Reg. No.															

Question Paper Code	13716

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2025

Second Semester

Mechanical Engineering

(Common to Civil Engineering & Mechanical and Automation Engineering)

24ESCE201 – ENGINEERING MECHANICS

Regulations - 2024

Duration: 3 Hours | Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	Polygon law of forces can be applied if there are (a) Only two forces (b) Any number of forces (c) At least three forces (d) Four or more forces	1	K1	CO1
2.	Labelling a free-body diagram represents (a) All forces acting on a body (b) Only external forces (c) Only internal forces (d) The object itself without forces	1	K1	CO1
3.	What is the SI unit of moment? (a) Newton (b) Joule (c) Pascal (d) Newton-meter	1	K1	CO2
4.	Which of the following supports can resist a force only perpendicular to the axis of movement? (a) Roller support (b) Hinge support (c) Fixed support (d) Simple support	1	K1	CO2
5.	In a ladder problem, the type of friction involved is called (a) Rolling friction (b) Ladder friction (c) Wedge friction (d) Static friction	1	K1	CO3
6.	Name the coefficient of friction is the ratio of the force of friction to the (a) Mass of the object (b) Weight of the object (c) Normal force (d) Gravitational force	1	K1	CO3
7.	The centroid of a quarter circle is located at $(2r/\pi, 2r/\pi)$ (b) $(r/2, r/2)$ (c) $(4r/3\pi, 4r/3\pi)$ (d) (r, r)	1	K2	CO4
8.	Theorem of Pappus is applied for (a) Calculating centroids (b) Finding moments of inertia (c) Determining surface areas of revolution (d) Analyzing stress in beams	1	K1	CO4
9.	Newton's Second Law of Motion states that (a) Every action has a reaction (b) F = ma (c) Bodies resist change in motion (d) Objects fall freely	1	K1	CO5
10.	General plane motion in a rigid body combines (a) Translational and rotational motions (b) Translational and curvilinear motions (c) Rotational and relative motions (d) Only translational motion	1	K1	CO6

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

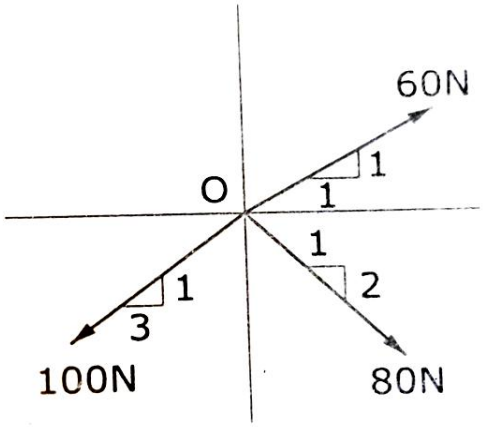
		Marks	K – Level	CO
11.	Define principle of transmissibility of a force.	2	K1	CO1
12.	State Lami's theorem.	2	K1	CO1
13.	Explain varignon's theorem.	2	K2	CO2
14.	List the common types of supports and beams.	2	K2	CO2
15.	Label the laws of Coulomb friction.	2	K2	CO3
16.	Define rolling resistance.	2	K1	CO3

17.	What is the difference between the centroid and centre of mass?	2	K1	CO4
18.	Define radius of gyration.	2	K1	CO4
19.	Differentiate between uniform and non-uniform motion.	2	K2	CO5
20.	Define acceleration and give its SI unit.	2	K1	CO5
21.	State D'Alembert's principle.	2	K1	CO6
22.	List the concept of impact in elastic bodies.	2	K2	CO6

PART - C (6 × 11 = 66 Marks)

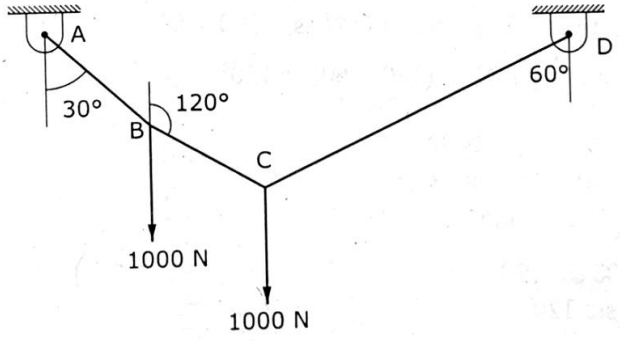
Answer ALL Questions

23.	a)	Solve the resultant of the force system as shown in figure.	11	K3	CO1

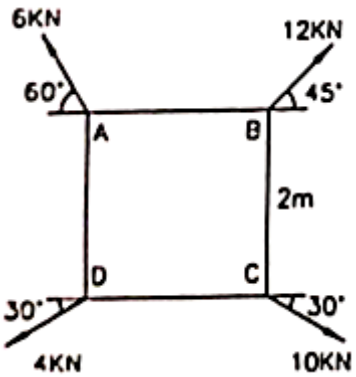


OR

	b)	A string ABCD, attached to two fixed points A and D has two equal weights of 1000N attached to it at B and C. The weights rest with the portions AB and CD inclined at angles of 30° and 60° respectively, to the vertical as shown in figure. Find the tensions in the portions AB, BC and CD of the string, if the inclination of the portion BC with the vertical is 120°.	11	K3	CO1

