SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF MECHANICAL ENGINEERING

QUESTION BANK

III SEMESTER

ME3332 – ENGINEERING MECHANICS

Regulation – 2023

Academic Year 2026 –2027 ODD

Prepared by

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SRM VALLIAMMAI ENGINEERING COLLEGE

SRM Nagar, Kattankulathur – 603 203

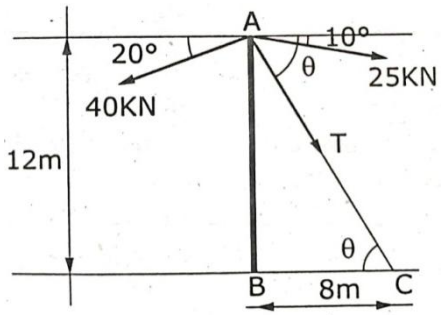
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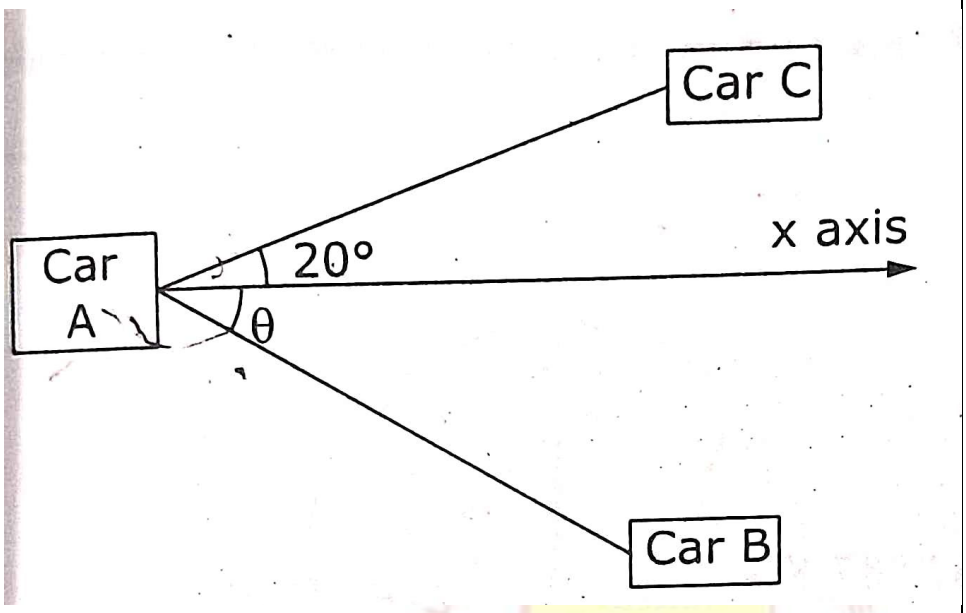
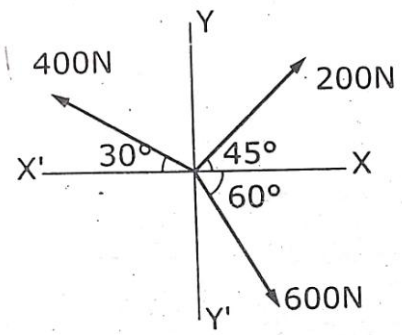
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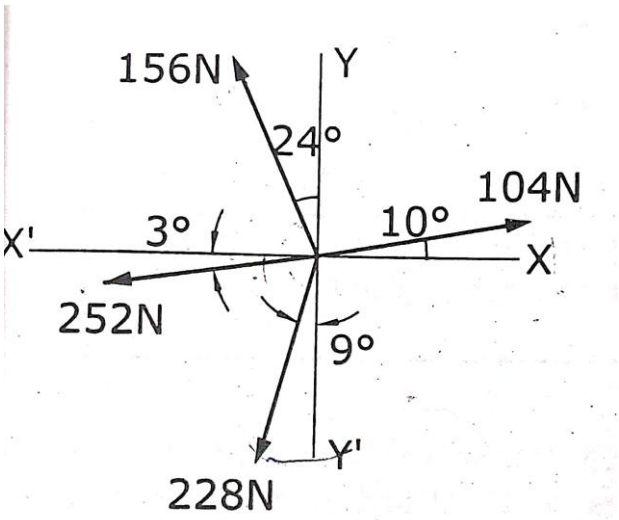
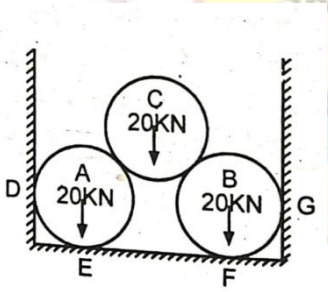
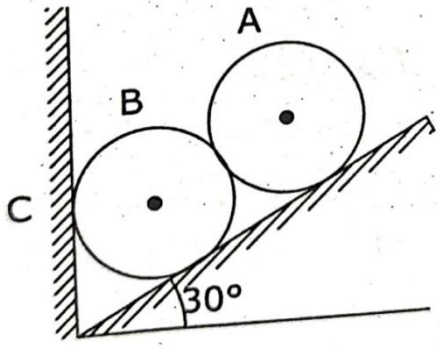
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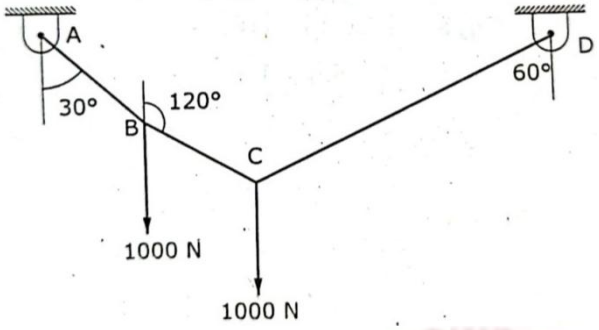
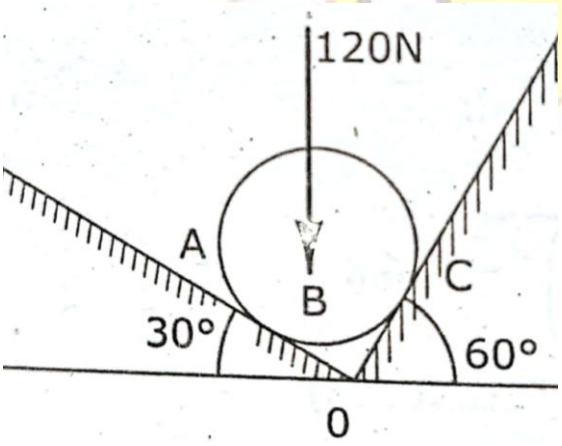
UNIT I: BASICS OF PARTICLES			
Fundamental Concepts and Principles, Systems of Units, Method of Problem Solutions, Statics of Particles - Forces in a Plane, Resultant of Forces, Resolution of a Force into Components, Action and Reaction.			
PART - A (2Marks)			
S.No	**QUESTIONS**	**LEVEL**	**COMPETENCE**
1.	Define Engineering Mechanics.	BT1	Remember
2.	Define static.	BT1	Remember
3.	State Kinematics.	BT1	Remember
4.	Define Kinetics.	BT1	Remember
5.	State Dynamics.	BT1	Remember
6.	State triangular law of forces.	BT1	Remember
7.	State Lami's theorem.	BT1	Remember
8.	Describe free body diagram.	BT2	Understand
9.	Recall the principle of resolution.	BT1	Remember
10.	State Newton's First law.	BT2	Understand
11.	State Newton's Second law.	BT1	Remember
12.	State Newton's third law.	BT1	Remember
13.	Describe Concurrent forces.	BT2	Understand
14.	State the principle of transmissibility of force.	BT1	Remember
15.	What is the significance of parallelogram law in statics of particles?	BT1	Remember

