Total No. of Questions : 8]

SEAT No. : [ ]

PB3592

[Total No. of Pages : 6

[6260]-7

F.E. (Common)

ENGINEERING MECHANICS

(2019 Pattern) (Credit System) (Semester - I/II) (101011)

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

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.***
6) ***Use of cell phone is prohibited in the examination hall.***

Q1) a) A 1.5 m cable placed around a crate as shown in Fig. 1 a. If the mass of the crate is 300 kg, determine the tension in the cable. **[7]**

b) A square mat foundation supports four column as shown in Fig. 1 b. Determine the magnitude and point of application of the resultant with respect to origin. **[7]**

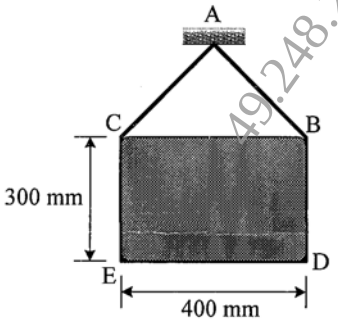

Fig. 1 a

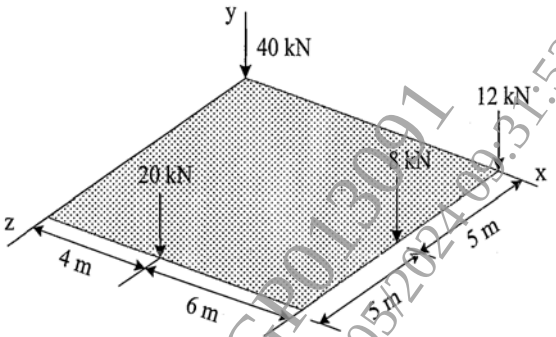

Fig. 1 b

c) Explain in brief free body diagram, active and reactive forces with suitable sketch. **[4]**

OR

P.T.O.

Q2) a) The boom is intended to support two vertical loads, F_1 and F_2 as shown in Fig. 2 a. If the cable CB can sustain a maximum load of 1500 N before it fails, determine the critical loads F_1 and F_2 if $F_1 = 2F_2$. Also determine the reaction at A. **[7]**

b) The square steel plate has a mass of 1800 kg with mass center G as shown in Fig. 2 b. Determine the tension in each cable so that the plate remains horizontal. **[7]**

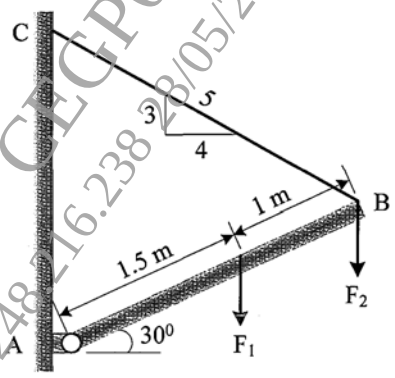

Fig. 2 a

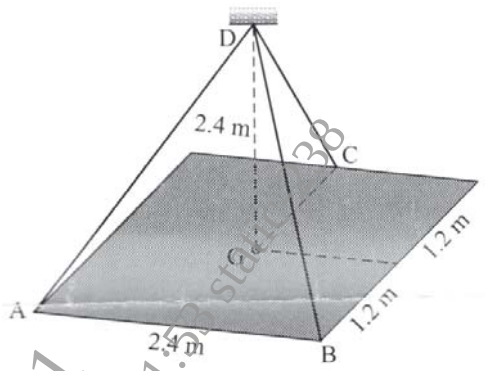

Fig. 2 b

c) Find support reaction at A and B for the beam AB as shown in Fig. 2 c.**[4]**

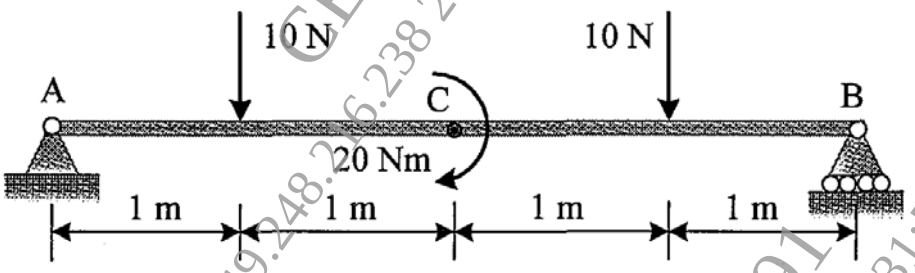

Fig. 2 c

Q3) a) Determine the forces in the members AB, AE and BE of the truss as shown in Fig. 3 a. **[7]**

b) The cable segment supports the loading as shown in Fig. 3 b. Determine the component of reactions at A and B. Also find maximum tension in segment of the cable. **[7]**

