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

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

SECOND SEMESTER B.TECH DEGREE EXAMINATION (S), AUGUST 2023

(2020 SCHEME)

Course Code : **20EST100**

Course Name: **Engineering Mechanics**

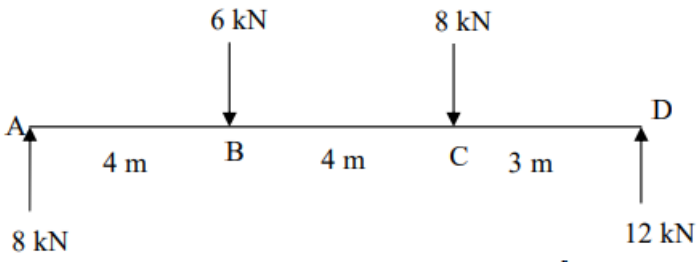
Max. Marks : **100** **Duration: 3 Hours**

Assume any missing data.

PART A

(Answer all questions. Each question carries 3 marks)

1. Define free body diagram. State the use of free body diagrams in engineering applications.
2. A force 100kN is acting downward at the end B of a horizontal rod AB. The rod AB has a length of 2m and is hinged at the end A. Calculate the moment of the force about the hinge.
3. Define (i) Sliding friction (ii) angle of friction and (iii) angle of repose.
4. A rigid bar AD is acted upon by forces as shown in figure below. Reduce the force system to a single force- system and locate the point of application of the single force.



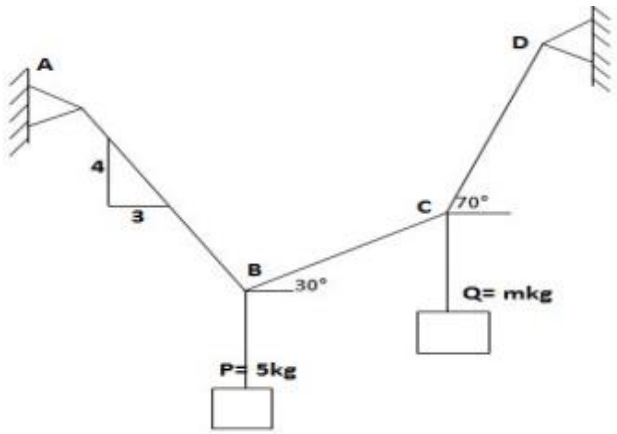
5. State Pappus Guldinus theorems.
6. Find the moment about C (-2,3,5) of the force F= $4i+4j-1k$ passing through the point A (1,-2,4).
7. Calculate the increase in reaction under the feet of person of weight 600 N in a lift, if the lift accelerates upward with an acceleration $1 m/s^2$.
8. A body is projected at an angle such that its horizontal displacement is 3 times that of maximum height. Find the angle of projection.
9. Explain instantaneous centre of zero velocity.
10. Differentiate between forced vibration and free vibration.

PART B

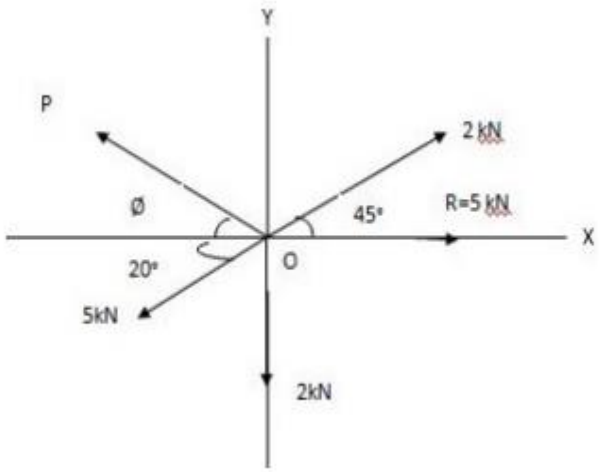
(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) A block P= 5kg and block Q of mass m kg are suspended through a chord which is in equilibrium as shown in figure given below. Determine the mass of the block Q. (7)

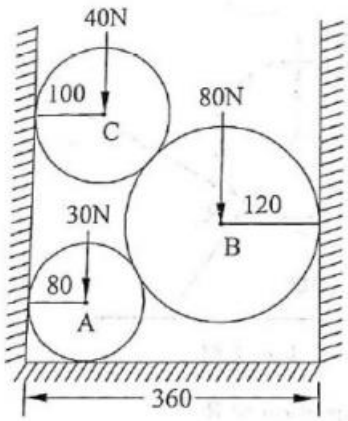


b) The resultant of a system of four forces is 5kN directed towards right along X-axis as shown in figure given below. Find the force P and its direction Ø. (7)



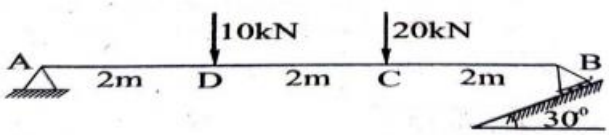
OR

12. Three cylinders are piled in a rectangular ditch as in figure. Neglecting friction, determine the reaction between cylinder A and vertical wall, if radii of all the spheres are in centimetres. (14)