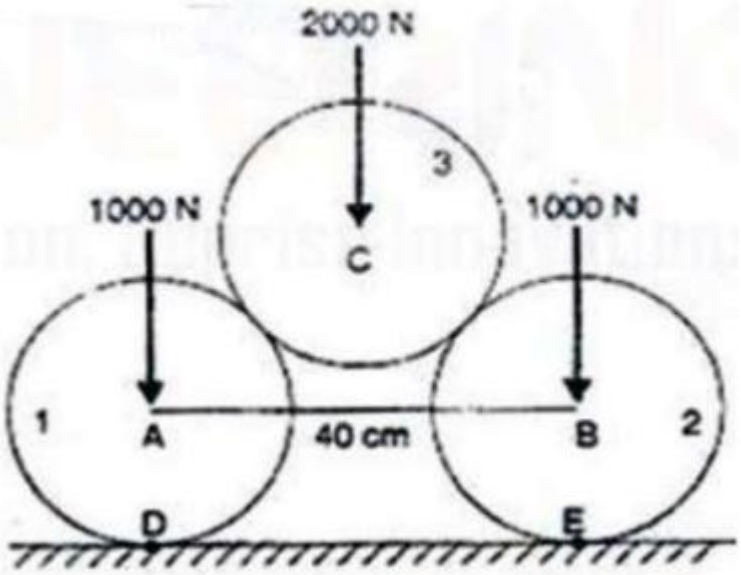
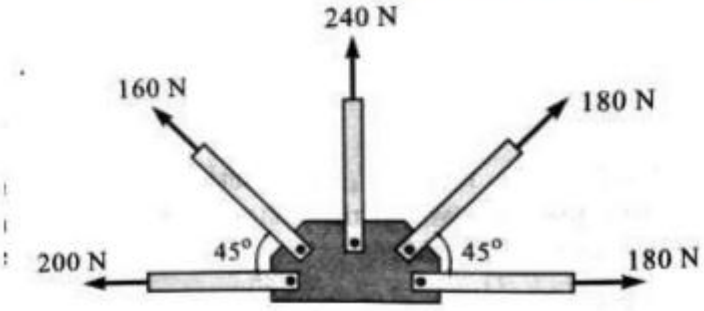
16.	Define equilibrium.	BT1	Remember
17.	What are the characteristics of a force?	BT1	Remember
18.	Define unit vector.	BT1	Remember
19.	Define Force.	BT1	Remember
20.	What is a scalar quantity?	BT1	Remember
21.	What is a vector quantity?	BT1	Remember
22.	What is the difference between the resultant force and the equilibrant force?	BT1	Remember
23.	State the necessary and sufficient condition for static equilibrium of a particle in two dimensions.	BT1	Remember
24.	Define particle.	BT1	Remember
25.	What is gravity?	BT1	Remember

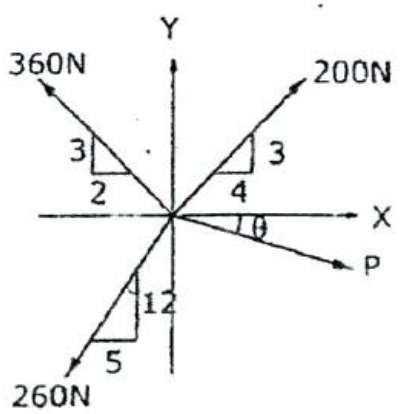
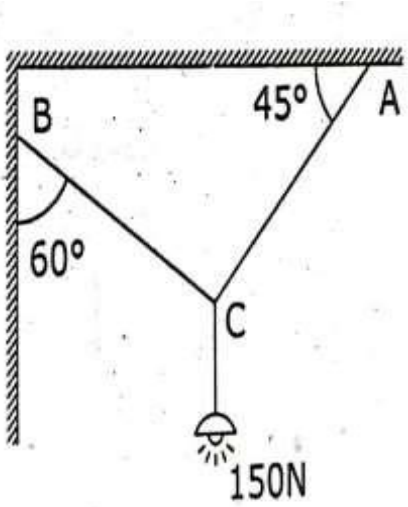
PART - B (16 Marks)				
S.No	**QUESTIONS**	**Marks**	**Level**	**Competence**
1	Forces of 10 N, 20 N , 30 N and 40 N are acting on one of the vertices of a regular pentagon towards the other vertices taken in order. Calculate the magnitude and direction of the resultant force R.	13	BT3	Apply
2	Two cables which have known tensions are attached to the top of a tower AB. A third cable AC is used as a guide wire as shown in the figure below. Determine the tension in AC if the resultant of the forces exerted at A by the three cables acts vertically downwards. 	13	BT3	Apply
3	Forces of 2 N, 3 N , 4 N ,5 N and 6 N are acting at one of the angular points of regular hexagon towards the other angular points taken in order. Determine the resultant and its direction.	13	BT3	Apply

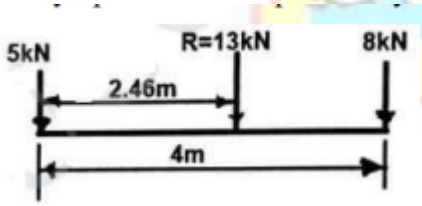
4	A disabled Car A is being pulled by two cars B and C as shown in the figure. The resultant of the forces exerted by the two cars is 30 kN which is directed along the axis of the Cars. Calculate (i) the required tensions in each of the ropes for Θ = 20° (ii) the value of Θ such that the tension in the rope PQ is minimum.  	13	BT4	Analyze
5	State and derive the expression for magnitude and direction of the resultant using the Parallelogram law of forces.	13	BT1	Remember
6	(i) Two concurrent forces acts at an angle of 30°. The resultant force is 15 N and one of the forces is 10 N. Find the other force. (7) (ii) Two concurrent forces 12 N and 18 N are acting at an angle of 60^o. Find the resultant force. (6)	13	BT3	Apply
7	Find the resultant force for given concurrent forces shown in figure.  	13	BT3	Apply

