Total No. of Questions : 8]

SEAT No. :

P6491

[Total No. of Pages : 7

[5868]-108
F.E. (All) (Semester I & II)
ENGINEERING MECHANICS (101011)
(2019 Pattern)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 and Q.7 or Q.8.***
2) ***Figures to the right indicate full marks.***
3) ***Assume suitable data, if necessary.***
4) ***Use of electronic pocket calculator is allowed in the examination.***
5) ***Use of cell phone is prohibited in the examination hall.***

Q1) a) A ball of weight W = 53.4 N rests in a right angled trough as shown in Fig. 1a. Determine the forces exerted on the sides of the trough at D & E. Assume all surfaces are perfectly smooth. **[6]**

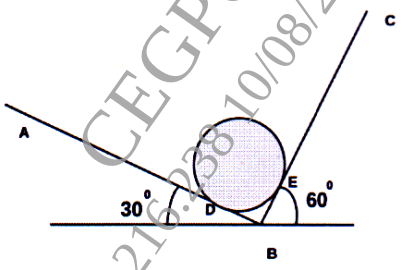

Fig. 1a

b) Three rods meeting at point A as shown in Fig. 1b. Find magnitude of the tension developed in each rod AB, AC and AD. **[6]**

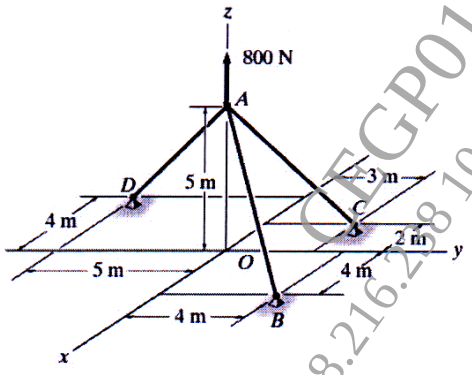

Fig. 1b

P.T.O.

c) Determine the support reaction of beam loaded and supported as shown in Fig.1c. **[6]**

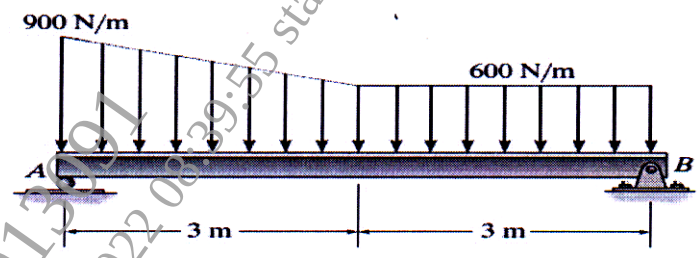

Fig. 1c

OR

Q2) a) A joist of length 4m and weighing 200N is raised by pulling a rope shown in Fig. 2a. Determine the tension T induced in the rope and reaction at end A of joist. **[6]**

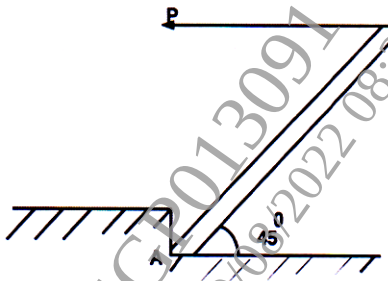

Fig. 2a

b) The rectangular 3m × 10m, steel plate subjected to four forces, as shown in Fig.2b. Determine the resultant force in magnitude and direction w.r.to 'O'. **[6]**

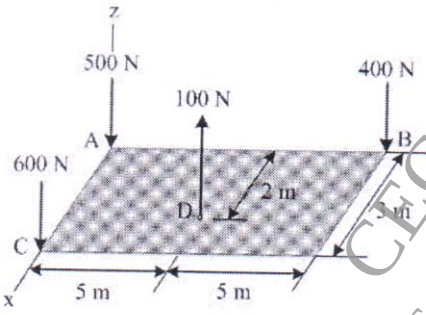

Fig. 2b

c) The I joist supports 20 kN and 40 kN on bean AB of span 7.5 m, as shown in Fig. 2c. Determine the support reactions at hinge B and roller D. **[6]**

