Total No. of Questions : 8]

SEAT No. :

P4935

[Total No. of Pages : 6

[5667]-1002

F.E. (Common)

ENGINEERING MECHANICS

(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) *Neat diagram must be drawn wherever necessary.*
3) *Figures to the right indicate 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 electronic pocket calculator is allowed.*

Q1) a) The weight of the cycle is 500 N which act at center of gravity G as shown in Fig. 1 a. Determine the normal reaction at A and B when the cycle is in equilibrium. **[7]**

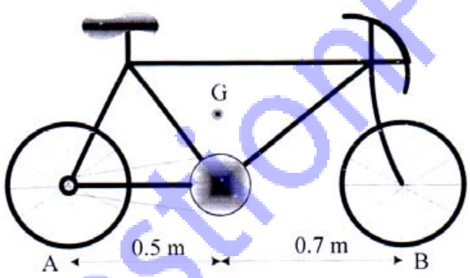

Fig. 1 a

b) Pole OA is kept in vertical position using three guy-wires AB, AC and AD as shown in Fig. 1 b. Calculate the tension in each wire, if the weight of the pole is 5000 N. **[8]**

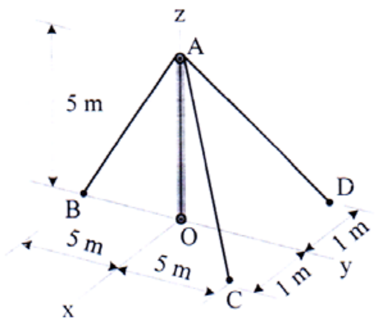

Fig. 1 b

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c) Explain hinge, roller and fixed support with maximum number of reaction exerted on it with suitable sketches. **[3]**

OR

Q2) a) Find the reaction exerted at A and B on the sphere of 200 N kept in a trough as shown in Fig. 2 a. **[8]**

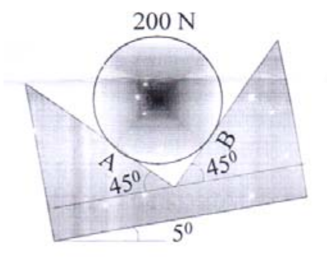

Fig. 2 a

b) A square mat foundation supports four column as shown in Fig. 2 b. Determine the magnitude and point of application of the resultant with respect to origin. **[7]**

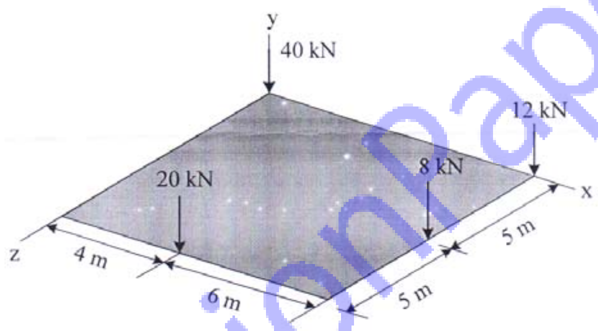

Fig. 2 b

c) State the equation of equilibrium for concurrent, parallel and general force system. **[3]**

Q3) a) Determine the forces in all members of the truss loaded and supported as shown in Fig. 3 a. **[7]**

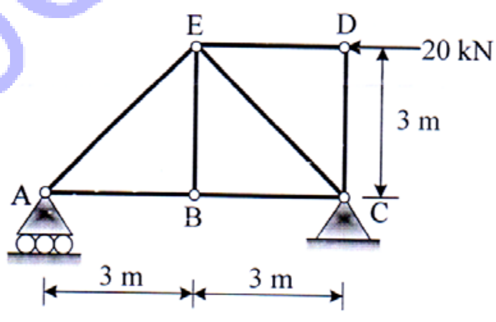

Fig. 3 a

b) Determine the x and y components of forces acting at joint B on the horizontal member BD for a frame loaded and supported as shown in Fig. 3 b. **[8]**

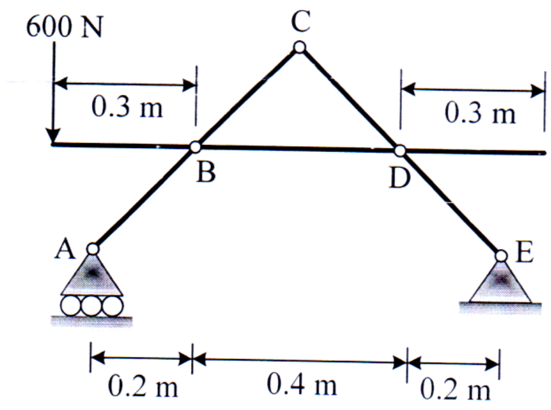

Fig. 3 b

c) Define two force and multi force members. **[2]**

OR

Q4) a) Determine the forces in the members DE, CE and BC for the truss loaded and supported as shown in Fig. 3 a. **[7]**

b) Determine the reactions at support A and B for the cable loaded and supported as shown in Fig. 4 b. **[7]**