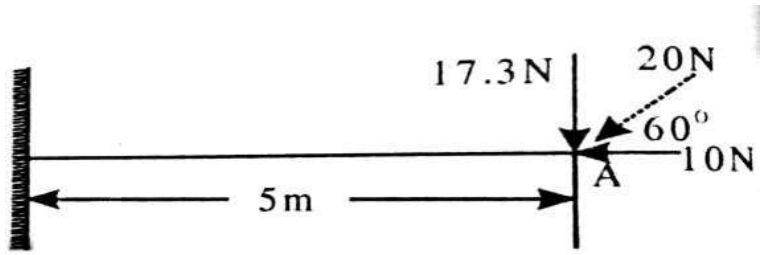
8	Find the resultant force for given concurrent forces shown in figure.  	13	BT3	Apply
9	Three smooth pipes each weighing 20 kN and of diameter 60 cm are to be placed in a rectangular channel with horizontal base as shown in the figure. Calculate the reactions at the point of contact between the pipes and between the channel and the pipes. Take the width of the channel as 160 cm.  	13	BT3	Apply
10	Two identical rollers, each of weight 50 N, are supported by an inclined plane and vertical walls as shown in the figure. Determine the reactions at the points of supports A, B and C. Assume all the surfaces to be smooth.  	13	BT3	Apply

11	A string ABCD, attached to two fixed points A and D has two equal weights of 1000 N attached to it at B and C. The weights rest with the portions AB and CD inclined at the angle of 30° and 60° respectively, to the vertical as shown in the figure. Determine the tensions in the portions AB, BC and CD of the string, if the inclination of the portion BC with the vertical is 120°. 	13	BT3	Apply
12	A ball of weight 120 N rests in a right angled groove as shown in the figure. The sides of the groove are inclined at an angle of 30° and 60° to the horizontal. If all the surfaces are smooth, then determine the reactions R_A and R_C at the point of contact. 	13	BT3	Apply
13	A string of length 310 mm has its extremities attached to two fixed points situated 250 mm apart in a horizontal line. If the string can bear any tension up to 36N, Calculate the greatest load that can be supported at a point of the string distance 240mm from one extremity.	13	BT3	Apply
14	Two smooth circular cylinders each of weight 1000 N and radius 15 cm are connected at their centers by a string AB of length 40 cm and rest upon a horizontal plane, supporting above them a third cylinder of	13	BT3	Apply

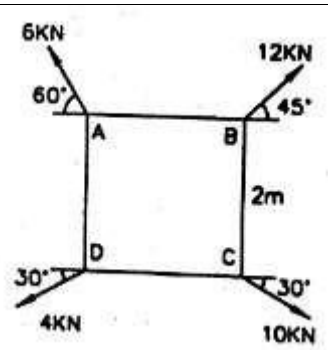
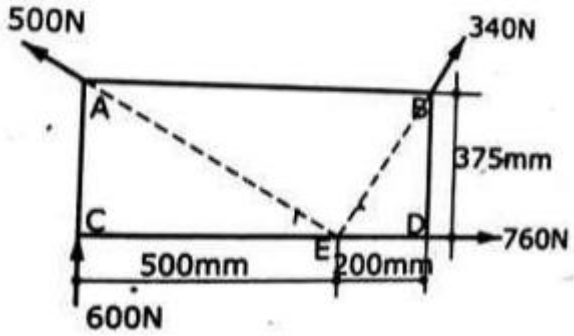
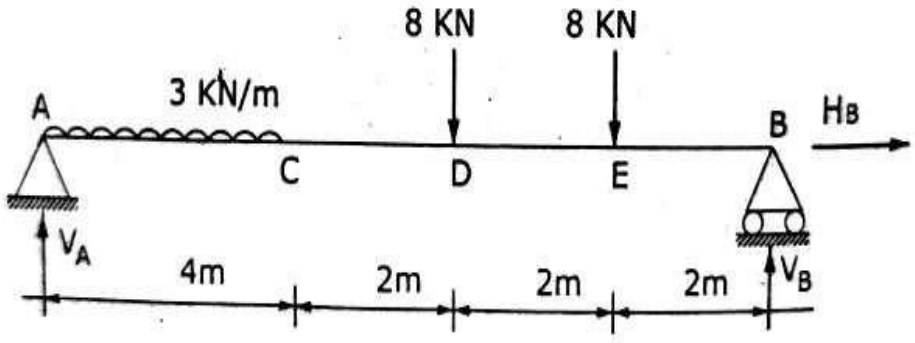
	weight 2000 N and radius 15 cm as shown in Figure. Determine the force S in the string AB and reactions on the floor at the points of contact D and E.  			
15	A gusset plate of roof truss is subjected to forces as shown in Fig.2. Determine the magnitude of the resultant force and its orientation measured counter clockwise from the positive x-axis.  	13	BT3	Apply
16	Resultant force of system shown in fig, is 520 N along with negative direction of the Y axis. Determine the value of the P and angle.	13	BT3	Apply

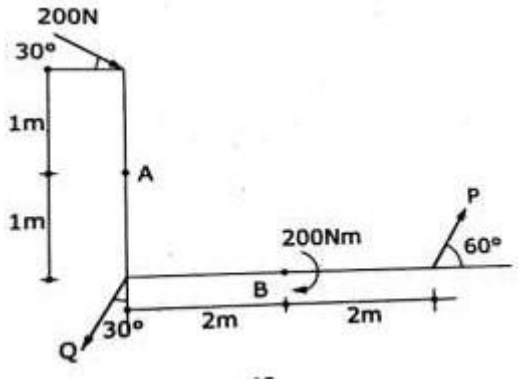
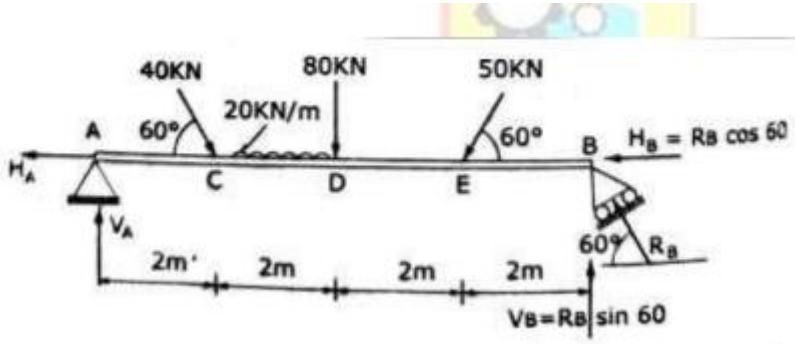
				
17	A electric light fixture weighing 150 N hangs from a point C, by two strings AC and BC as shown in the figure. Determine the forces in the strings AC and BC. 	13	BT3	Apply
18	Five forces are acting on a particle. The magnitude of forces are 300 N, 600 N, 700 N, 900 N and P and their respective angles made with the horizontal are 0°, 60°, 135°, 210° and 270°. If the vertical component of all forces is -1000 N, find the value of P. Also calculate the magnitude and the direction of the resultant, assuming that the first force acts towards the point, while all the remaining forces act away from the point.	13	BT3	Apply

