Register No.:   ………………………………   Name: ……………………………………………………………

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

SECOND SEMESTER B.TECH DEGREE EXAMINATION (R), MAY 2023

(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. Define system of forces. Explain the different systems of forces
2. Explain the principle of transmissibility of forces.
3. Explain (i) cone of friction, (ii) angle of friction and (iii) angle of repose.
4. Define couple and explain the properties of a couple.
5. State Pappus Guldinus theorems.
6. Explain (i) radius of gyration, (ii) parallel axis theorem and (iii) perpendicular axis theorem.
7. Describe D-Alembert's principle.
8. Define i) trajectory, (ii) angle of projection and (iii) horizontal range.
9. What is meant by instantaneous centre of rotation? What are the properties of instantaneous centre of rotation?
10. What is meant by periodic motion? What are the conditions to be satisfied for a periodic motion to be simple harmonic motion?
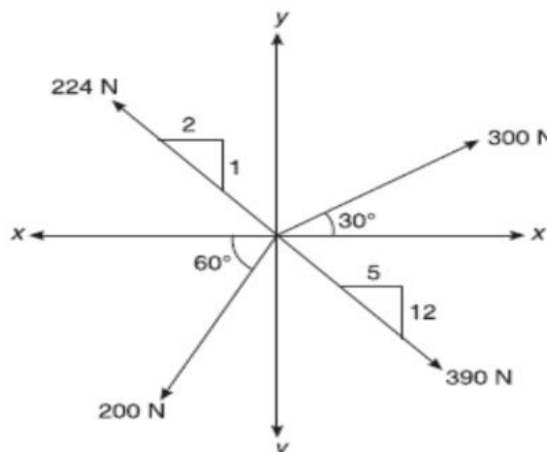
PART B
(Answer one full question from each module, each question carries 14 marks)

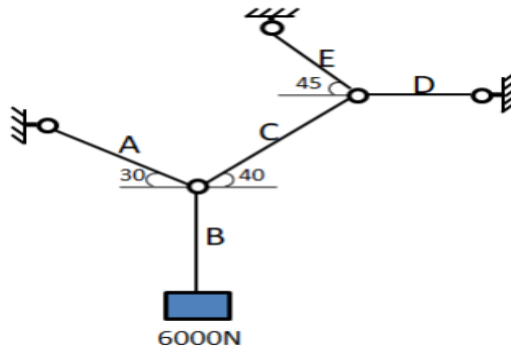### MODULE I

11. a) Determine the resultant of the four forces shown in figure.

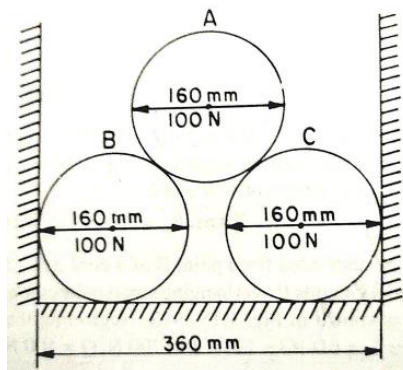   (6)

b) Determine the tension in string D shown in figure using Lami's Theorem.   (8)

6000N

OR

12. Three cylinders weighing 100N each and 160mm in diametre are placed in a rectangular channel as shown in figure. Determine the reactions at all contact points?   (14)
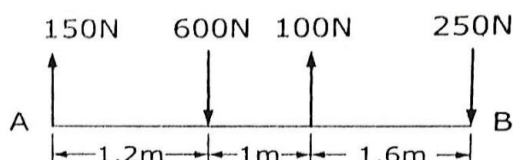

MODULE II

13. a) A beam 8m long is hinged at A and supported on rollers over a smooth surface inclined at 30^0 to the horizontal at B. The beam is loaded as shown in figure. Determine the support reactions at A and B.   (9)
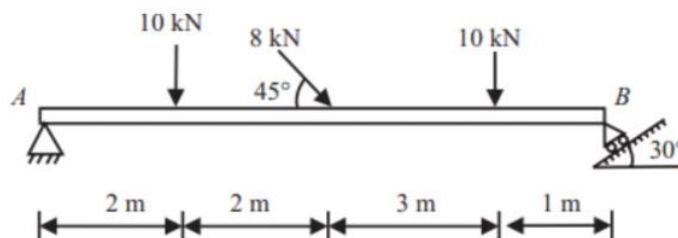

b) A 3.8 m long beam is subjected to the forces shown in figure. Reduce the given force system to   (5)
       i)   a single force
   ii)   an equivalent force-couple system at B