c) Differentiate truss and, frame with suitable sketch. **[4]**

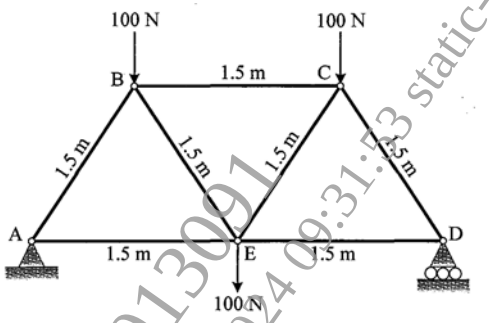

Fig. 3 a

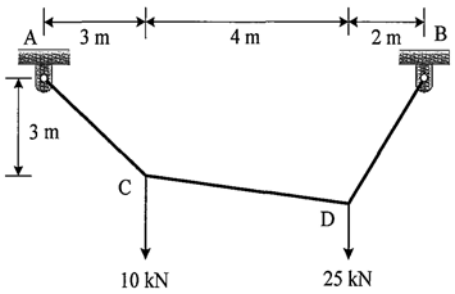

Fig. 3 b

OR

Q4) a) Determine the forces in the members BC, BE and AE of the truss as shown in Fig. 3 a. **[7]**

b) Determine the components of reactions at supports A and B for the frame loaded and supported as shown in Fig. 4 b. **[7]**

c) The maximum tension is 100 N for the Cable profiles ABCD as shown in Fig 4 c. Determine the force P at B and C to keep the segment BC in horizontal position. Also find tension in segment BC. **[4]**

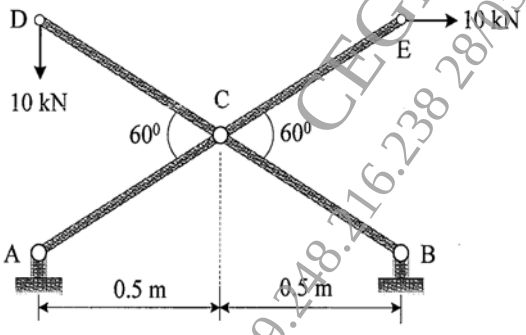

Fig. 4 b

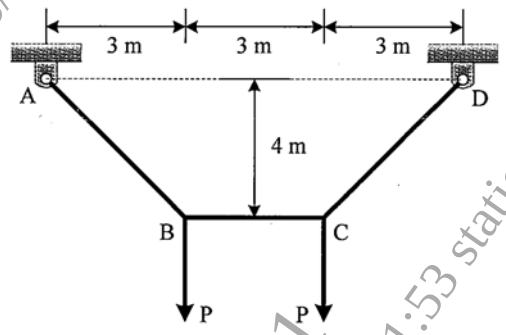

Fig. 4 c

Q5) a) A car comes to rest from an initial speed of 80 km/h in a distance of 30 m. With the same constant acceleration, determine the distance 's' for which the car comes to rest from an initial speed of 110 km/h. **[5]**

b) The truck travels at a speed of 4 m/s along a circular road that has a radius of 50 m. For a short distance from s = 0, its speed is then increased by $a_t = (0.05s)\ m/s^2$, where s is in meters. Determine the speed and magnitude of its acceleration when it has moved s = 10 m. **[6]**

c) A projectile is launched with a speed of V_0 = 25 m/s at an angle of θ = 30° with horizontal as shown in Fig. 5 c. Determine the maximum distance travel by projectile along horizontal and vertical direction. **[6]**

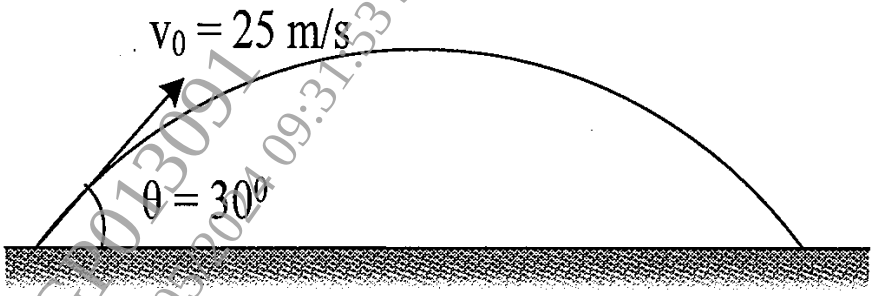

Fig 5 c

OR

Q6) a) The motion of a particle is defined by $x = 2t^3 - 15t^2 + 24t + 4$, where x is in m and t is in s. Determine when the velocity is zero and find position at which acceleration is zero. **[5]**

b) A motorist is traveling on a curve road of radius 760 m with 25 m/s. If he applies breaks to slow down to 20 m/s in 8 s. Determine the total acceleration of the vehicle at 20 m/s. **[6]**

c) 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 c. Determine the maximum horizontal distance x_{max} and maximum height h_{max} it attain. **[6]**