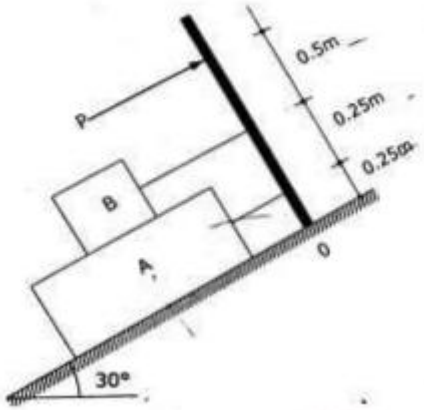
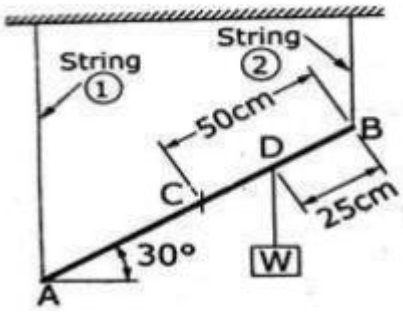
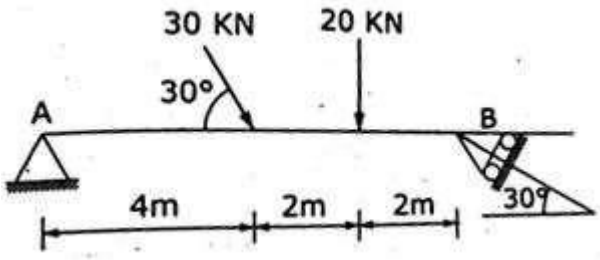
UNIT II EQUILIBRIUM OF RIGID BODIES			
Moment of a Force about a Point, Varignon's Theorem, Rectangular Components of the Moment of a Force,- Moment of a Couple, Equivalent Couples, Addition of Couples, Resolution of a Given Force into a Force -Couple system, Further Reduction of a System of Forces, Equilibrium in Two Dimensions - Reactions at Supports and Connections.			
PART - A (2Marks)			
S.No	**QUESTIONS**	**LEVEL**	**COMPETENCE**
1.	List out the types of support.	BT1	Remember
2.	State the necessary and sufficient conditions for equilibrium of rigid bodies in two dimensions.	BT1	Remember
3.	List out the types of load.	BT1	Remember
4.	Define the term couple.	BT1	Remember
5.	Describe support reaction.	BT1	Remember
6.	Represent a (i) Horizontal roller support and (ii) Inclined roller support showing the direction of the reaction.	BT1	Remember
7.	Determine the magnitude and position of the resultant of two forces 5kN and8kN both acting vertically upwards and separated by 4m. 	BT3	Apply
8.	Define Beam.	BT1	Remember
9.	Define Frame.	BT1	Remember
10.	What is the difference between a moment and a couple?	BT1	Remember
11.	What is difference between a fixed vector and free vector?	BT1	Remember
12.	For what condition the moment of a force will be zero.	BT1	Remember
13.	Calculate the moment of the force of 15N acting along the positive direction of X-axis about the point A (2, 3).	BT3	Apply
14.	Sketch the idealized, graphical and reaction of a cantilever support at a point.	BT2	Understand

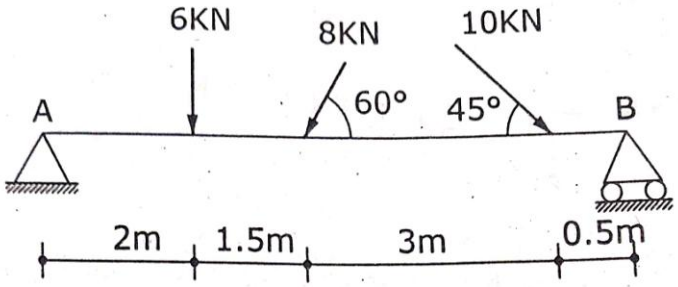
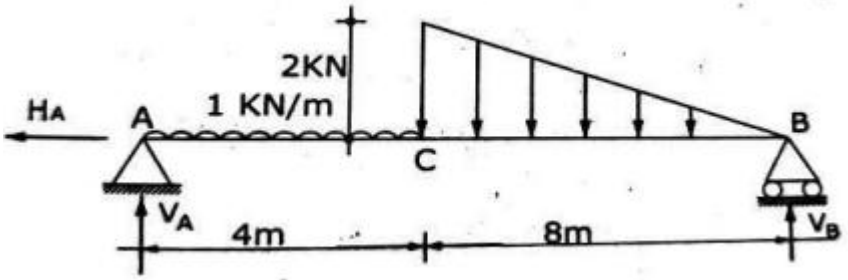
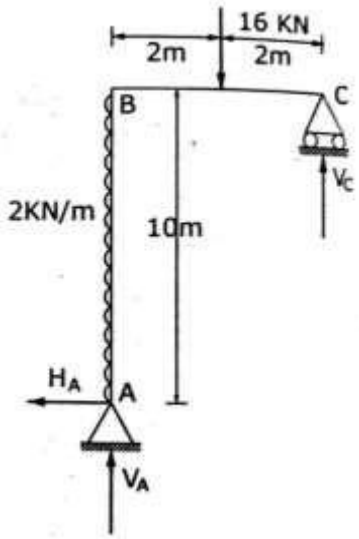
15.	State the requirements for equilibrium of a body acted upon by a parallel force system?	BT1	Remember
16.	What are the necessary and sufficient conditions for the equilibrium of a rigid body in three dimensions?	BT1	Remember
17.	What are the common types of supports used in two dimensions?	BT1	Remember
18.	Find the moment of 20 N force about the point 'O' as shown in Fig. 	BT3	Apply
19.	What are the common types of supports used in three dimensions?	BT1	Remember
20.	Mention some applications of cantilever beams.	BT1	Remember
21.	What are the common types of loads?	BT1	Remember
22.	What is a statically determinate structure?	BT1	Remember
23.	What are the reactions at fixed support of a plane beam that are possible?	BT1	Remember
24.	State necessary and sufficient conditions for equilibrium of rigid bodies in two dimensions?	BT1	Remember
25.	When is the moment of force maximum about a point?	BT1	Remember

