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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

First Semester, B.E. - Semester End Examination; Dec. - 2015

Engineering Mechanics

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer **FIVE** full questions selecting **ONE** full question from each unit.*
ii) Missing data if any, may suitably assumed.

UNIT - I

1 a. Explain the following with next sketches :
(i) Force (ii) Principle of transmissibility
iii) Arm of a couple (iv) Lami's theorem. 8

b. Determine the magnitude and direction of the resultant of three forces converging at a point 'O' as shown in Fig. Q 1(b). 4

c. Fig. Q1(c) shows a system of cables in equilibrium condition under two loads of 300 N and 500 N. Determine the forces developed in the different segments. 8

2 a. Find the resultant of the force system acting on a plate ABCD as shown in Fig. Q 2(a). Also find the point where resultant will cut with X axis. 8

b. With neat sketch list different types of loads with their reduced concentrated load. 4

c. Determine the reactions at the supports for the beam shown in Fig. Q 2(c). 8

UNIT - II

3 a. What is centroid? Explain the significance of axis of reference for determining centroid. 3

b. From first principles obtain the centroidal distance of a quarter of a circle of radius 'R'. 5

c. Find the coordinates of centroid of a Lamina shown in Fig. Q3 (c) from OX and OYaxis. 12

4 a. With neat sketch, explain axis of symmetry and its features. 4

b. Using method of integration determine the centroid of a right angle triangle of base 'b' and height 'h' with respect to its base. 6

c. Locate the centroid of the Fig. Q 4 (C) with respect to 'O' 10

UNIT - III

5 a. With neat sketch explain the concept of moment of Inertia. 4

b. State and prove parallel axis theorem. 6

c. Determine the moment of Inertia about x-x axis of the Fig. Q 5(c) 10

6 a. Write a brief note on: Radius of Gyration and polar moment of Inertia. 4

b. Find the second moment of a rectangle of breadth "b" and depth "d" using method of integration about its base. 6

Contd…..2

c. Find the moment of inertia of the section shown in Fig. Q 6(c) about the horizontal centroidol axis and also find the radius of Gyration about the same axis. 10

UNIT - IV

7 a. With neat sketch explain:
(i) angle of friction (ii) cone of friction. 6

b. Explain laws of static friction. 4

c. Determine the range of values that a weight 'w' may have so that the block "A" of 1000 N shown in Fig. Q 7(c) will neither start up nor slip down the plane, take coefficient of friction to be 0.3 and assume smooth pulley. 10

8 a. Write a note on types of friction. 4

b. A block of 500 N on a horizontal plane is just moved by a pull of 180 N as shown in Fig. Q 8(b). Determine the coefficient of friction between floor and block. 6

c. A uniform ladder of length 10 m weighting 20 N is placed against vertical wall with its lower end 6 m from wall. The coefficient of friction contact surface is 0.30. What is the frictional force acting on the ladder at the points of contact? 10

UNIT - V

9 a. With the help of flow diagram comment on the subdivisions of dynamics. 4

b. A stone dropped into a well is heard to strike the water after 4 seconds. Find the depth of the well. Given the velocity of sound = 350 m/s, g = 9.8 m/s^2. 8

c. A ball is thrown from a point 'O' so as to just clear a wall of 4 m high and at a horizontal distance of 5m from 'O'. If the ball falls 4 m behind the wall, find the velocity of projection of the ball and the angle of projection take; g = 9.81 m/s^2 8

10a. With instances explain work, power and Energy. 6

b. State and explain D'Alembert's principle. 4

c. A train weighing 200 tonnes starts from rest with an acceleration of 1 m/s^2 and acquires speed of 108 KMPH. Find the Kinetic energy at the final speed and the average power required. If the power is shut off and the train is subjected to a retarding force equal to 10% of the weight, find the distance it will run before coming to rest. Consider; g = 9.81 m/s^2 10

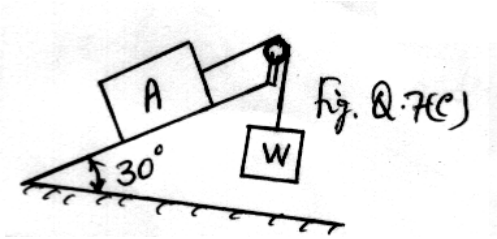

Fig. Q.7(c)

Contd…..3

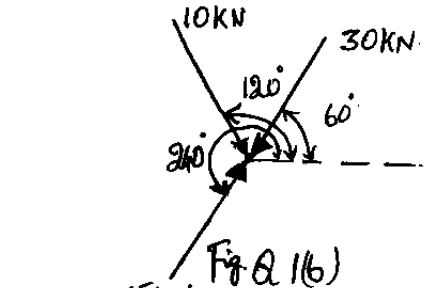

Fig. Q 1(b)