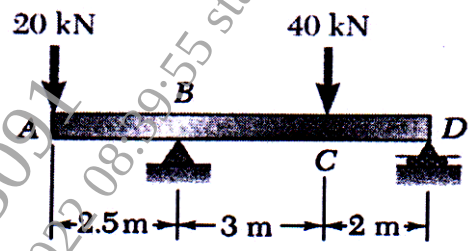

Fig. 2c

Q3) a) Determine the forces in all members of a truss loaded and supported as shown in Fig. 3a. **[6]**

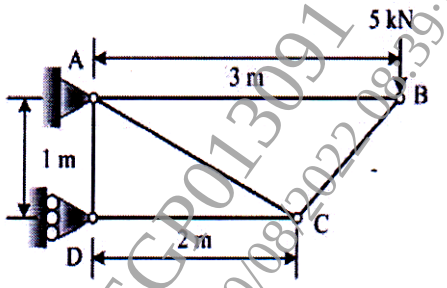

Fig. 3a

b) Cable ABCD is loaded and supported as shown in the Fig. 3b. If $d_c = 0.75$ m and $d_b = 1.125$ m, determine the component of reaction at A & maximum tension in the cable. **[5]**

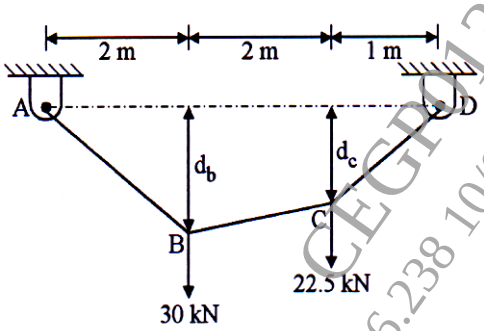

Fig. 3b

c) Determine the components of all forces acting on member ABE for the frame loaded with 2400N at D of the frame as shown in Fig. 3c. **[6]**

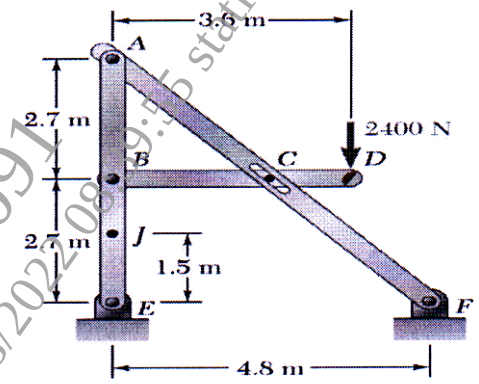

Fig. 3c

OR

Q4) a) Determine the forces in the members AB, AC and DC of the truss loaded and supported as shown in the Fig. 3a. Use method of section. **[6]**

b) Cable ABCDE supports two loads 6kN and 10 kN at B and C, as shown in Fig.4b. If the 'h_B'= 1.8 m, determine 'h_C' and reaction components at A and D. **[5]**

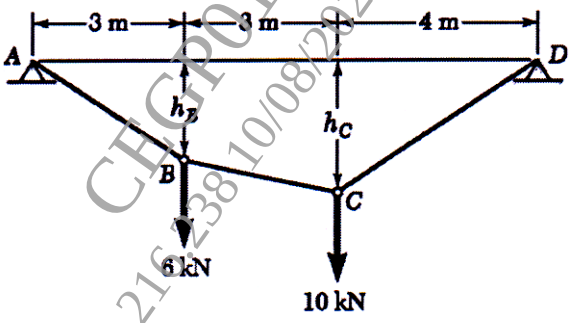

Fig. 4b

c) Determine the pin reactions at A, B and roller D for the frame members ABCand BD meeting at B as shown in Fig. 4c. **[6]**

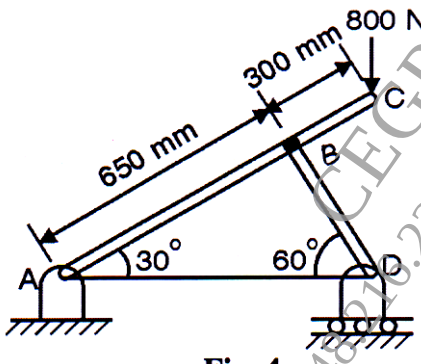

Fig. 4c

Q5) a) The acceleration of particle in rectilinear motion is given by $a = (3t^2+2)$. Initial velocity and displacements are 2m/s & 3m respectively. Find Position, velocity & acceleration of the particle at t = 2s. **[6]**

b) A projectile fired from the edge of a 150 m high cliff with an initial velocity of 180 m/s at an angle of elevation of 30° with the horizontal. Neglecting air resistance find : **[6]**

i) The greatest elevation above the ground reached by the projectile;

ii) Horizontal distance from the gun to the point, where the projectile strikes the ground

c) A car starts from rest and with constant acceleration achieves a velocity of 15 m/s when it travels a distance of 200 m. Determine the acceleration of the car and the time required to attain the velocity. **[6]**