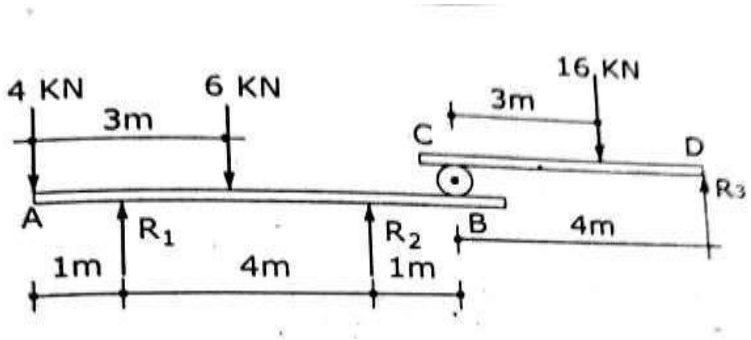
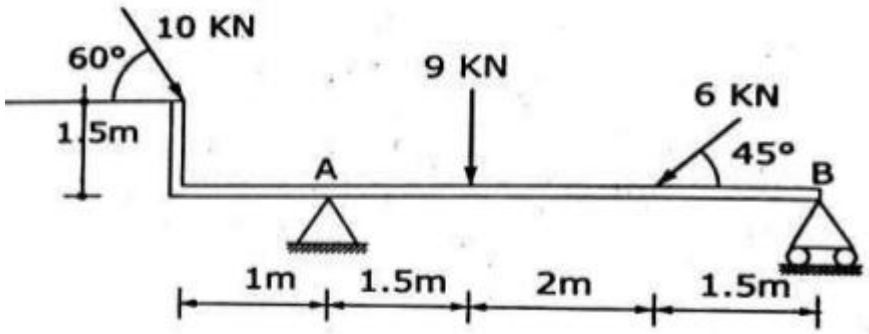
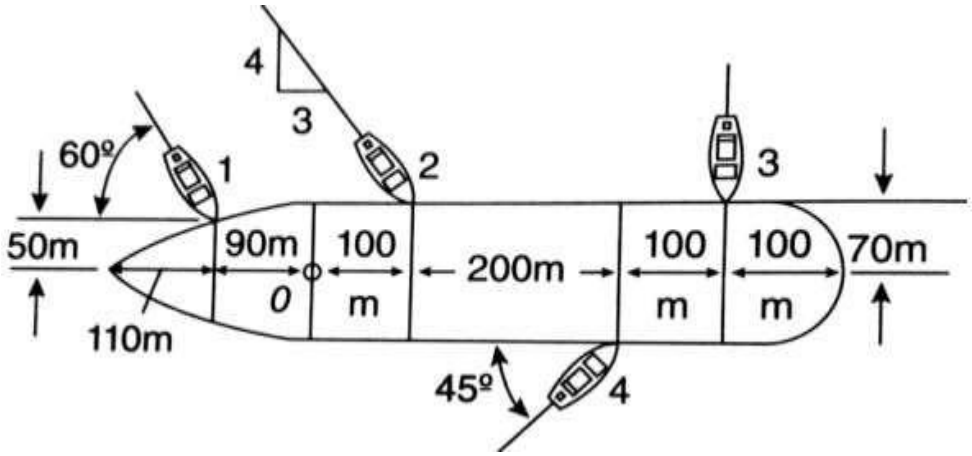
	PART - B (16 Marks)			
S.No	**QUESTIONS**	**Marks**	**Level**	**Competence**
1	Four forces of magnitude and direction acting on a square ABCD of side 2 m are shown in the figure. Calculate the resultant in magnitude and direction and also locate its point of application with respect to the sides AB and AD.	13	BT3	Apply

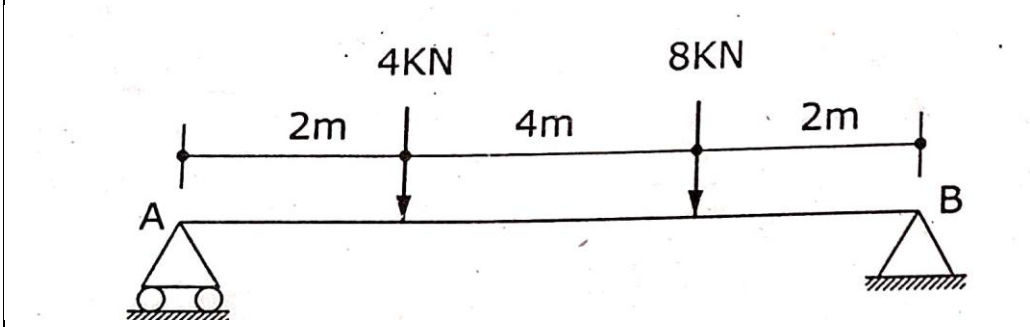
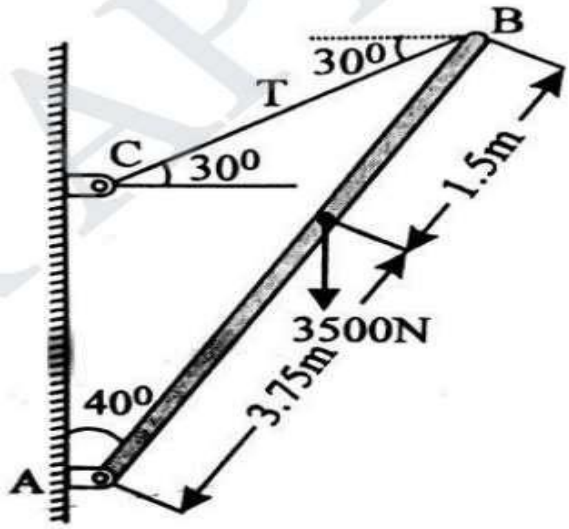
				
2	Four forces act on a 700 mm X 375 mm plate as shown in the figure. (a) Find the resultant of these forces. (b) Locate the two points where the line of action of the resultant intersects the edge of the plate. 	13	BT3	Apply
3	A beam AB of span 10 m span is loaded as shown in the figure. Determine the reactions at A and B. 	13	BT3	Apply

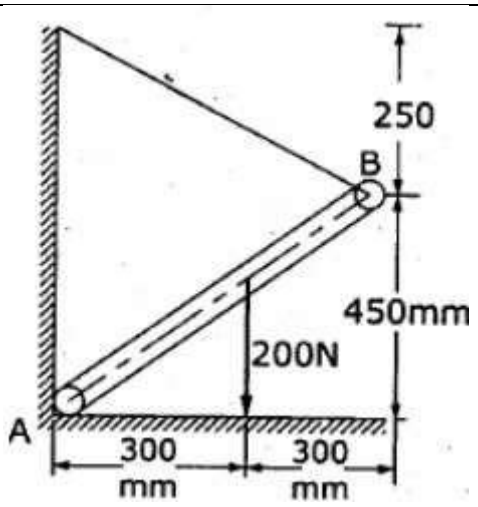
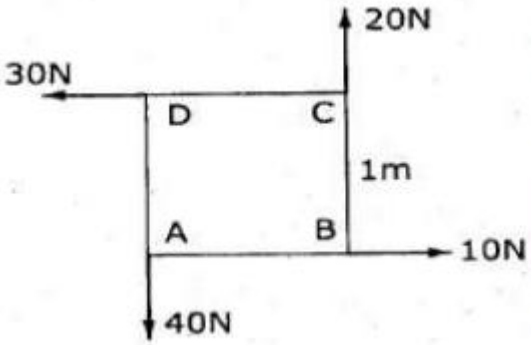
4	For the system of forces shown in the figure, determine the magnitude of P and Q such that the resultant of the system passes through A and B.  	13	BT3	Apply
5	Find the reactions at the supports A and B of the beam shown in the figure.  	13	BT3	Apply