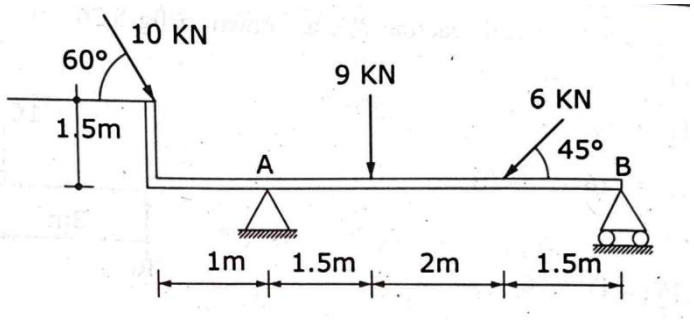


24.	a)	Four forces of magnitude and direction acting on a square ABCD of side 2m are shown in figure. Calculate the resultant in magnitude and direction and also locate its point of application with respect to the sides AB and AD.	11	K3	CO2

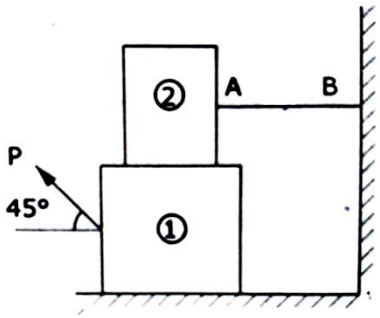


OR

b) A Beam AB is simply supported and carries loads as shown in figure. Calculate the reactions at A and B. *11 K3 CO2*



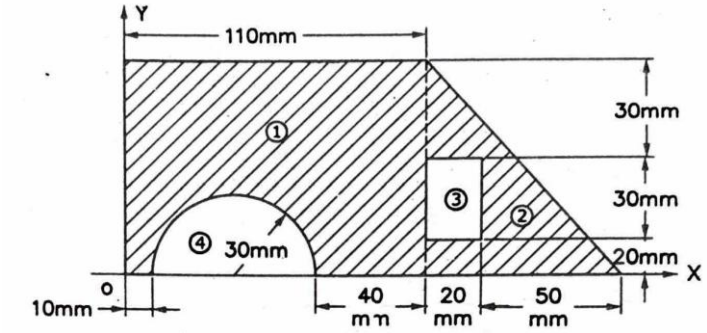
25. a) Block (2) rests on block (1) and is attached by a horizontal rope AB to the wall as shown in figure. What force P is necessary to cause motion of block (1) to impend? The co-efficient of friction μ between the blocks is 1/4 and between the floor and block (1) is 1/3. Mass of blocks (1) and (2) are 14 kg and 9 kg respectively. *11 K3 CO3*



OR

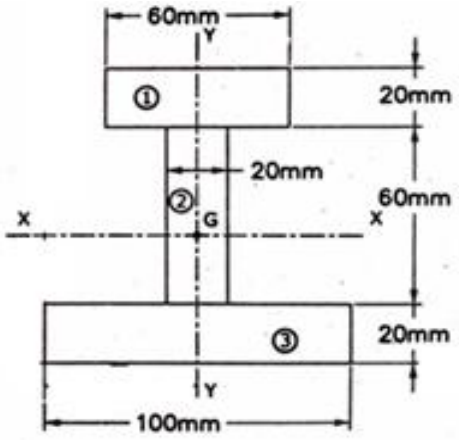
b) A 7m long ladder rests against a vertical wall, with which is makes an angle of 45° and on a floor. If a man whose weight is one half that of the ladder climbs it, at what distance along the ladder will he be, when the ladder is about to slip? Take co-efficient of friction μ between the ladder and the wall is 0.3 and that between the ladder and the floor is 0.5. *11 K3 CO3*

26. a) Find the centroid of the sectioned area shown in figure. *11 K3 CO4*



OR

b) Identify the moment of inertia of an unsymmetrical I-section shown in figure about its centroidal axes. *11 K3 CO4*



27. a) A particle moves along a straight line with variables accelerations. If the displacement is measured in m, and given by the relation in terms of time taken t, as below. $S = 3t^3 + 2t^2 + 7t + 3$ *11 K CO5*

Determine

i). The velocity of the particle at start and after 3 seconds

ii). The acceleration of the particle at start and after 3 seconds.

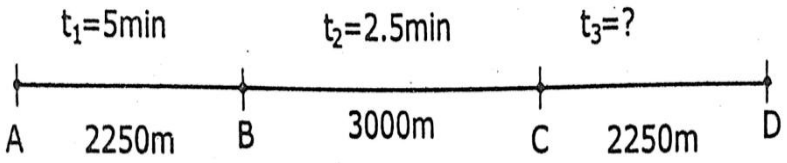
OR

b) A train is travelling from A to D along the track shown in figure. Its initial velocity at A is zero. The train takes 5 min to cover the distance AB, 2250m length and 2.5 minutes to cover, the distance BC, 3000m in length, on reaching the station C, the brakes are applied and the train stops 2250m beyond, at D *11 K3 CO5*

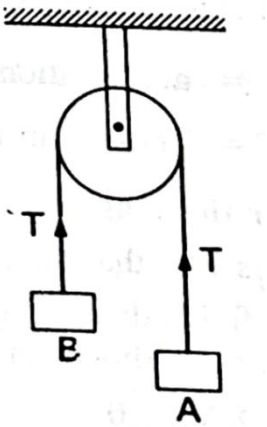
i). Find the retardation on CD,

ii). The time takes the train to get from A to D, and

iii). Its average speed for the whole distance.



28. a) Two blocks A and B of weight 80N and 60N are connected by a string, passing through a smooth pulley, as shown in figure. Calculate the acceleration of the body and the tension in the string, using Newton's law of motion. *11 K3 CO6*



OR

b) Two weights 80N and 20N are connected by a thread and move along a rough horizontal plane under the action of force 40N, applied to the first weight of 80N as shown in figure. The coefficient of friction between the sliding surfaces of the weights and the plane is 0.3. Determine the acceleration of the weights and the tension in the thread using work-energy equation. *11 K3 CO6*