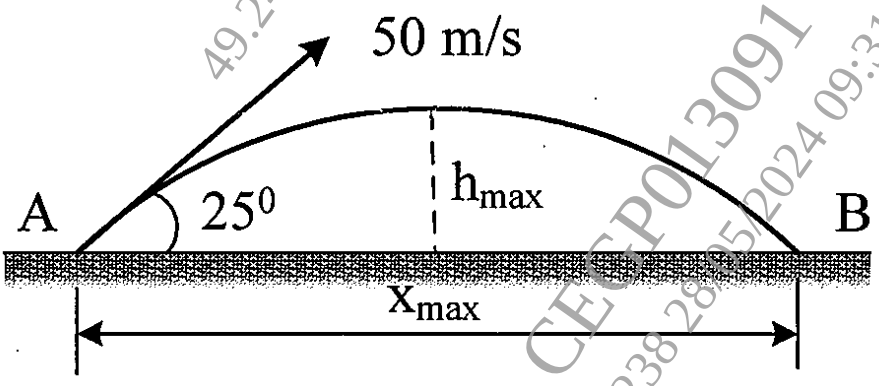

Fig. 6 c

Q7) a) The system shown in Fig. 7 a is initially at rest. Neglecting axle friction and mass of pulley, determine the acceleration of 200 kg block A. **[6]**

b) The pendulum bob has a mass 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]**

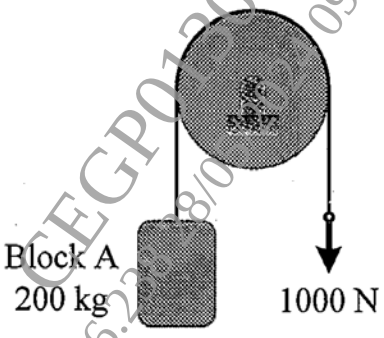

Fig. 7 a

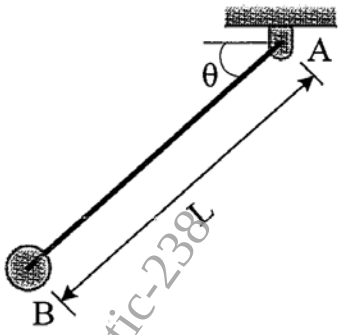

Fig. 7 b

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) A block of weight 200 N is kept on an incline plane and a force P = 200 N is applied to move the block as shown in Fig. 8 a. Determine the acceleration of the block, if coefficient of static and kinetic friction between block and plane are 0.3 and 0.25 respectively. **[5]**

b) The man has a mass of 80 kg and sits 3 m from the center of the rotating platform as shown in Fig. 8 b. Due to rotation his speed is increase from rest by $a_t = 0.4$ m/s^2. If the coefficient of static friction between the clothes and the platform is $\mu_s = 0.3$, determine the time required to cause him to slip. **[6]**

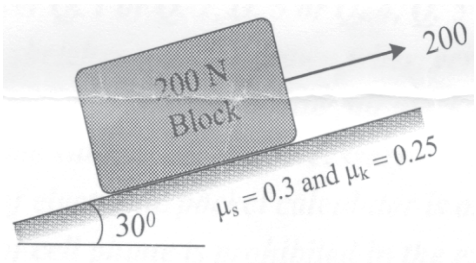

Fig. 8 a

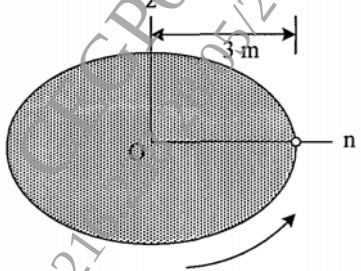

Fig. 8 b

c) A 2 kg pellet is released from rest at A and slides without friction along the surface as shown in Fig. 8 c. Using work energy principle find velocity at B. Also find the normal forces exerted by the surface on the pellet as it crosses point B. **[6]**

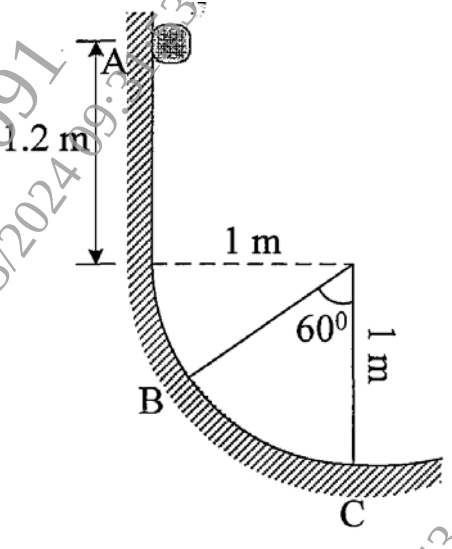

Fig. 8 c