Code: 13A01101 **R13**

B.Tech I Year (R13) Supplementary Examinations December/January 2015/2016

ENGINEERING MECHANICS

(Common to CE and ME)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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

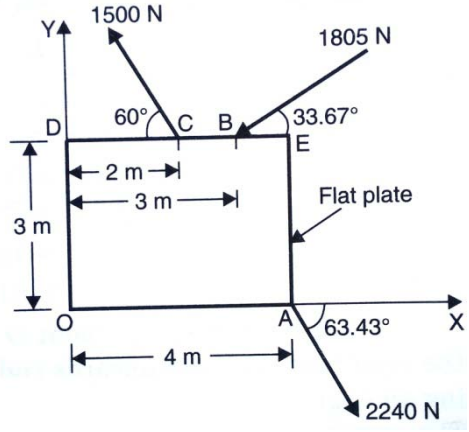
(a) Mention the characteristics of force and what is the S.I unit of force.
(b) State Lami's theorem.
(c) Define angle of repose.
(d) What is the relationship between coefficient of friction and angle of friction?
(e) What are the centroidal co-ordinates of quarter circular area of radius R placed in second quadrant of co-ordinate system?
(f) What is the relationship between mass moment of inertia and area moment of inertia?
(g) Define kinematics.
(h) Define perfect frame.
(i) What do you understand by free vibrations?
(j) Explain the terms 'amplitude' and 'frequency'.

PART – B

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

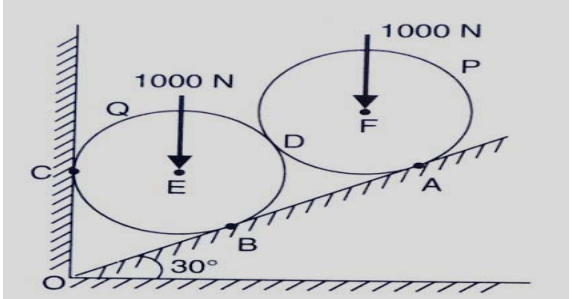
UNIT – I

2 The following figure shows the coplanar system of forces acting on a flat plate. Determine the magnitude of the resultant and the direction of the resultant.



OR

3 Two identical rollers, each of weight W = 1000 N, are supported by an inclined plane and a vertical wall as shown in figure below. Find the reactions at the points of supports A, B and C. Assume all the surfaces to be smooth.



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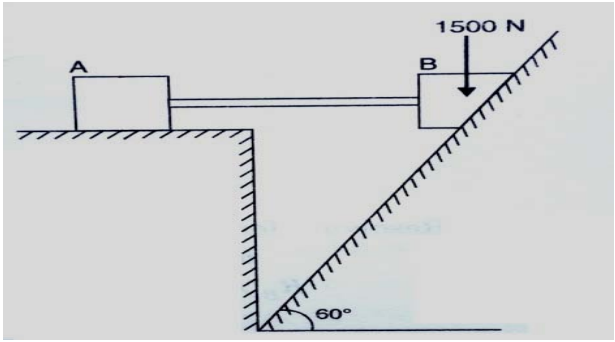
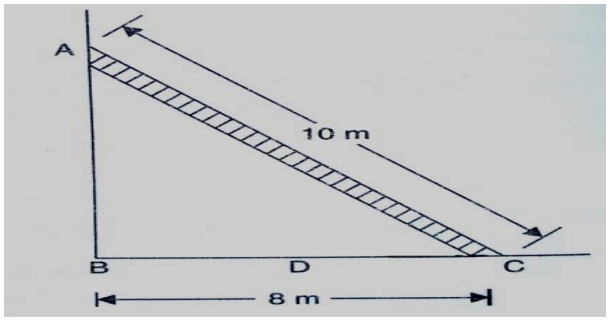
UNIT – II

4 Two blocks A and B are connected by a horizontal rod and are supported on two rough planes as shown in figure below. If the weight of block B is 1500 N and coefficient of friction of block A and B are 0.25 and 0.35 respectively, find the smallest weight of block A for which equilibrium can exist.



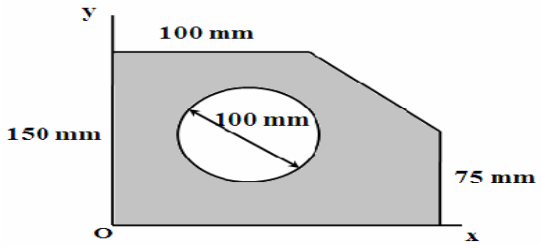
OR

5 A uniform ladder of length 10 m and weighing 20 N is place against a smooth vertical wall with its lower end 8 m from the wall. In this position the ladder is just to slip. Determine: (i) The coefficient of friction between the ladder and floor. (ii) Frictional force acting on the ladder at the point of contact between ladder and floor.