6	Blocks A and B of the weight 200 N and 100 N respectively, rest on a 30° inclined plane and are attached to the post which is held perpendicular to the plane by a force P, parallel to the plane as shown in the figure. Assume that all surfaces are smooth and that the cords are parallel to the plane. Determine the value of P. Also find the normal reaction of the blocks A and B. 	13	BT3	Apply
7	A uniform meter rod AB, assumed rigid of the mass 0.5 kg is suspended from its ends in an inclined position and a mass of 1 kg is suspended from a point D, as shown in the figure. Determine the tension in each strings. Where the suspended mass should be placed in order to get equal tension in the strings. 	13	BT3	Apply
8	Find the support reactions of the beam as shown in the figure. 	13	BT3	Apply

9	Determine the Support Reaction of the beam shown in figure. 	13	BT3	Apply
10	Calculate the support reactions of a simply supported beam as shown in the figure. 	13	BT3	Apply
11	A bent up beam ABC is shown in the figure. It is hinged at A and supported on rollers at C. If there is an uniform wind pressure of 2 kN/m on the vertical side AB and a central point load of 16 kN at middle of BC, calculate the reactions offered by the supports. 	13	BT3	Apply

12	Calculate the reactions R1, R2 and R3 for the beams AB and CD supported as shown in the figure. There being a hinge connecting B and C. 	13	BT3	Apply
13	A beam AB is simply supported and carries loads as shown in the figure. Calculate the reactions at A and B. 	13	BT3	Apply
14	Four tug boats are used to bring a large ship to its pier. Each tug boat exerts a 5000 N force in the direction as shown in Fig. Determine the equivalent force - couple system at point 'O' and the point on hull where a single more powerful tug boat should push to produce the same effect as the original four boats. 	13	BT3	Apply

15.	Find the support reactions of a simply supported beam, shown in figure.  	13	BT3	Apply
16.	A load of 3500 N is acting on the boom, which is held by a cable BC as shown in figure below the weight of the boom can be neglected.  (i) Sketch the free body diagram of the boom (ii) Determine the tension in cable BC (iii)Find the magnitude and direction of the reaction at A.	13	BT3	Apply
17.	A cable BD and the corner of wall and floor surface as shown in fig support a rod AB of weight 200N. Find the reaction at A and tension in the cord.	13	BT3	Apply

				
18.	Four forces act on a square of side 1m as shown in fig. Reduce the force system into an equivalent force-couple system at A. 	13	BT3	Apply

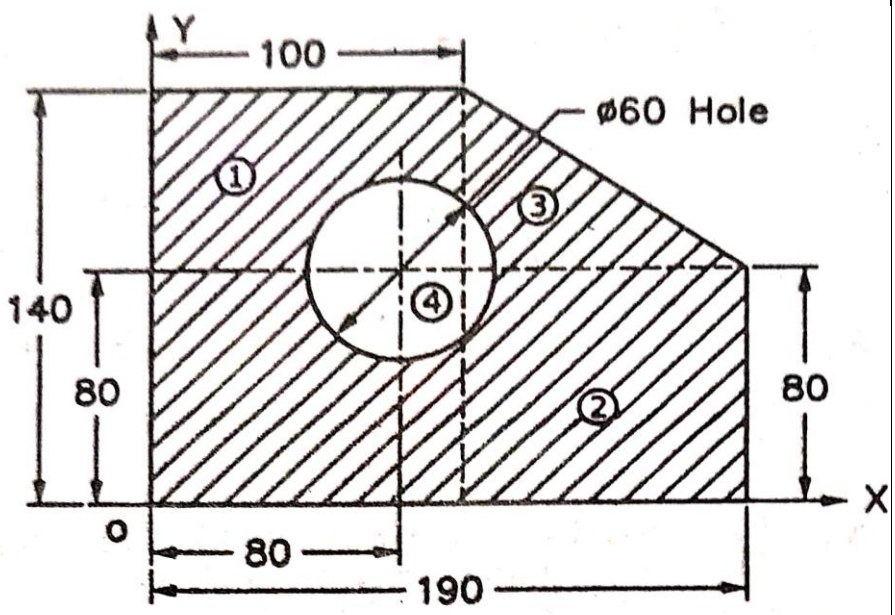
UNIT III – DISTRIBUTED FORCES

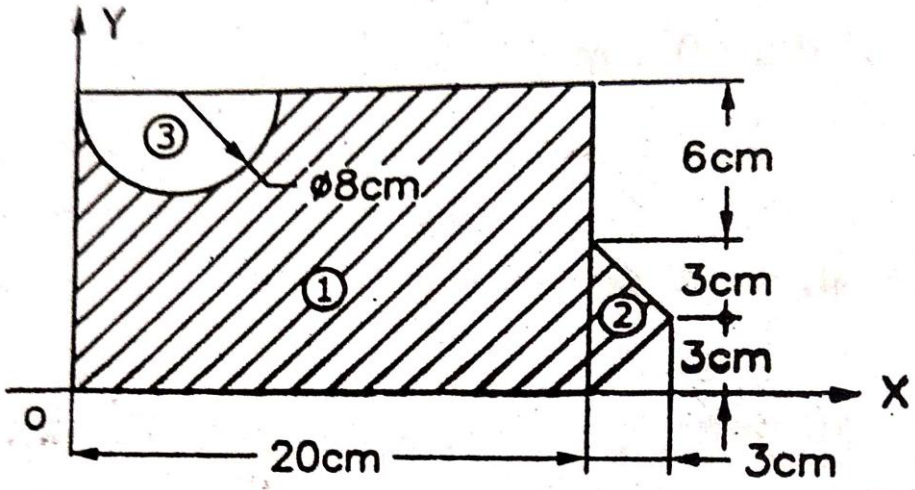
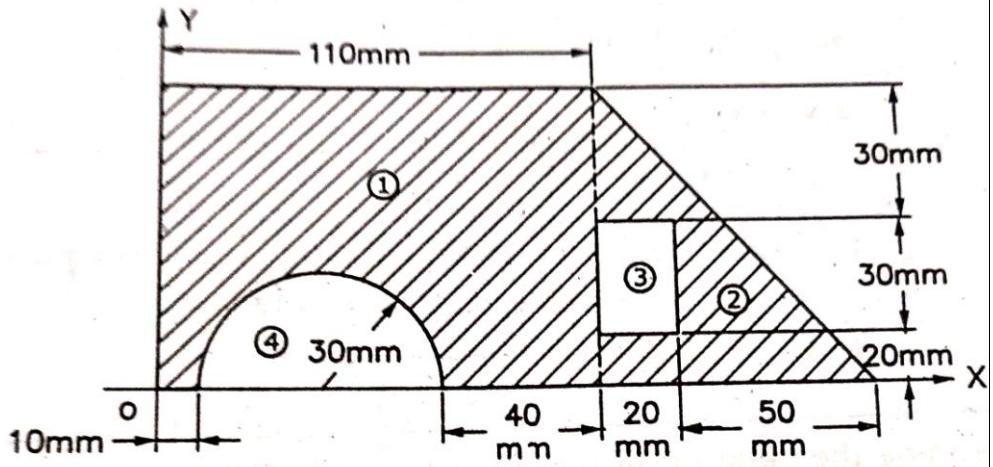
Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration, Theorems of Pappus-Guldinus, Centroid of a Volume, Composite Bodies. Moments of Inertia of Areas - Determination of the Moment of Inertia of an Area by Integration, Polar Moment of Inertia, Radius of Gyration of an Area, Parallel-Axis Theorem, Moments of Inertia of Composite Areas.