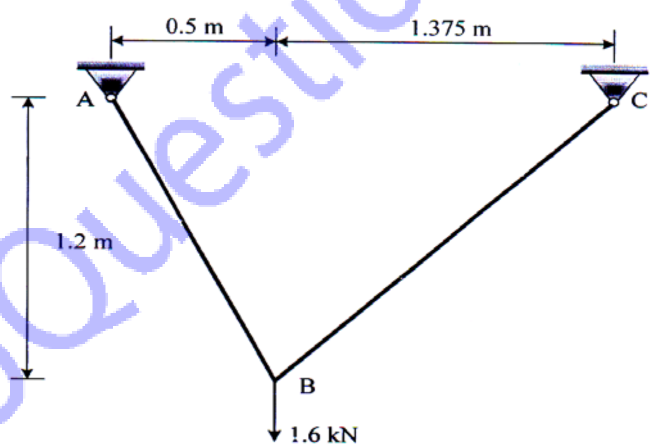

Fig. 4 b

c) Explain imperfect, perfect and redundant truss with a sketches. **[3]**

Q5) a) Automobile A and B are traveling in adjacent lane at t = 0 and have the position and speed as shown in the Fig. 5 a. Knowing that automobile A has a constant acceleration of 0.6 m/s^2 and B has constant deceleration of 0.4 m/s^2, determine when and where A will overtake B. Also determine the speed at that time. **[8]**

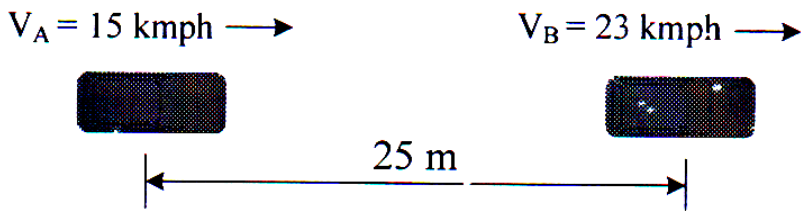

Fig. 5 a

b) A stone thrown vertically upward comes back to ground in 8 s. Determine its velocity of projection and maximum height attained by the stone. **[4]**

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

OR

Q6) a) A car comes to complete stop from an initial speed of 50 m/s in a distance of 100 m. With the same constant acceleration, what would be the stopping distance s from an initial speed of 70 m/s. **[6]**

b) A golfer hits the golf ball from point A with an initial velocity of 50 m/s at an angle of 25° with the horizontal shown in Fig. 6 b. Determine the horizontal distance AB and maximum height it attain. **[6]**

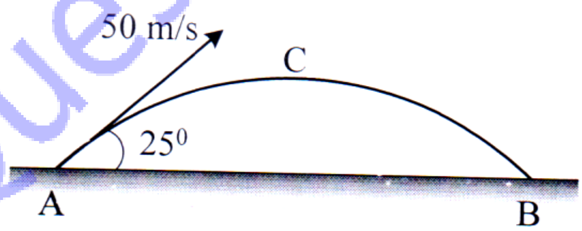

Fig. 6 b

c) A train enters a curved horizontal section of track at a speed of 100 km/h and slows down with constant deceleration to 50 km/h in 12 seconds. An accelerometer mounted inside the train records a horizontal acceleration of 2 m/s^2 when the train is 6 seconds into the curve. Calculate the radius of curvature ρ of the track for this instant. **[6]**

Q7) a) The conveyor belt is designed to transport packages of various weights. Each 10 kg package has a coefficient of kinetic friction $\mu_k = 0.15$. If the speed of the conveyor is 5 m/s and then it suddenly stop, determine the distance the package will slide on the belt before coming to rest. Refer Fig. 7 a. **[6]**

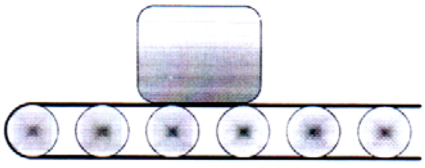

Fig. 7 a

b) The pendulum bob has a mass m, length 1 m and is released from rest as shown in Fig. 7 b when θ = 0°. Determine the tension in the cord as function of the angle of descent θ. Neglect the size of bob. **[6]**

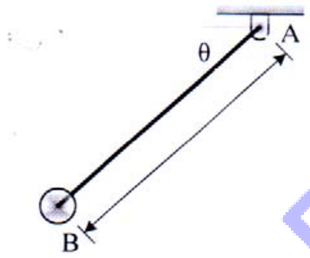

Fig. 7 b

c) 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 the coefficient of restitution between the two cars is e = 0.65 determine the speed of the cars after the collision. **[5]**

OR

Q8) a) Block A has a weight of 40 N and block B has a weight of 30 N. They rest on a surface for which the coefficient of kinetic friction is $\mu_k = 0.2$. If the spring has a stiffness of k = 300 N/m, and is compressed 0.05 m, determine the acceleration of each block just after they are released. **[6]**

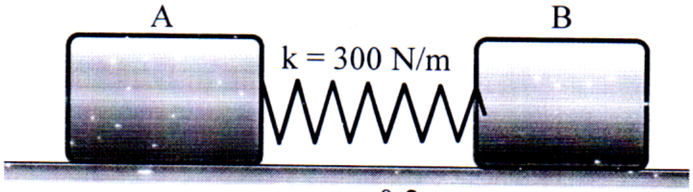

Fig. 8 a

b) The man has a mass of 80 kg and sits 3 m from the center of the rotating platform. If the coefficient of static friction between the clothes and the platform is $\mu_s = 0.3$ and tangential component of acceleration is 0.4 m/s^2, determine the time required to cause him to slip. **[6]**

c) The velocities of two identical steel blocks of mass 0.6 kg before impact are $v_A = 4$m/s rightward and $v_B = 2$ m/s leftward. After impact the velocity of block B is observed to be 2.5 m/s to the right, determine the coefficient of restitution between the blocks. **[5]**

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