Register No.: …… Name: ……..

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

SECOND SEMESTERB.TECH DEGREE EXAMINATION (S), SEPT 2022

(2020 SCHEME)

Course Code: **20EST100**

Course Name: **Engineering Mechanics**

Max. Marks: **100** **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

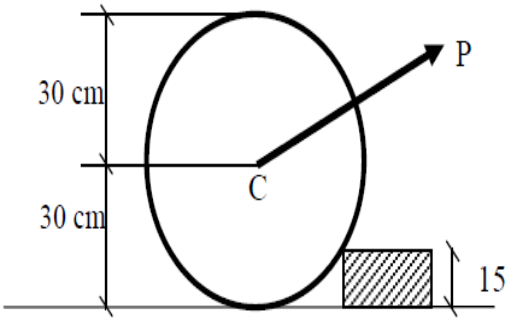
1. Three forces 20N, 30N and 40N act along AB, BC and CA respectively, the three sides of an equilateral triangle ABC. Find the resultant.
2. State and explain Varignon's theorem for concurrent coplanar forces.
3. Briefly explain the analysis of forces acting on a wedge with a suitable example.
4. What do you understand by the reactions at supports?
5. Differentiate Polar moment of Inertia and Mass moment of Inertia.
6. State Pappus Guldinus theorems.
7. A block of mass 10kg is suspended by an inextensible string passing over a smooth frictionless pulley. If the mass is pulled up at an acceleration of $1m/s^2$, calculate the tension in the string.
8. Calculate the increase in reaction under the feet of person of weight 600N in a lift, if the lift accelerates upward with an acceleration $1m/s^2$.
9. What do you mean by instantaneous centre of rotation? How can it be located for a body moving with combined motion of rotation and translation?
10. Distinguish damped and undamped free vibrations.

PART B

(Answer one full question from each module, each question carries 14marks)

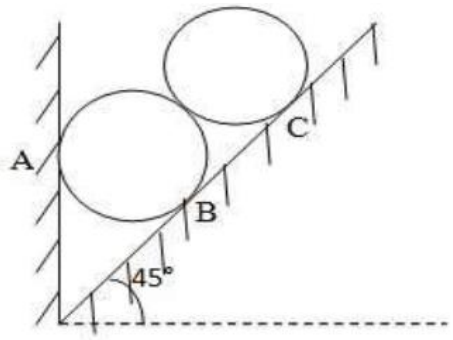
MODULE I

11. A uniform wheel 60cm diameter weighing 1000N rests against a rectangular obstacle 15cm height as shown in figure. Find the least force required which when acting through the center of the wheel will just turn the wheel over the corner of the block. (14)



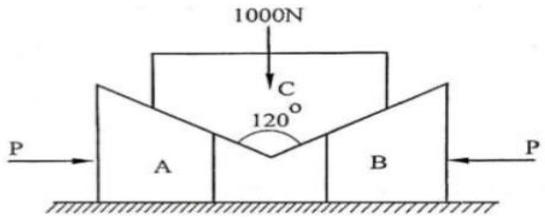
OR

12. Two rollers each of weight 75N are supported by an inclined plane and a vertical wall. Find the reaction at the points of contact A, B, C. Assume all the surfaces to be smooth. (14)



MODULE II

13. Two wedges A and B are used to raise another block C weighing 1000N as shown in figure. Assuming coefficient of friction as 0.25 for all surfaces, determine the value of P for impending upwards motion of block C shown in figure. (14)