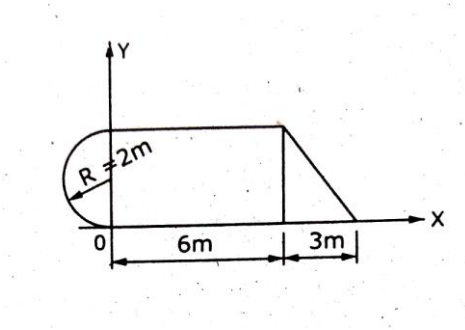
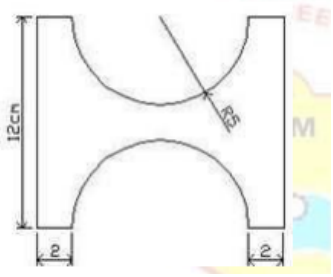
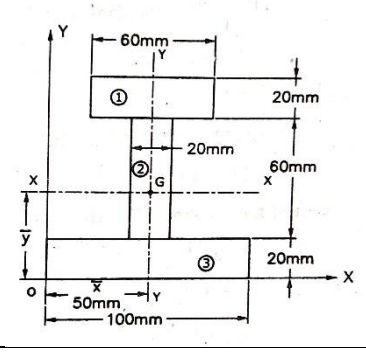
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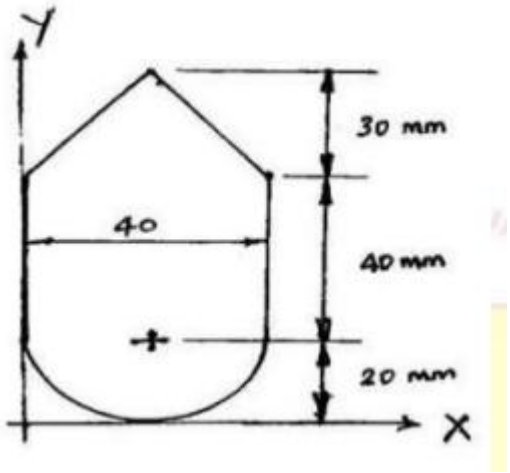
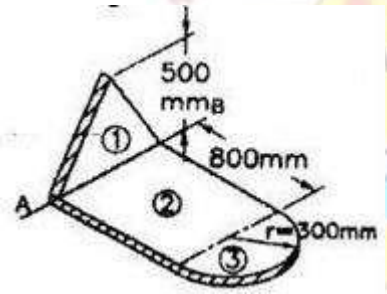
S.No	QUESTIONS	LEVEL	COMPETENCE
1.	Define centre of gravity.	BT1	Remember
2.	State centroid.	BT1	Remember
3.	Express the centroidal coordinates of a quadrant of the circle.	BT2	Understand
4.	What does reference axes mean?	BT1	Remember
5.	What is meant by centroidal axis?	BT1	Remember
6.	Describe the parallel axes theorem for moment of inertia.	BT2	Understand
7.	Describe the perpendicular axes theorem for moment of inertia?	BT2	Understand
8.	Define the product of inertia.	BT1	Remember
9.	State the principal moment of inertia.	BT1	Remember
10.	What is mass moment of inertia?	BT1	Remember
11.	Define Radius of Gyration.	BT1	Remember
12.	State Pappus theorem.	BT1	Remember
13.	State Guldinus theorem	BT1	Remember
14.	Express the centroidal coordinates of a quadrant of a circle.	BT1	Remember
15.	When will the product of inertia of an become zero?	BT1	Remember
16.	Define first moment of an area about an axis.	BT1	Remember
17.	What do you mean by polar moment of inertia?	BT1	Remember
18.	When will the centroid and centre of mass coincides?	BT1	Remember
19.	Describe centre of mass.	BT1	Remember
20.	How will you locate the principal axes of inertia?	BT1	Remember

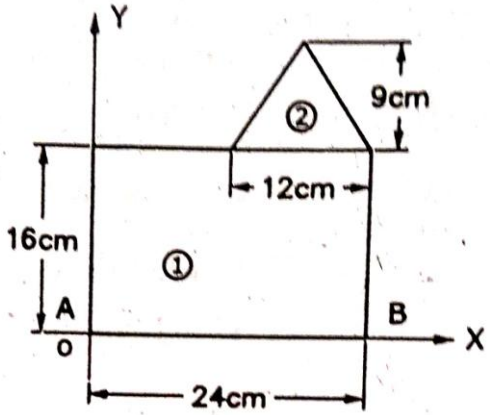
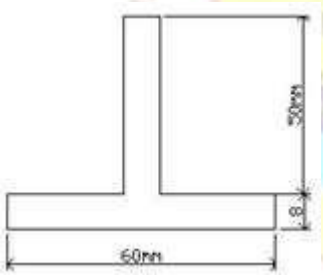
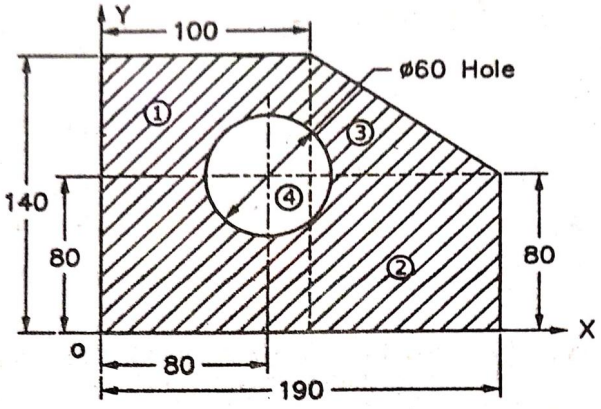
21.	What are the various methods to find centre of gravity?	BT1	Remember
22.	What is section modulus?	BT1	Remember
23.	State the relationship between the second moment of area and mass moment of inertia for a thin uniform plate.	BT1	Remember
24.	List out the theorems that deal with moment of inertia.	BT1	Remember
25.	Describe major and minor principal axes.	BT2	Understand