MODULE II

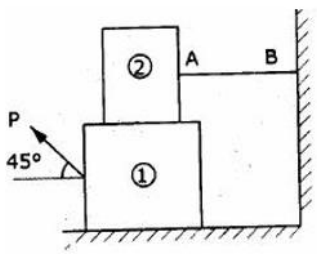
13. a) A beam 6m long is loaded as shown in figure given below. Calculate the reactions at A and B. (7)



b) A uniform ladder of mass 10kg and length 2m is leaning against a vertical wall. The coefficient of static friction at A (wall) is 0.6 and at B (floor) is 0.4. Determine the smallest angle, for which the ladder can remain in equilibrium. (7)

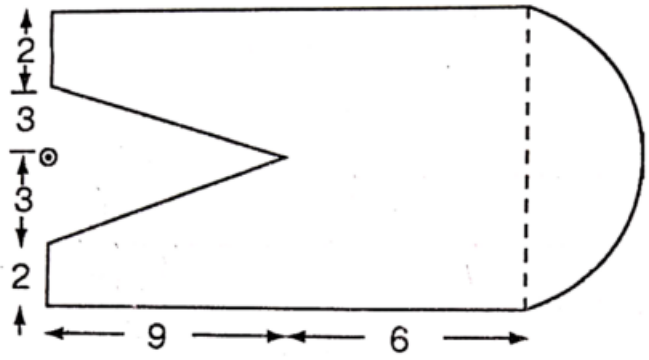
OR

14. Block 2 rests on block 1 and is attached by a horizontal rope AB to the wall as shown in figure given below. What force P is necessary to cause motion of block 1 to impend? The co-efficient of friction between the blocks is 1/4 and between the floor and block 1 is 1/3. Mass of blocks 1 and 2 are 14kg and 9kg respectively. (14)



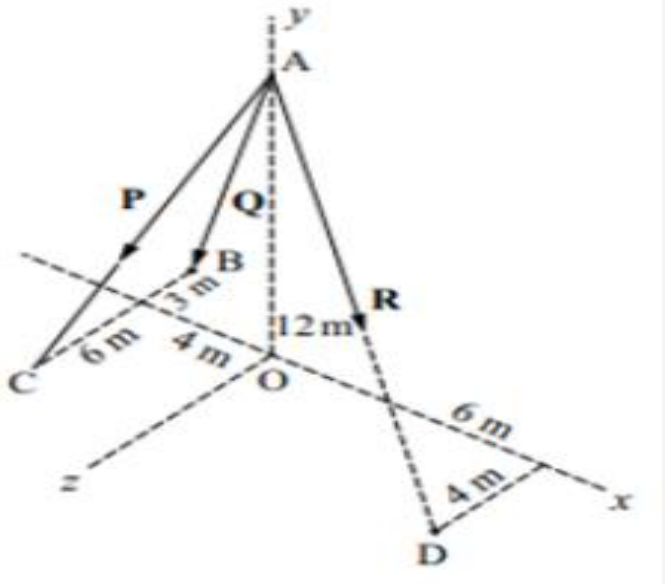
MODULE III

15. Find the moment of inertia of the lamina shown in the figure below about the centroidal axes. All dimensions are in cm. (14)



OR

16. Find the resultant of the force system shown in figure below, in which P = 280N, Q = 260N and R = 210N. (14)



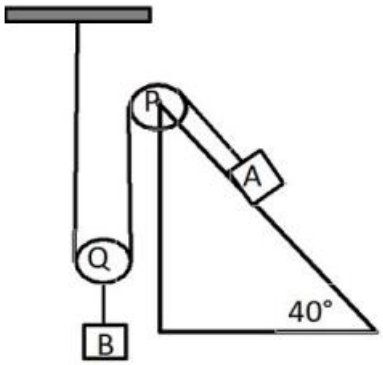
MODULE IV

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 0.75 m/s^2 and 1.75 seconds later, car B starts and accelerates at 1.1 m/s^2. Determine (8)
    i) when and where B will overtake A
    ii) speed of each car at that time.

    b) If a ball hits with another ball of twice its mass moving with 1/7th of its velocity and if the coefficient of restitution between them is 3/4, determine the final velocity of the first ball after impact. (6)

OR

18. Determine the tension in the inextensible string and the acceleration of the masses shown in the figure. Consider the pulley as massless and coefficient of friction as 0.20. Block A=200kg and block B=100kg. (14)



MODULE V

19. a) A particle performing simple harmonic motion has velocities 1.2m/s and 0.8m/s respectively, when it is at distances of 10cm and 20cm from the mean position. (9)
Determine
i) amplitude of oscillations
ii) time period of oscillations
iii) its maximum velocity
iv) its maximum acceleration

b) A 50N weight is suspended from a spring of constant k=8N/cm. Neglecting the mass of the spring, find the period for small amplitudes of vertical oscillations. (5)

OR

20. A wheel accelerates from rest to a speed of 180rpm uniformly in 0.4 seconds. It then rotates at that speed for 2s and then decelerates and comes to rest in 0.3s. Determine the total revolutions made by the wheel. (14)

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