown in the **Fig. 5b.** Determine the tension in the cables AB, AC and AD if the weight of the container is 1000N. **[7]**

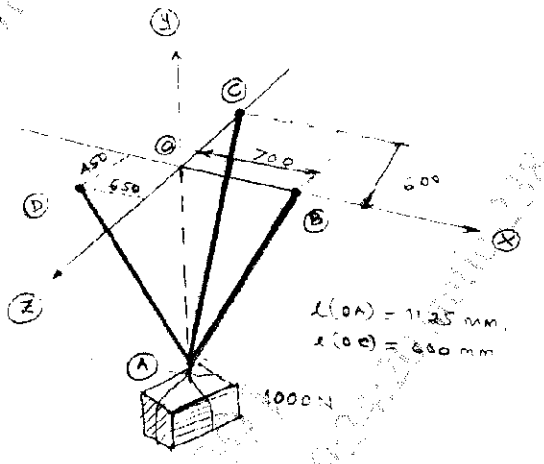

Fig. 5b

OR

Q6) a) Determine the reactions at all the point of contacts for a sphere of 200 N kept in a trough as shown in the **Fig. 6a.** **[6]**

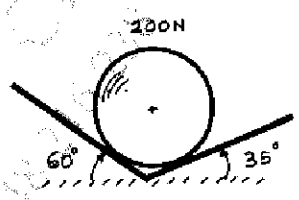

Fig. 6a

b) The square mat foundations supports four columns as shown in the **Fig.6b.** Determine the magnitude and position of the resultant force w.r. to origin 'O'. **[7]**

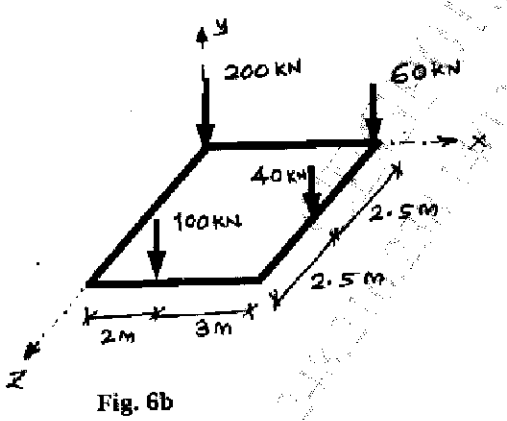

Fig. 6b

Q7) a) The truss supports vertical loads as shown in **Fig. 7a.** Determine the forces in all the members of the truss and state the nature of the forces in tabular form. **[7]**

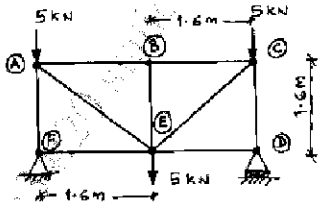

Fig. 7a

b) The hawser thrown from ship to a pier is wrapped by two full turns around the capstan as shown in the **Fig. 7b.** If the tension in the hawser is 7500 N and is maintained without slipping by exerting 150 N force on the free end. Determine the coefficient of friction between hawser and capstan. **[6]**

Fig. 7b

OR

Q8) a) The truss supported and loaded as shown in the **Fig. 7a.** determine the forces in the members AB, BF and EF using section method. Also give the nature of the forces. **[7]**

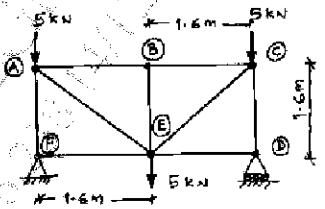

Fig. 7a

b) Cable ABC supports 65 kg and 75 kg loads at 'B' and 'C' points as shown in the **Fig. 8b.** Determine the magnitude of the force 'P' and distance 'a' to maintain equilibrium. **[6]**

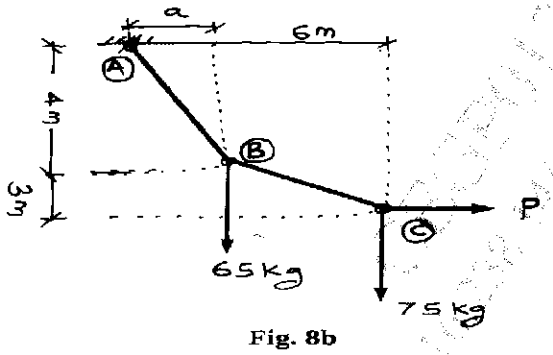

Fig. 8b

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