

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)

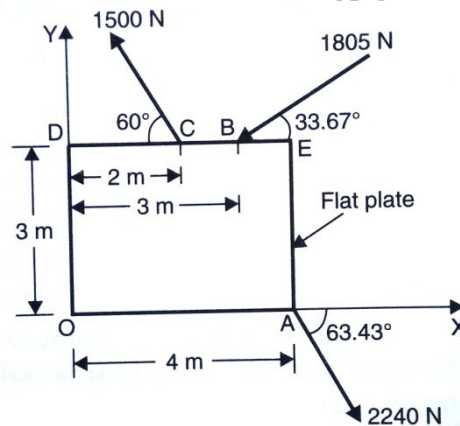
- 1 Answer the following: (10 X 02 = 20 Marks)
 - (a) Mention the characteristics of force and what is the S.I unit of force.
 - (b) State Lami's theorem.
 - (c) Define angle of repose.
 - (d) What is the relationship between coefficient of friction and angle of friction?
 - (e) What are the centroidal 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)

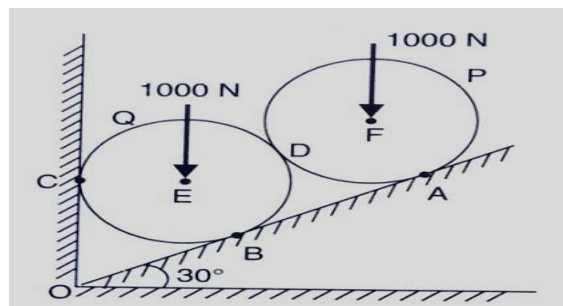
UNIT – I

- 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

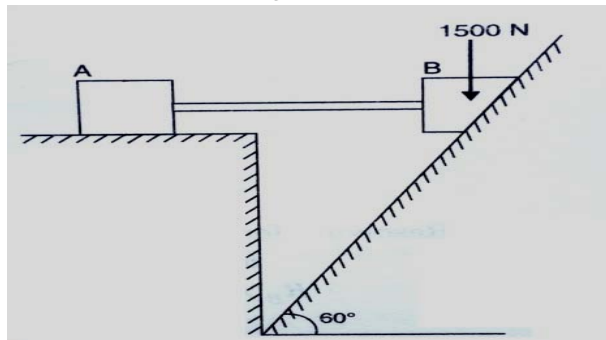
- 3 Two identical rollers, each of weight $W = 1000 \text{ N}$, are supported by an inclined plane and a vertical wall as shown in figure below. Find the reactions at the points of supports A, B and C. Assume all the surfaces to be smooth.



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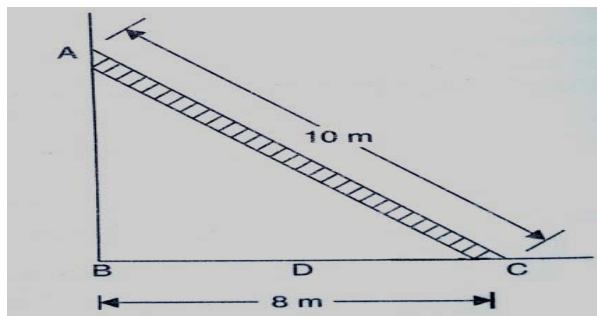
UNIT – II

- 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.



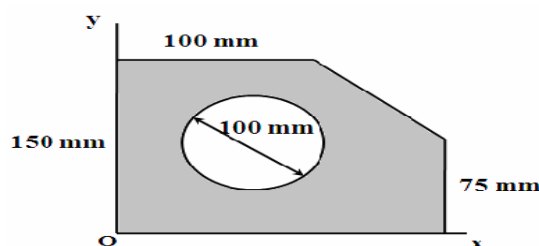
OR

- 5 A uniform ladder of length 10 m and weighing 20 N is placed 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.



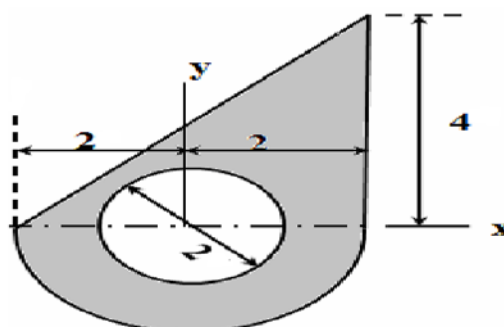
UNIT – III

- 6 Referring to the figure below, determine the co-ordinates x_c and y_c 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.



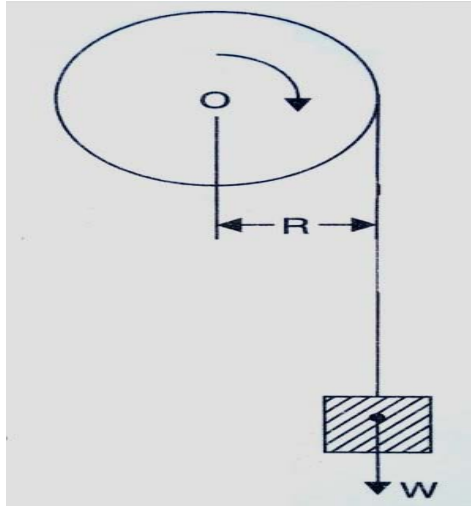
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UNIT – IV

- 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.

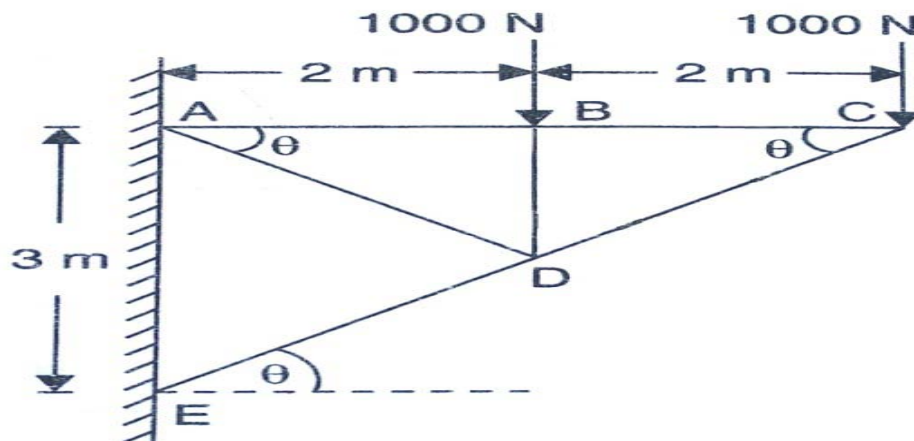
OR

- 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 $g = 9.81 \text{ m/s}^2$.



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 $0.8 \times 10^5 \text{ N/mm}^2$. Determine the frequency of torsional vibrations if $E = 2 \times 10^5 \text{ N/mm}^2$.