OR

Q6) a) A ball is thrown vertically upward with an initial speed of 80m/s from the base of 50m high tower. Determine the distance 'h' by which the ball clear the top of tower. Also determine the time of travel when it reaches to base again. **[6]**

b) An outdoor track is 126 m in diameter. A runner increases her speed at a constant rate from 4.2 m/s to 7.2 m/s over a distance of 28.5 m. Determine the total acceleration of the runner 2s after she begins to increases her speed. **[6]**

c) A stone is dropped from the top of a tower 50 m high, At the same time another stone is thrown up from the foot of the tower with a velocity of 25 m/s. At what distance from the top & after how much time the two stones cross each other? **[6]**

Q7) a) A 30 kg block is dropped from a height of 2 m onto the 10 kg pan of a spring scale as shown in Fig. 7a. Assuming the impact to be perfectly plastic, determine the maximum deflection of the pan. The constant of the spring is k = 20 kN/m. **[6]**

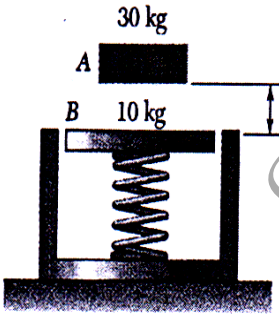

Fig. 7a

b) The bottle rests at a distance of 1 m from the center of the horizontal platform as shown in Fig. 7b. If the coefficient of static friction between the bottle and the platform is $\mu_s = 0.3$ determine the maximum speed that the bottle can attain before slipping. Assume the angular motion of the platform is slowly increasing. **[5]**

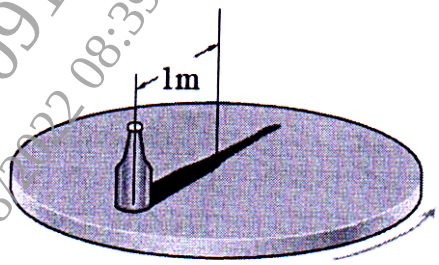

Fig. 7b

c) A ball is dropped from a height $h_0 = 2$ m on a smooth floor. Knowing that the height of the first bounce is $h_1 = 1.2$ m, determine (i) coefficient of restitution, and (ii) expected height h_2 after the second bounce. **[6]**

OR

Q8) a) Ball 'A' of 20 N and initial velocity 6 m/s rightwords collides with ball 'B' of 10 N and initial velocity 8 m/s leftwords before impact. If the coefficient of restitution is 'e' is 0.6, then determine the velocities of balls 'A' and 'B' after impact. **[5]**

b) Calculate the velocity v of the 50-kg crate, as shown in Fig. 8b, when it reaches the bottom of the chute at B, if it is given an initial velocity of 4 m/s down the chute at A. The coefficient of kinetic friction is 0.30. **[6]**

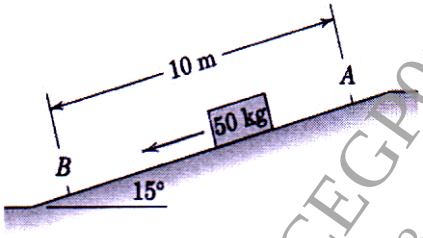

Fig. 8b

c) The 2kg pendulum bob 1.5m, is released from rest when it is at A as shown in Fig.8c. Determine the speed of the bob, using work energy principle, when it passes at a position 60 degrees down from A. **[6]**

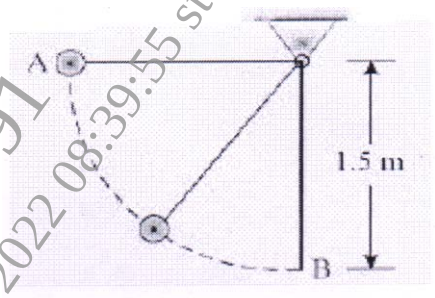

Fig. 8c