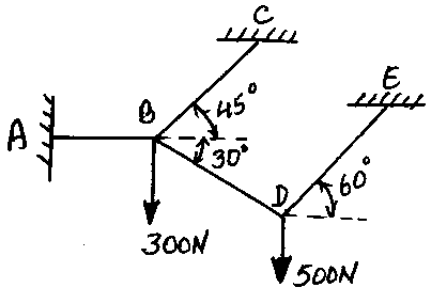

Fig. Q 1(c)

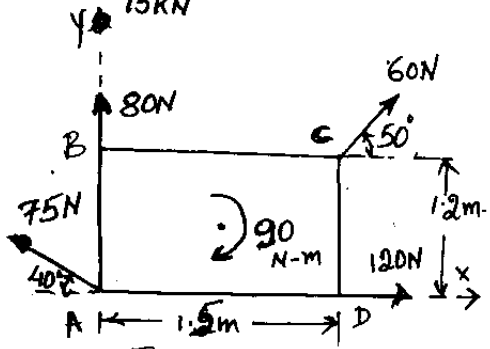

Fig. Q2(a)

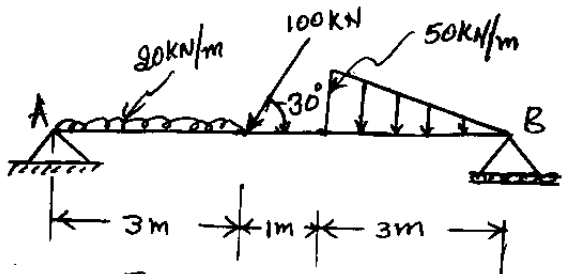

Fig. Q 2 (c)

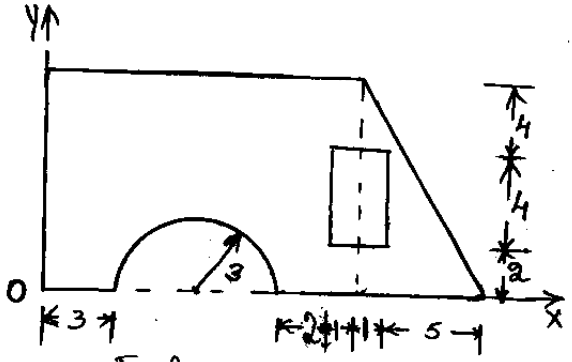

Fig. Q. 3(c)

All dimensions in m.m.

Not to scale.

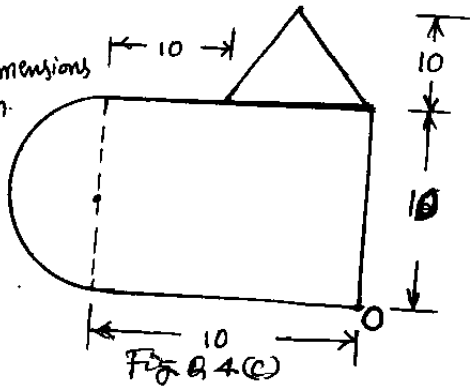

Fig. Q 4(c)

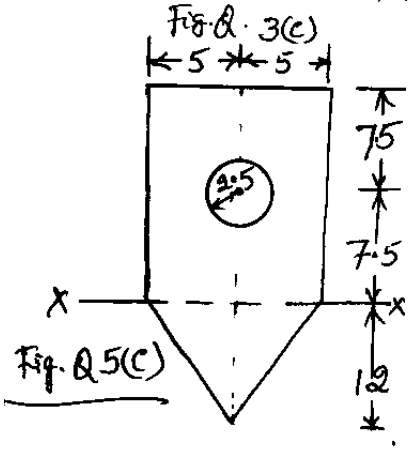

Fig. Q 5(c)

All dimensions in mm

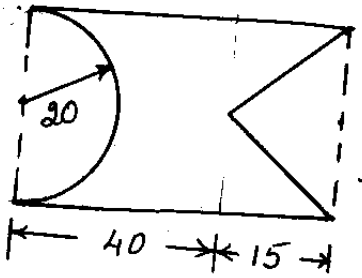

Fig. Q 6(c)

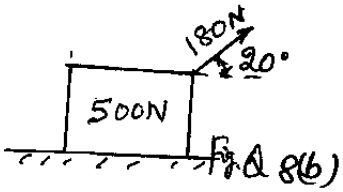

Fig. Q 8(b)

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