Total No. of Questions : 8]

SEAT No. : ____

PC-1681

[Total No. of Pages : 5

[6351]-107
F.E. (Common)
ENGINEERING MECHANICS
(2019 Pattern) (Semester - I) (101011)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates :

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

Q1) a) A 20 kg homogeneous smooth sphere rests on two inclinations at 75° and 30° as shown in **Fig. 1 a.** Calculate the contact forces at A & B. **[6]**

b) The square plate has mass of 1800kg with mass center at 'G'. Calculate the tension in each of the three cables with which the plate is lifted while remaining horizontal as shown in **Fig. 1 b.** **[8]**

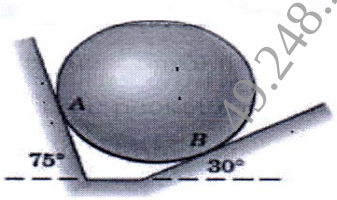

Fig. 1 a

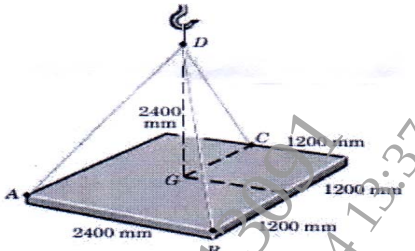

Fig. 1 b

c) Explain how uniformly distributed load (UDL) and uniformly varying load (UVL) is converted in to a point load with sketch. **[4]**

OR

P.T.O.

Q2) a) Determine the support reactions at roller A and pin at B for a beam loaded with 300kg box as shown in **Fig. 2 a.** Neglect the weight of beam. **[5]**

b) A uniform steel plate of 20 cm × 20 cm weighing 750 N is suspended in horizontal plane by three vertical wires as shown in **Fig. 2 b.** Calculate the tension in each wire at A, B and C. **[7]**

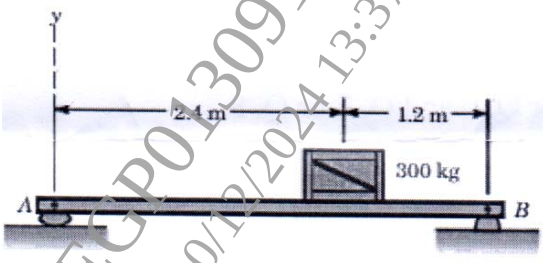

Fig. 2 a

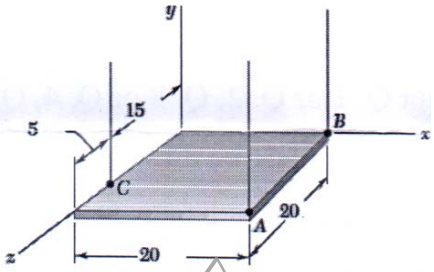

Fig. 2 b

c) Explain Simple, Roller, Hinge and Fixed support with number of reactions developed at each joint with sketch. **[6]**

Q3) a) Determine the force in all members of the truss loaded with 1000 N force at A, B and C with supports as shown in **Fig. 3 a.** **[6]**

b) Determine the x and y components of forces acting at joint B and D on the member BD for a frame loaded and supported as shown in **Fig. 3 b.** **[7]**

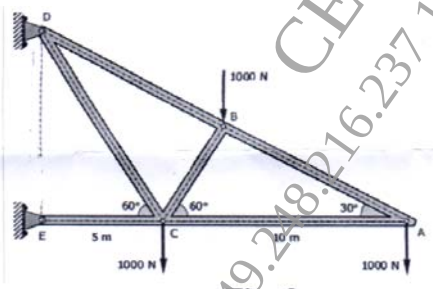

Fig. 3 a

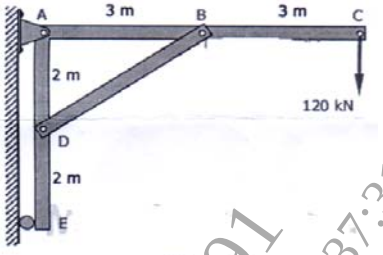

Fig. 3 b

c) Define two force and multi force member with a sketch. **[4]**

OR

Q4) a) Determine the forces in the members AC, BC and BD for the truss loaded and supported as shown in **Fig. 3 a.** **[6]**

b) Knowing that m_C = 50 kg, determine the tension in each segment of the cable and magnitude of mass 'm_B' for cable supported and loaded as shown in **Fig. 4 b.** **[6]**