OR

14. The ladder shown in figure is 4m long and is supported by a horizontal floor and vertical wall. The co-efficient of friction at the wall is 0.25 and at the floor is 0.5. The weight of the ladder is 200N, considered concentrated at G. The ladder supports a vertical load of 1000N at C. Determine the reactions at A and B, and compute the least value of 'α' at which the ladder may be placed without slipping to the right.   (14)
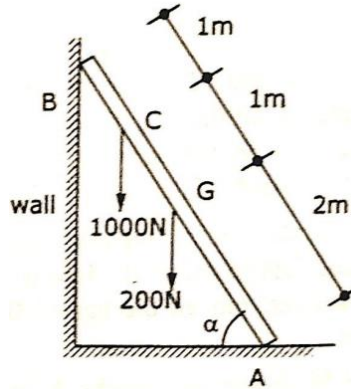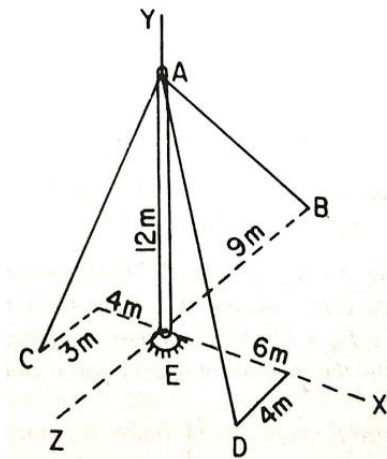

MODULE III

15. Find the moment of inertia of the shaded area shown in figure about its centroidal horizontal axis.   (14)
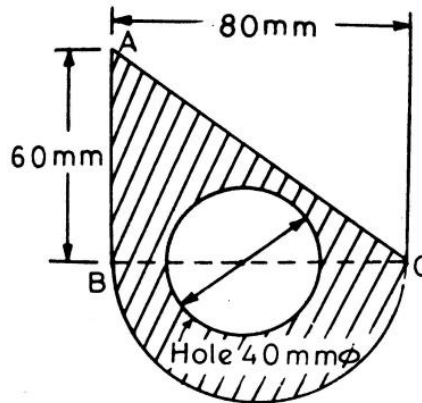
OR

16. In the figure given below, a vertical boom AE is supported by guy wires from A to B, C and D. If the tensile load in AD = 2520N, find the forces in AC and AB so that the resultant force on A will be vertical.   (14)
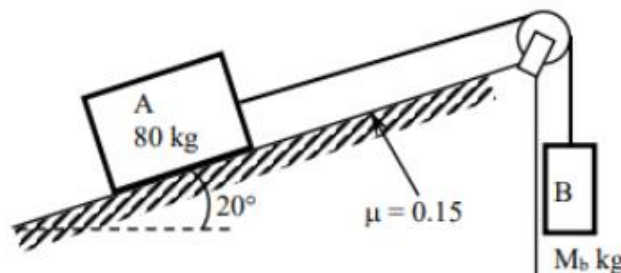
MODULE IV

17. a) The acceleration of a moving body starting from rest and moving along a straight line is given by, $a = 8 - \frac{t^2}{5}$ where **'a'** is in m/s² and **'t'** is in seconds. (9)
    Determine

    (i) velocity attained by the body and the distance travelled after 10 seconds.

    (ii) when will the particle come to rest again and what distance will it travel by then.

    b) A man weighing 850N gets into a lift. Calculate the force exerted by him on the floor of the lift, when it is (5)

    i) moving upwards with an acceleration of 4m/s².

    ii) moving downwards with an acceleration of 3m/s².

<div align="center">**OR**</div>

18. a) A piece of stone falling down for 4 seconds from rest breaks a glass panel and loses 25% of its velocity in breaking the panel. How much will it fall in the next second? Take g = 9.81m/s². (4)

    b) Block A of mass 80kg is connected to block B of unknown mass using a light cable which runs over a light and smooth pulley. Determine the tension in the cable and the mass of block B such that block A will have an acceleration of 0.2m/s² down the inclined plane. (10)

MODULE V

19. a) A flywheel rotates with a constant retardation due to braking. In 10 seconds, it made 300 revolutions. At t = 7.5 seconds, its angular velocity was 40π rad/second. Determine (10)

    i) the value of constant retardation

    ii) the total time taken to come to rest

    iii) the total revolutions made till it comes to rest

    b) A particle moving in simple harmonic motion, has an acceleration of 6m/s² at a distance of 1.5m from the centre of oscillation. Find the time period of the oscillation. (4)

<div align="center">**OR**</div>

20. a) A flywheel accelerates uniformly from rest to 1800rpm in 15 seconds. (4) Find out the angular acceleration. How many revolutions does the wheel make to attain the speed of 1800 rpm?

   b) A particle performing simple harmonic motion has 1.6 metres (10) amplitude and period of oscillation is 4 seconds. Determine the time required for the particle to pass between two points which are at a distance of 1.2m and 0.6m from the centre and are along the same direction.

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