Total No. of Questions : 8]

SEAT No. :

PD4030

[Total No. of Pages : 4

[6401]-1907

F.E.

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 and 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) State and explain free body diagram with suitable sketch. **[4]**

b) Determine the force in cable AB and AC as shown in Fig. 1 b, if the weight of crate is 550 N. **[7]**

c) Determine the support reaction for a given beam loaded and supported as shown in Fig. 1 c. **[7]**

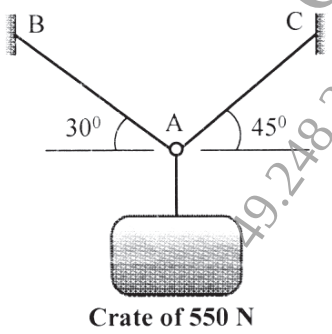

Fig. 1 b

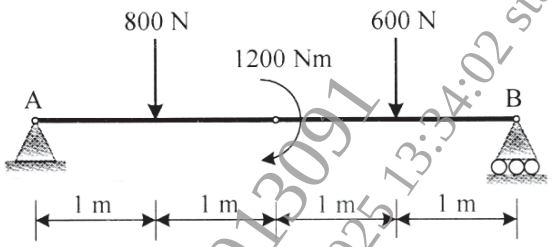

Fig. 1 c

OR

Q2) a) State and explain in brief resultant and equilibrant force. **[4]**

b) A 3 *m* wooden beam weighing 540 N is supported as shown in Fig. 2 b. Find the reaction at A and tension in cable BC. **[7]**

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c) Determine the resultant force of given parallel space force system as shown in Fig. 2 c. Also locate the position of resultant force with respect to origin O. **[7]**

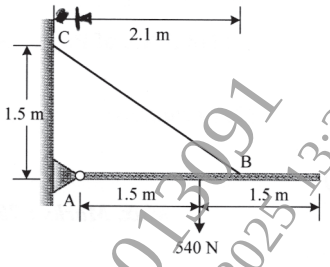

Fig. 2 b

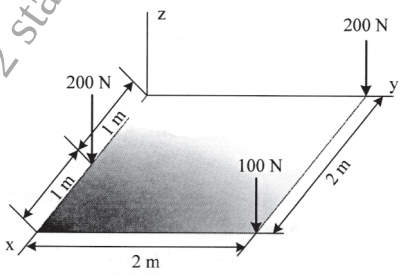

Fig. 2 c

Q3) a) Differentiate pin jointed truss and cable with suitable sketch. **[4]**

b) Determine the forces in the members of the pin jointed truss as shown in Fig. 3 b. **[7]**

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

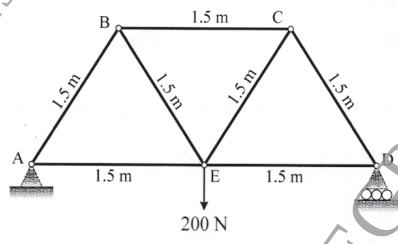

Fig. 3 b

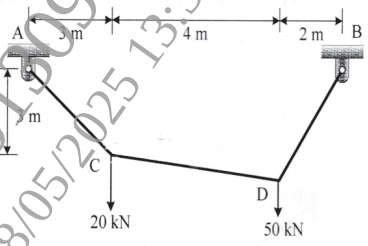

Fig. 3 c

OR

Q4) a) Explain deficient, determinate and indeterminate truss. **[4]**

b) The maximum tension is 100 N for the Cable profiles ABCD as shown in Fig 4 b. Determine the force P at B and C to keep the segment BC in horizontal position. **[7]**

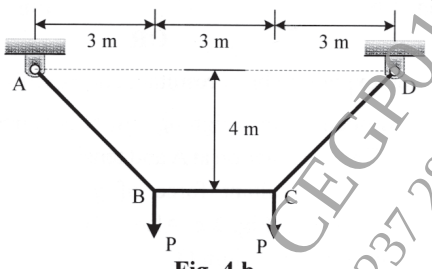

Fig. 4 b

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

Q5) a) The motion of particle is defined by $x = t^3 - 6t^2 + 9t + 5$, where x is in meter and t in seconds. Find the time at which velocity is Zero. Also determine velocity and acceleration at t = 5 s. **[5]**

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 increase her speed. **[6]**

c) A cricket ball thrown by a fielder from a height of 2 m at an angle of 45° to the horizontal with an initial velocity of 25 m/s hit the wickets at the height of 0.6 m from the ground, find distance of fielder from the wickets. **[6]**

OR

Q6) a) A baseball is thrown downward from a 15 m tower with an initial speed of 5 m/s. Determine the speed at which it hits the ground and the time of travel. **[5]**

b) A particle moves in a circular path of radius 0.4 m. Calculate magnitude of acceleration of the particle if its speed is 0.6 m/s and it increasing at the rate of $a_t = 1.2$ m/s^2. **[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]**

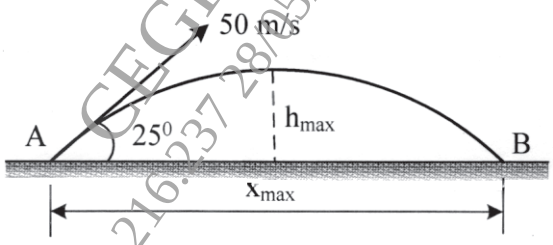

Fig. 6 c

Q7) a) A 150 kg car enters a curved portion of the road of radius 200 m travelling at a constant speed of 36 km/h. Determine the normal and tangential component of force at curved portion. **[5]**

b) A 2 kg stone is dropped from a height *h* and strike the ground with a velocity of 24 m/s. find the kinetic energy of the stone as it strikes the ground and the height *h* from which it was dropped using work energy method. **[6]**

c) A railroad car having a mass of 15 Mg is coasting at 1.5 m/s on a horizontal track. At the same time another car having a mass of 12 Mg is coasting at 0.75 m/s in the opposite direction. If the car meet and couple together, find the common speed of cars. **[6]**

OR

Q8) a) A tennis ball is dropped from a height 1600 mm and it rebounds to a height 1100 mm. Determine the coefficient of restitution. **[5]**

b) A 50 kg crate shown in Fig. 8 b rests on a horizontal plane for which the coefficient of kinetic friction is $\mu_k = 0.3$. If the crate does not tip over when it is subjected to a 400 N towing force as shown, determine the velocity of the crate in 5 s starting from rest. **[6]**

c) Determine the work done by all forces acting on the block of 18 kg as shown in Fig. 8 c as it moves 12 m upwards along the plane. Take coefficient of kinetic friction $\mu_k = 0.2$. **[6]**

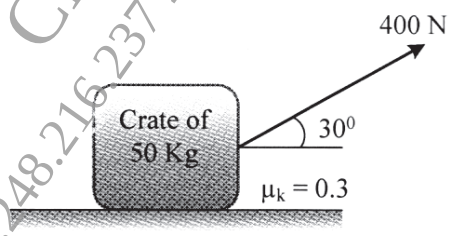

Fig. 8 b

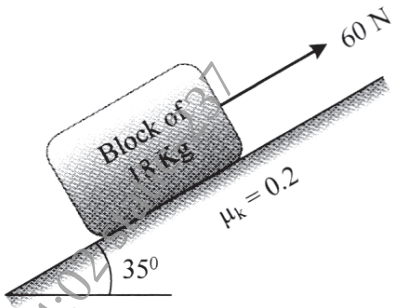

Fig. 8 c