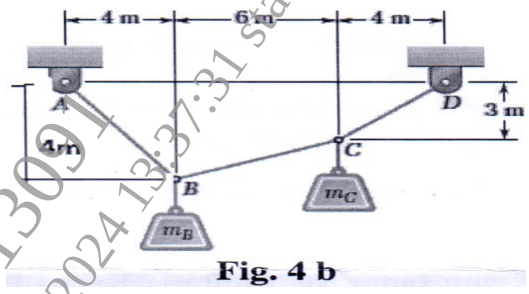

Fig. 4 b

c) Explain deficient, determinate and indeterminate truss with a sketch. **[5]**

Q5) a) Acceleration of a particle moving along a straight line is given as 'a=t/6', where 'a' is acceleration in m/s^2 and 't' is time in seconds. Initially, then t = 0 sec, the velocity is 2 m/s and displacement is 7m. Determine velocity and displacement of particle at t=3 seconds. **[6]**

b) A stone thrown vertically upward with 20 m/s from top of a tower 80 m high. Determine velocity with which it hits the ground at base level of tower and total time required to reach the ground level. **[6]**

c) A golf player hits the ball from point A with a velocity 45 m/s as shown in **Fig. 5c** at an angle of 20° with horizontal. Determine the maximum height it reaches and the horizontal distance it falls w.r.to A. Consider ground to be horizontal. **[6]**

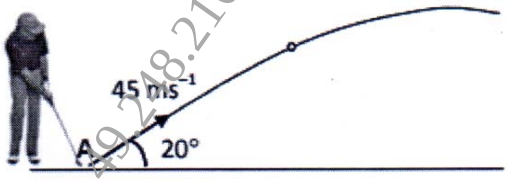

Fig. 5 c

OR

Q6) a) The acceleration of a particle is given by an expression, a = k.t^2. At t = 0, velocity of the particle is – 12 m/s. Knowing that v = 0 and x = 15 m when t = 4 s, write the equation of motion of a particle. **[6]**

b) A golf player hits the ball from point A with a velocity 45 m/s as shown in **Fig. 6b** at an angle of 20° with horizontal. Determine whether the ball will pass over the 12m high tree placed at 80m from A. Consider ground to be horizontal. **[6]**

c) A motorist starts from rest at point A on a circular ramp of 150 m radius when t = 0 s, increases speed at a constant rate and enters the highway at point B as shown in **Fig. 6c.** Knowing that her speed increases with same rate till it reaches to 100 km/h at point C, determine the speed at point B. **[6]**

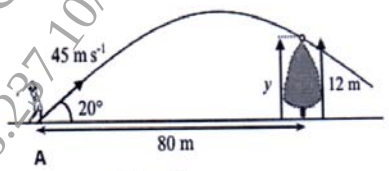

Fig. 6 b

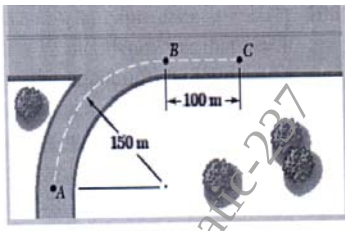

Fig. 6 c

Q7) a) A 15 kg ball suspended by 3m describes an arc of a circle leftwards as shown in **Fig. 7a.** If the tension in the string is 2.5 times weight of the ball, for the position as shown, determine the velocity and acceleration of the ball in that position. **[6]**

b) A racing car travels around the horizontal circular track of radius 100m. If the car starts from rest and accelerates with tangential acceleration of 7 m/s^2 for some time. Determine the time and velocity when the total acceleration of the racing car reaches to 8 m/s^2. **[6]**

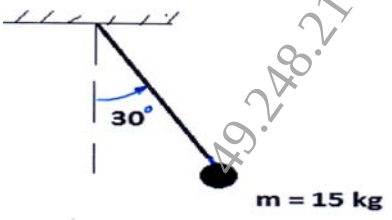

Fig. 7 a

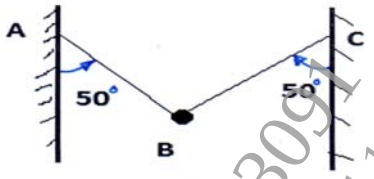

Fig. 8 a

c) A ball of mass 1kg dropped from 5m height on a horizontal floor rebounds back to 3m height. Determine the coefficient of restitution between the floor and ball. Also Determine its renounced height after falling from 3m again. **[5]**

OR

Q8) a) A 65 kg wrenching ball 'B' is suspended through cables AB and BC as shown in **Fig. 8a**. Determine the tension in the cable BC at that moment, if the cable AB is cut. **[6]**

b) Cylinder A of 0.5 kg is dropped from 2.4 m onto pan B of 2.5 kg, which is at a resting on a spring constant k = 3kN/m. Assuming the impact to be perfectly plastic, determine the compression of the spring after impact.**[6]**

c) Ball 'A' of 5 kg moving with 10 m/s rightwards, strikes with ball 'B' of 1 kg which is at rest. If after the impact the velocity of the ball 'B' is 10 m/s rightwards. Determine, the velocity of the ball 'A' after impact and coefficient of restitution 'e'. **[5]**

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