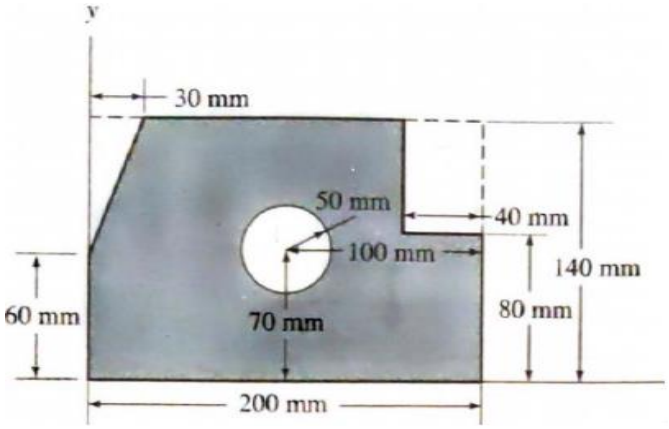
OR

14. a) A uniform ladder 6m long, weighing 300N is resting against a wall with which it makes 30° with the vertical. A man weighing 750N climbs up the ladder. At what position along the ladder from the bottom end does the ladder slips? The coefficient of friction is 0.20. (9)

b) A rough inclined plane, rises 1cm for every 5cm along the inclined length. Calculate the effort required to drag a body weighing 100N up the plane, when the effort is applied parallel to the plane. ($\mu = 0.25$) (5)

MODULE III

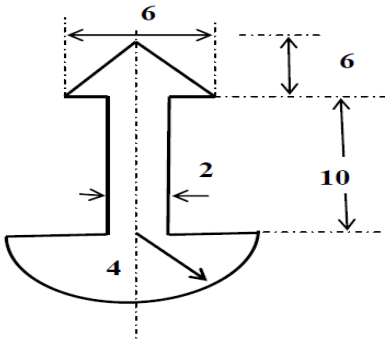
15. a) Find the centroid of the shaded area shown in figure. (10)



b) A force 2i+4j-3k is applied at the point A(1,1,-2). Find the moment of the force about the point (2,-1,2). (4)

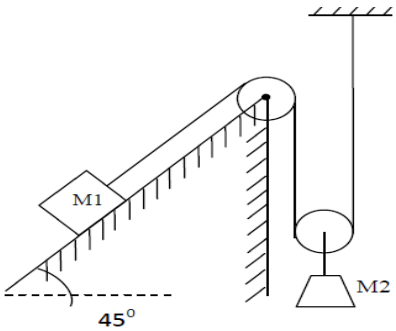
OR

16. Find the moment of inertia of the area shown in figure about the horizontal and vertical centroidal axis. All dimensions in cm. (14)



MODULE IV

17. a) A block of mass M1 resting on an inclined plane is connected by a string and pulleys to another block of mass M2 as shown in figure. Find the tension in the string and acceleration of the blocks. Assume the coefficient of friction between the blocks M1 and the plane to be 0.2. M1 =1500N, M2 = 1000N. Angle of inclined plane = 45°. (10)



b) State D'Alembert's principle. Draw the free body diagram of a lift of weight 'W', moving upwards with an acceleration 'a' and also write the equations of dynamic equilibrium using this principle. (4)

OR

18. a) An elevator weights 2500N and is moving vertically downwards with constant acceleration. Write the equation for the elevator cable tension. Starting from rest it travels a distance of 35m during an interval of 10s. Find the cable tension during this time. Neglect all other resistances to motion. What are the limits of cable? (10)

b) A lift has an upward acceleration of 1.2m/s^2. What force will a man weighing 750N exert on the floor of the lift? What force would he exert if the lift had an acceleration of 1.2m/s^2 downwards? (4)

MODULE V

19. a) With neat sketches differentiate between motion of translation and motion of rotation. (5)

b) A bar PQ of length 1m has its end Q constrained to move horizontally and the other end P constrained to move vertically as shown in the figure given below. The end P moves horizontally with a constant velocity of 5m/s. The bar makes an angle of 30^0 with the horizontal. Find the angular velocity of the bar and the velocity of end Q and M. (9)

OR

20. a) A particle moving with simple harmonic motion has velocities of 8m/s and 4m/s when at the distance of 1m and 2m from the mean position. Determine (i) amplitude, (ii) period, (iii) maximum velocity, and (iv) maximum acceleration of the particle. (7)

b) A weight of 50N suspended from a spring vibrates vertically with an amplitude of 7.5cm and a frequency of 1oscillation/second. Find the stiffness of the spring and the maximum tension induced in the spring. (7)

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