Code: 15A03302

R15

B.Tech II Year I Semester (R15) Regular Examinations November/December 2016

ENGINEERING MECHANICS

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

PART - A

(Compulsory Question)

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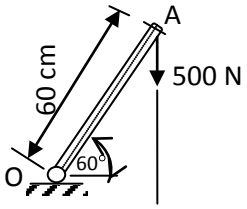
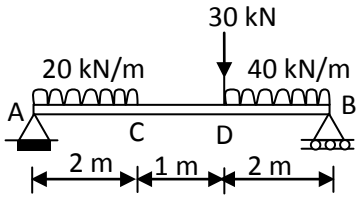
1 Answer the following: (10 X 02 = 20 Marks)

(a) A 500 N vertical force is applied to a 60 cm long bar OA hinged at O and inclined at 60° to the horizontal as shown in figure. (i) Determine the moment of the 500 N force about O.



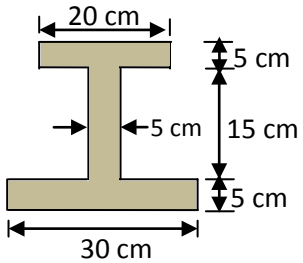
(b) Determine the support reaction of the beam shown in figure below.



(c) List any two Coulomb's laws of friction.

(d) A body of weight 100 N is placed on a rough horizontal plane, and pushed by a force of 45 N, to just cause sliding over the horizontal plane. Determine the co-efficient of friction.

(e) Locate the centroid of the lamina shown in figure below.



(f) State parallel axis theorem with simple sketch.

(g) A body moves along a straight line so that its displacement from a fixed point on the line is given by $s = t^3 - 3t^2 + 2t + 5$. Find the velocity and acceleration at the end of 4 seconds.

(h) A train running at 80 km/h is brought to a standing halt after 50 seconds. Find the retardation and the distance travelled by the train before it comes to a halt.

(i) A member of a roof truss AB of 4 m is transmitting a force of 20 N (tension). Find out the tension coefficient of the member.

(j) A simple harmonic motion is defined by the expression a = -25s. Determine its period and frequency.

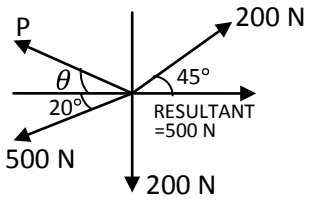
Contd. in page 2

PART - B

(Answer all five units, 5 X 10 = 50 Marks)

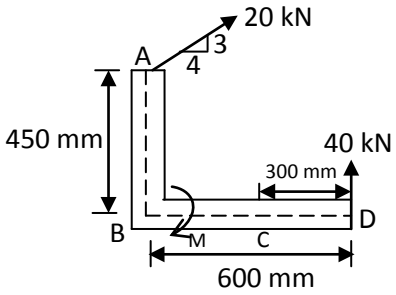
UNIT - I

2 The four coplanar forces are acting at a point as shown in figure below. One of the forces is unknown and its magnitude is shown by P. The resultant is having a magnitude 500 N and it acting along x-axis. Determine the unknown force P its inclination with x-axis.



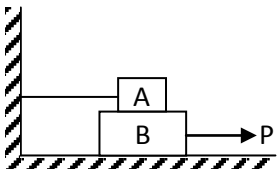
OR

3 A coplanar force system consists of two forces and a couple as shown in figure below. Determine magnitude and sense (direction) of couple M so that resultant of the system passes through (a) Point D (b) Point B.



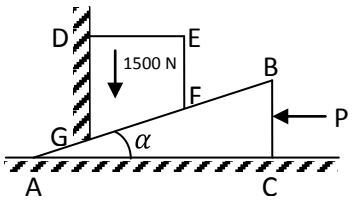
UNIT - II

4 Block A weighing 1000 N rests over block B which weighs 2000 N as shown in figure below. Block A is tied to wall with a horizontal string. If the coefficient of friction between A and B is 1/4 and between B and the floor is 1/3, what should be the value of P to move the block B.



OR

5 A block placed over a 10° wedge on a horizontal floor and leaning against a vertical wall as shown in figure below, and weighing 1500 N is be raised by applying a horizontal force to the wedge. Assuming co-efficient of friction between all the surfaces in contact to be 0.3, determine the minimum horizontal force to be applied to raise the block.



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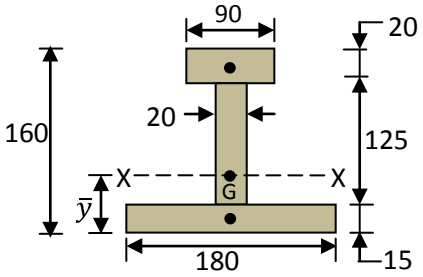
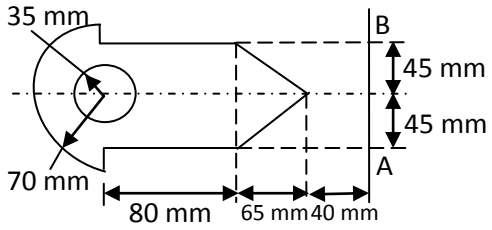
UNIT - III

6 A I-section has top flange 90 mm x 20 mm while bottom flange is 180 mm x 15 mm. If web thickness is 20 mm and overall depth of section is 160 mm as shown in figure below, obtain moment of inertia of the section about horizontal centroidal axis.



OR

7 Determine moment of inertia of plane lamina about line AB as shown in figure below.

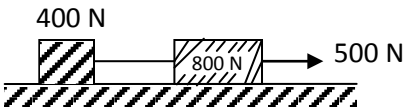


UNIT – IV

8 A small steel ball is shot vertically upwards for the top of a building 25 m above the ground with an initial velocity of 18 m/sec.
(a) In what time it will reach the maximum height.
(b) How high above the building will the ball rise?
(c) Compute the velocity with which it will strike the ground and the total time it is in motion.

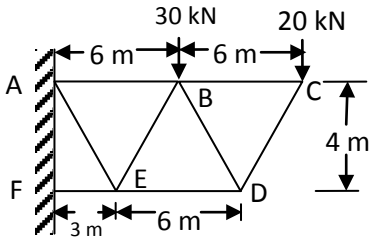
OR

9 Weights 800 N and 400 N are connected by a thread and move along a rough horizontal plane under the action of a force of 500 N applied to 800 N weights as shown in figure below. The coefficient of friction between the sliding surface of the weights and the plane is $\mu = 0.25$. Determine the acceleration of the weights and tension in the thread, using the D'alembert's principle.



UNIT – V

10 Determine the forces in all the members of the frames by any method shown in figure below. Indicate the nature of the forces also.



OR

11 A particle is in simple harmonic motion. It has a velocity of 0.5 m/sec when it is 0.2 m from its static equilibrium position and has a velocity of 0.35 m/sec when it is 0.3 m from the equilibrium position. Determine the maximum velocity, maximum acceleration and the frequency of vibration.

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