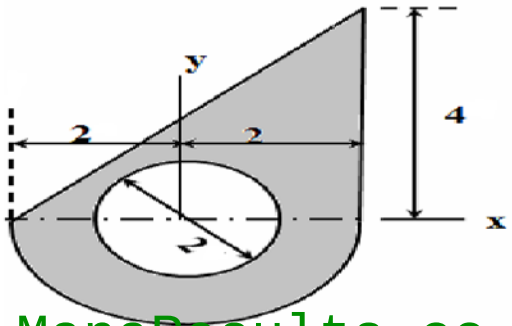
UNIT – III

6 Referring to the figure below. determine the co-ordinates xc and yc of the center of a 100 mm diameter, circular hole cut in a 150 x 200 mm thin plate so that this point will be the centroid of the remaining shaded area.



OR

7 Calculate the moment of inertia of shaded area shown in the following figure below, with respect to the centroidal axes parallel to x axes and all the units are in mm.



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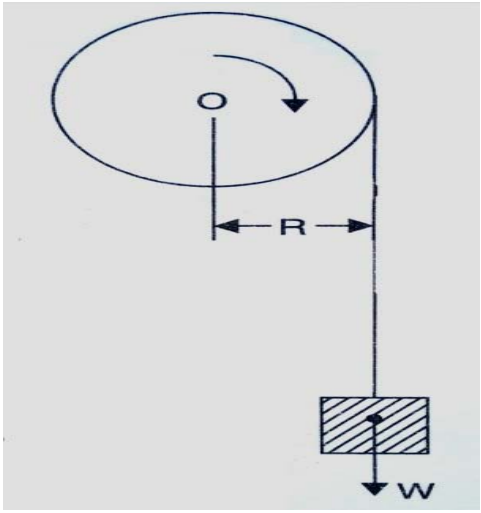
UNIT – IV

8 The equation of motion of a particle moving in a straight line is given by $s = 18t + 3t^2 - 2t^3$ where s is the total distance covered from the starting point in meters at the end of t seconds. Find: (i) The velocity and acceleration at start. (ii) The time, when the particle reaches its maximum velocity. (iii) The maximum velocity of the particle.

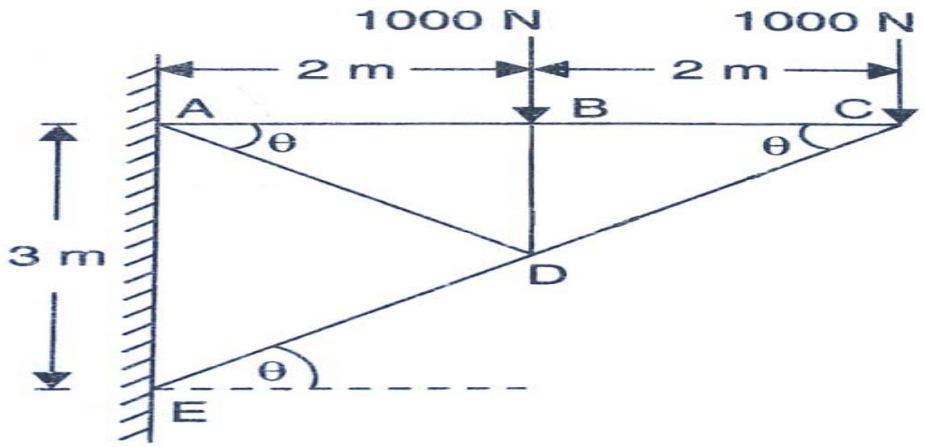
OR

9 A weight of 5 N is suspended by a light rope wound round a pulley of weight 50 N and radius 30 cm, the other end of the rope being fixed to the periphery of the pulley. If the weight is moving downwards, determine: (i) Acceleration of the weight 5 N.(ii) Tension in the string. Take g = 9.81 m/s^2.



UNIT – V

10 Determine the forces in all the members of a cantilever truss shown in the following fig.



OR

11 A vertical shaft 100 mm diameter and 1 m in length has its upper end fixed to the ceiling. At the other end it carries a disc of weight 5000 N having a radius of gyration of 450 mm. The modulus of rigidity for the material of shaft is 0.8×10^5 N/mm^2. Determine the frequency of torsional vibrations if $E = 2 \times 10^5$ N/mm^2.

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