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

(An Autonomous Institution affiliated to VTU, Belagavi)

First Semester, B.E. - Semester End Examination; Dec - 2017/Jan - 2018

Engineering Mechanics

(Common to All Branches)

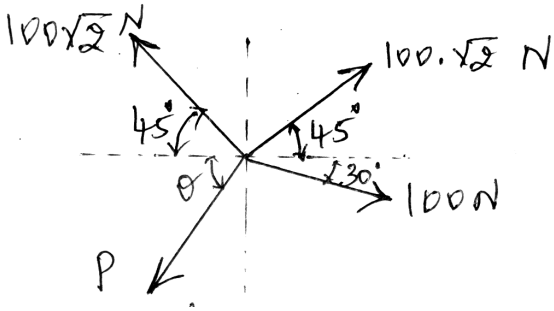
Time: 3 hrs *Max. Marks: 100*

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

UNIT - I

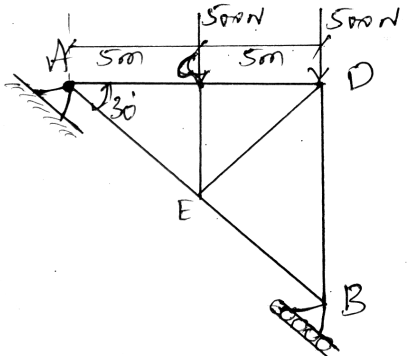
1 a. Draw the flow chart of classification of Mechanics. 6

b. Determine the Magnitude end direction of force '*P*', which keeps the concurrent system of force in equilibrium.



6

c. Determine the reactions at the hinged support '*A*' and the roller support at '*B*' as shown in figure.



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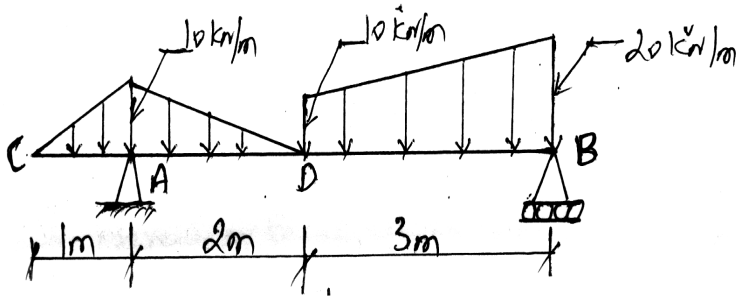
2 a. What is meant by support reactions? With a neat sketch, mention the different types of supports. 6

b. Find the reactions developed at the supports A and B of the loaded beam as shown in figure.



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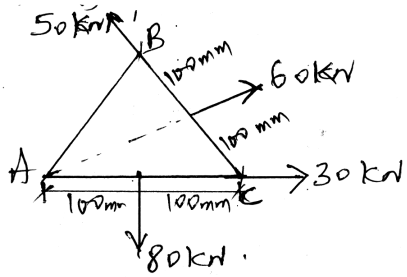
c. An equilateral triangular plate of sides 200 mm is acted upon by four forces as shown in figure. Determine the magnitude, direction of the resultant and its position. 8

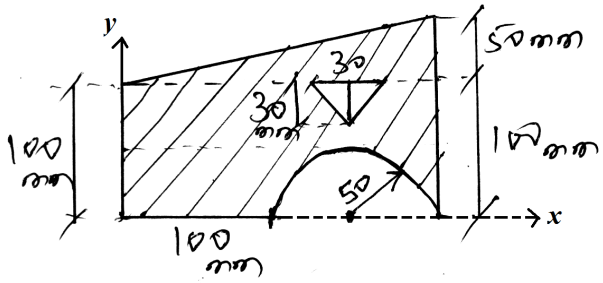


UNIT - II

3 a. Define centroid and centre of gravity. 4

b. Determine the centroid of a triangle from first principle. 6

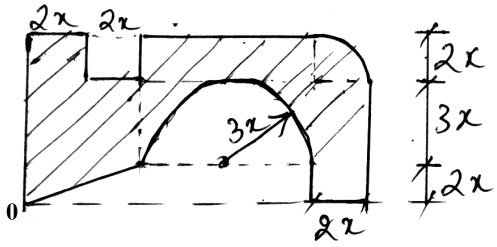
c. With respect to the co-ordinate axes *x* and *y*, locate the centroid of the shared area as shown in figure. 10



