QP Code:CE1T02-2 **(Pages: 4)**

Reg No : ..... Name : .....

MAR ATHANASIUS COLLEGE OF ENGINEERING, KOTHAMANGALAM

(Govt. Aided Autonomous Institution)

First Semester B.Tech. Degree (SAY) Examination, February, 2026

Course Code: B24CE1T02

Course Name: Engineering Mechanics

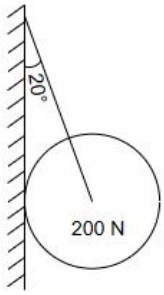
Max. Marks: 100 Duration: 3 Hours

PART - A: 30 Marks (10 Qns x 3 Marks)

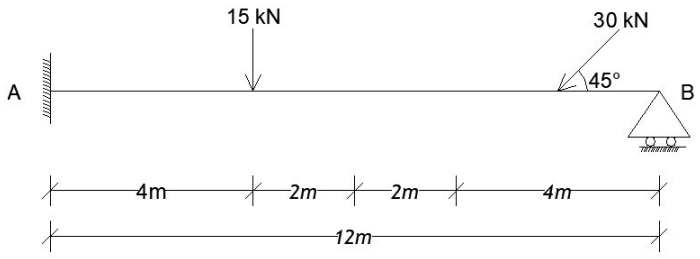
Answer all questions

1. Determine the magnitude and direction of the resultant of the two forces of magnitude 12 N and 9 N acting at a point, if the angle between the two forces is 30°.

2. A sphere weighing 200N is tied to a smooth wall by a string as shown in figure. Find the tension in the string and reaction of the wall.



3. Identify the support provided in the figure given below and specify the allowable translations and rotations permitted for the given support systems.



4. Differentiate between roller support and hinged support with neat sketches.

5. The x,y,z components of a force are 36 kN, -24 kN and 24 kN respectively. Find the components of this force along the line joining A (1,2,-3) and B (-1,-2,2)

6. Explain cone of friction with neat sketches.

7. State and explain parallel axis theorem

8. Distinguish between centroid and centre of gravity with neat sketches.

9. A ball of mass ‘m’ is dropped from rest from the top of a tower of height H. Write the equations of kinematics for the motion of the ball under free fall at any instant‘t’ of the motion.

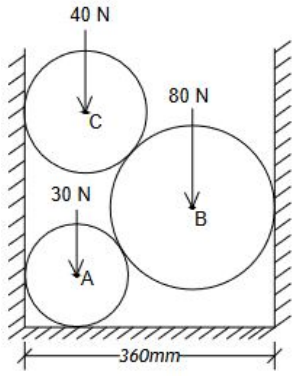
10. State and explain D’Alembert’s principle.

PART - B: 70 Marks (5 Qns x 14 Marks)

Answer any Five full question from each module.

Module 1

11. Three cylinders A, B and C of radiuses 80mm, 120mm and 100mm respectively are piled in a rectangular ditch as in the figure shown below. Neglecting friction, determine the reactions acting on all cylinders .

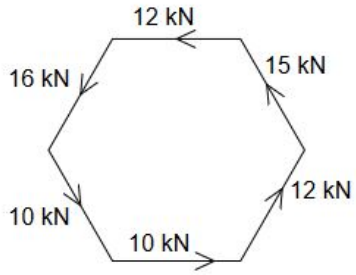


OR

12. Six forces of magnitude 10 kN, 12 kN, 15 kN, 12 kN, 16 kN, and 10 kN are acting along the sides of a regular hexagon of side 2 m in order. Determine:

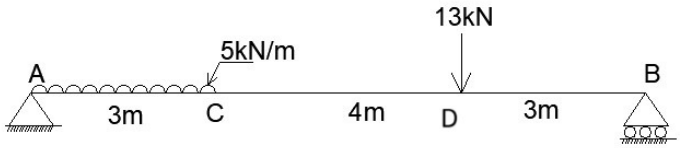
i) Magnitude, direction and position of the resultant with respect to the centre of the hexagon. (10 Marks)

ii) Equivalent force couple system through the centre of the hexagon. (4 Marks)



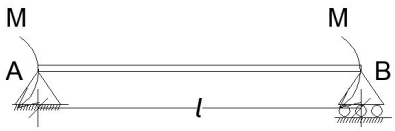
Module 2

13. A Simply Supported beam is loaded as shown in figure. Determine beam reactions using Principle of virtual work.

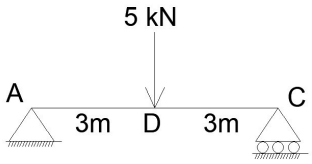


OR

14. (a) Applying equations of equillibrium find the reactions of beam AB when subjected to a moment M at supports A and B. (7 marks)



(b) Find the support reactions at A & B of the beam shown in figure below using Principle of Virtual work. (7 marks)



Module 3

15. The uniform ladder is of mass 10kg and 2m long, 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 the equilibrium.

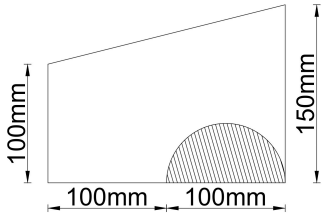
OR

16. (a)Three forces act on a body in equilibrium at point P. The forces are given by $F_1=6i-3j+2k$, $F_2=-4i+5j-k$, and $F_3=ai+bj+ck$. Find the values of a,b and c for which the body remains in equilibrium. (7 marks)

(b)Two forces act on a point P in space. The first force is represented by the vector $F_1=7i-2j+4k$, and the second force by $F_2=-3i+8j-5k$. Determine the magnitude and direction cosines of the resultant force vector $F=F_1+F_2$. (7 marks)

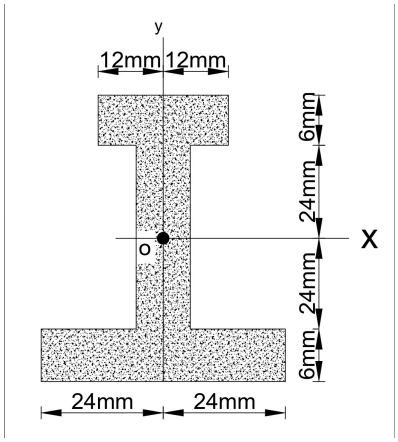
Module 4

17. A semicircular area is removed from the trapezoid as in figure. Determine the centroid of remaining area. Also find the moment of inertia of the section about the horizontal centroidal axis.



OR

18. Determine the Moment of Inertia of the shaded area with respect to X and Y axis.



Module 5

19. A mass of 60kg is supported by two springs of stiffnesses 6 kN/m and 8 kN/m. The springs are arranged in series. The mass is given an initial displacement of 40 mm and then released. Determine the period of vibration, the maximum velocity, and maximum acceleration.

OR

20. During a very quick stop, a car decelerates at 7 m/s^2.

(a) What is the angular acceleration of its 0.28 m - radius tyres, assuming they do not slip on the pavement?

(b) How many revolutions do the tyres make before coming to rest, given their initial angular velocity is 95 rad/s?

(c) How long does the car take to stop completely?

(d) What is the total distance covered by the car?

****