

Register No.: Name:

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)
 (AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY,
 THIRUVANANTHAPURAM)
SECOND SEMESTER B.TECH DEGREE EXAMINATION (Regular), JULY 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)

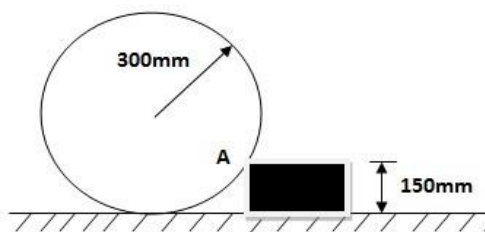
1. State and explain Lami's theorem.
2. Explain the concept of free body diagrams.
3. Define coefficient of friction and angle of friction. Establish the relation between them.
4. A simply supported beam AB of span 4m is carrying point loads 5kN and 3kN at 2m, and 3m respectively from the support A. Calculate the support reactions at A and B.
5. Explain moment of inertia and polar moment of inertia.
6. State the theorems of Pappus Guldinus.
7. A lift has an upward acceleration of 1.5m/sec^2 . What force will a man weighing 500N exert on the floor of the lift?
8. Calculate the work done in pulling up a block weighing 20kN for a length of 3m on a smooth plane inclined 30° with horizontal.
9. Define a) Amplitude (b) Time period (c) Frequency.
10. A 100N weight is hung on the end of helical spring. The weight makes 4 oscillations per second. Determine stiffness of spring.

PART B

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

MODULE I

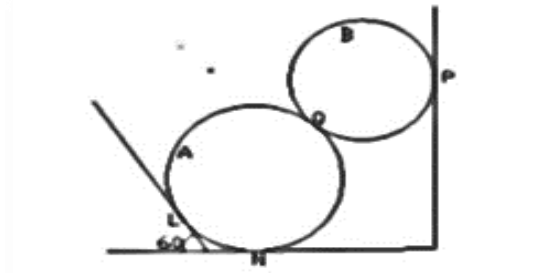
11. A roller of radius 300mm and weight 1200N is to be pulled over a rectangular block of height 150mm as shown in figure. Determine (i) the horizontal force required to be applied through the center and (ii) the required horizontal force when it is applied through the top end of vertical diameter.



(14)

OR

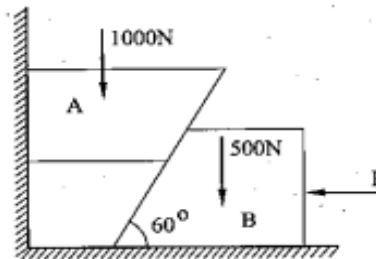
12. Two cylinders A and B rest in a horizontal channel as shown in figure. The cylinder A has a weight of 1000N and of radius 90mm. The cylinder B has a weight of 400N and a radius of 50mm. The channel is 180mm wide at the bottom with one side vertical. The other side is inclined at an angle of 60° with the horizontal. Find the reaction at all the contact points.



(14)

MODULE II

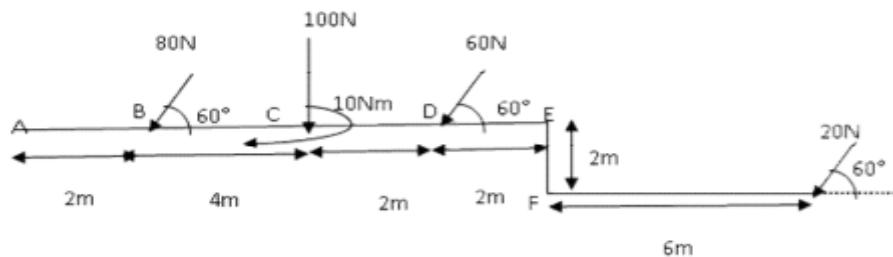
13. Two blocks A and B are resting against a wall and floor as shown in figure. Find the range of value of P applied to the lower block for which the system remains in equilibrium. Coefficient of friction is 0.25 at the floor and 0.3 at wall and 0.2 between the blocks.



(14)

OR

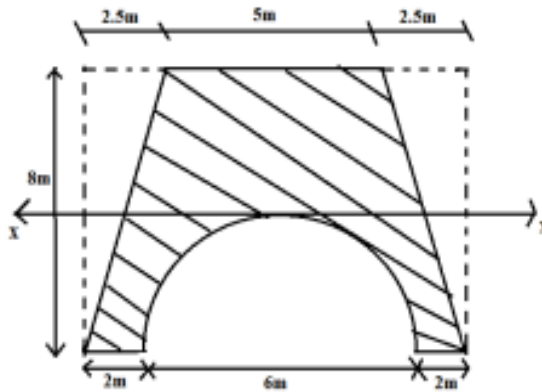
14. Find the magnitude, direction and position of the resultant of forces shown in figure.



(14)

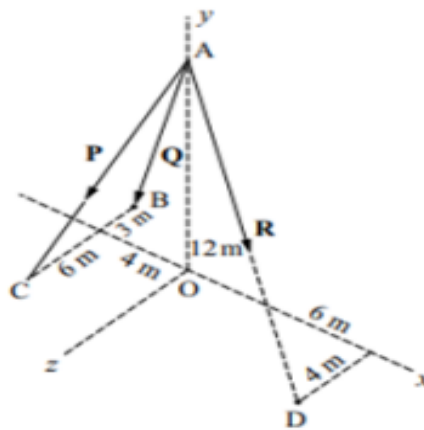
MODULE III

15. Find the centroid of the cross section of a culvert as shown in figure below. Determine the Moment of Inertia of horizontal axis XX passing through top of the semi-circle.



OR

16. Find the resultant of the force system shown in Fig. in which $P = 280\text{N}$, $Q = 260\text{N}$ and $R = 210\text{N}$.



(14)

MODULE IV

17. a) Two cars A and B travelling in same direction get stopped at a traffic signal. When signal turns green, car A accelerates at 0.75m/s^2 and 1.75 seconds later, car B starts and accelerates at 1.1m/s^2 . Determine i) when and where B will overtake A and ii) the speed of each car at that time. (10)
- b) The position of a particle moving along a straight line is defined by the relation $S = t^3 - 3t^2 + 3t + 12$. Compute the time taken by the particle when its velocity becomes zero. (4)

OR

18. a) An aircraft moving horizontally at a speed of 108km/hr . at an attitude of 1000m towards a target on the ground releases a bomb which hits the target. Estimate the horizontal distance of the air-craft from the target when it released the bomb. Calculate also the direction and velocity with which the bomb hits the target. (10)
- b) What do you mean by projectile, angle of projection, trajectory and range of projectile? (4)

MODULE V

19. An inextensible rope passing over a smooth pulley has two blocks of mass 20kg and 30kg attached to its two ends. The mass of the pulley is 10kg and radius of gyration 0.3m. Determine the tension on the rope and the acceleration of the masses. (14)

OR

20. a) A particle has SHM. Its maximum velocity is 6m/s and maximum acceleration is 12m/s^2 . Determine the angular velocity and amplitude. Also determine its velocity and acceleration when displacement is half of the amplitude. (7)
- b) A spring stretches by 0.015m when a 1.75kg object is suspended from its end. How much mass should be attached to the spring so that its frequency of vibration is 3Hz. (7)