4 a. Determine the centroid of a sector of a circle using the method of Integration. 6

b. With a neat sketch, discuss centroid of a Lamina. 4

c. Determine the coordinates of the centroid of shaded area as shown in figure. with respect to '0'. Take $x = 40$ mm. 10

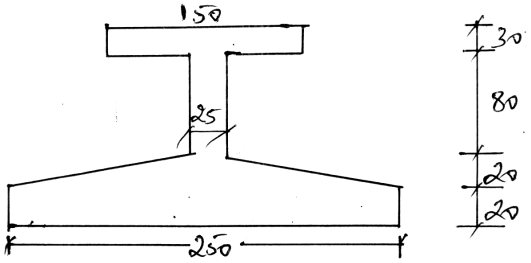


UNIT - III

5 a. State and prove perpendicular axes theorem. 4

b. Determine the moment of inertia of a rectangular section by the method of Integration. 6

c. Determine the M.I. of the built up section as shown in Fig. about its centroidal axis. 10



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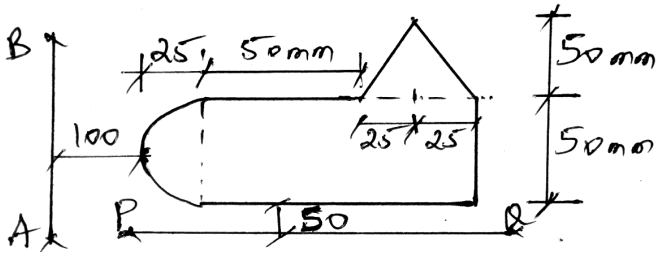
6 a. Define; 4

i) Radius of gyration ii) Polar moment of Inertia.

b. Determine the moment of inertia of a triangular section by the method of Integration. 6

c. Determine the M.I. about PQ and AB of the lamina as shown in figure. 10



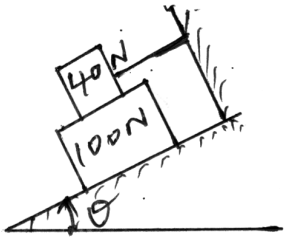
UNIT - IV

7 a. Define; 4

i) Angle of friction ii) Cone of friction.

b. Define coefficient of friction. Show that the coefficient of friction is tangent to the angle of friction. 6

c. Find the angle of the Inclined plane as shown in figure, if the 100 N block impends down the plane. Take $\mu = 0.3$ for all contact surface. 10



8 a. State the laws of solid friction. 4

b. Define angle of repose. Prove that angle of repose is equal to the angle of friction. 6

c. A ladder 6 m long rests on a horizontal floor end beans against a vertical wall. The coefficient of friction between the floor end the ladder is 0.42 end between the wall and ladder is 0.26. The ladder weights 250 N, it also supports a vertical bed of 1 kN, which is at a distance of 1m from the upper end measured along the ladder. Determine the inclination of the ladder with the wall so that it does not slip. Also calculate the reactions at this stage. 10

UNIT - V

9 a. What is a projectile? 2

b. Define; 8

i) Anlge of projection ii) Horizontal range

iii) Vertical height iv) Time of flight.

Contd…4

c. Two bodies of weight 60 N and 40 N are connected to the two ends of a light inextensible string, which passes over a smooth pulley.

Case - I : The weight 60 N is placed on a smooth inclined plane of inclination 10, while the weight 40N is hanging free in air.

Determine; i) Acceleration of the system ii) Tension in the string

Take $g = 9.8$ m/s^2

Case – II : If the inclined plane is rough one, having coefficient of friction between the weight 60 N and inclined surface equal to 0.2. 10

Determine;

i) Acceleration of the system

ii) Tension in the string.

iii) Distance moved by the weight 40 N in 3 sec, starting from rest. Take $g = 9.8$ m/s^2.

10 a. State end explain D'Alembert's principle applicable to plane motion. 4

b. Briefly explain analysis of lift motion. 6

c. A bullet of mass 81gm and moving with a velocity of 300 m/s is fired into a block of wood end it penetrates to a depth of 100 mm. If the bullet moving with the same velocity were fixed into a similar piece of wood 50 mm thick, with what velocity would it emerge? Find also the force of resistance. Assuming it to be uniform. 10

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