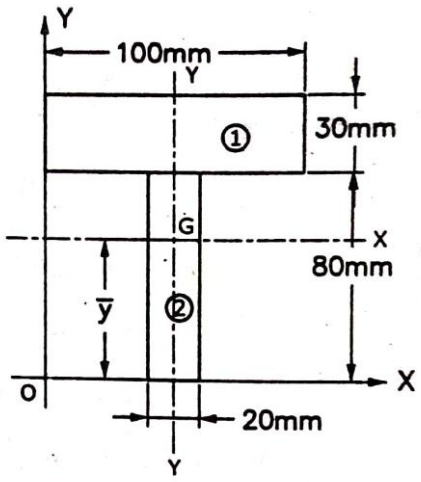
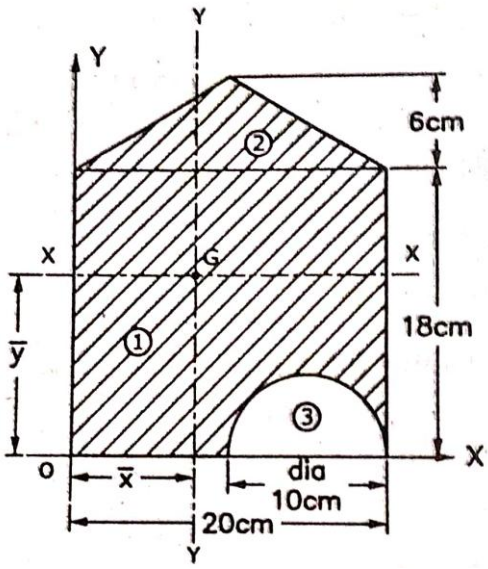
PART - B (16 Marks)				
S.No	**QUESTIONS**	**Marks**	**Level**	**Competence**
1	Find the Centroid of the lamina shown in figure. All dimensions are in mm. 	16	BT3	Apply

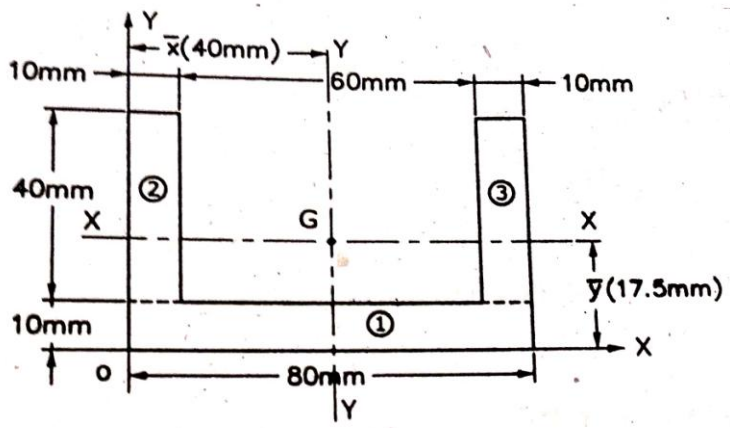
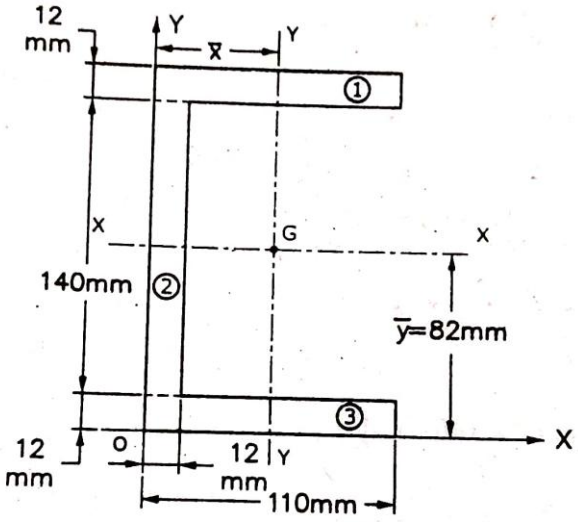
2	Locate the centroid of the plane lamina shown in figure. 	16	BT3	Apply
3	Locate the centroid of the sectioned area shown in figure. 	16	BT3	Apply

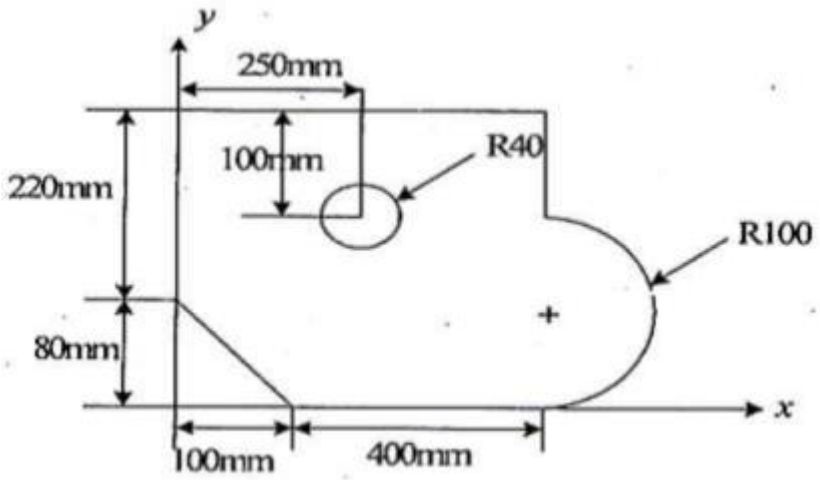
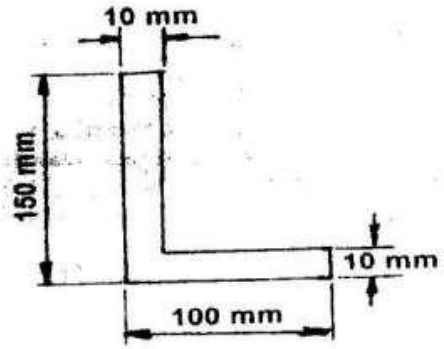
4	Analyse the centroid of the area shown in figure, with respect to the axis. 	16	BT4	Analyze
5	Illustrate the Mass moment of inertia of plane area about centroidal axes shown in fig. 	16	BT3	Apply
6	Find the moment of inertia of an un symmetrical I Section shown in figure, about is centroidal axis. 	16	BT3	Apply

7	Figure shows a composite area. Find the moment of inertia (Second moment of area) about both the centroidal axes. 	16	BT3	Apply
8	Find the mass moment of inertia of the plate shown in fig with respect to the axis AB. Thickness of the plate is 5mm and density of the material is 6500kg/m^3. 	16	BT3	Apply
9	Derive the expression for mass moment of inertia of prism along three axes.	16	BT4	Analyze

10	Calculate Moment of Inertia about the co-ordinate axes of plane area shown in fig. Also find Polar Moment of Inertia. All the dimensions are in 'mm'. 	16	BT3	Apply
11	Determine the principal moments of inertia and find location of principal axes of surface shown in figure 	16	BT3	Apply
12	Find the moment of inertia of the section shown in figure about its horizontal centroidal axis 			

13	Find the moment of inertia of T section of flange 100 mm x 30 mm and web 20 mm x 80 mm about its centrodal axes. 	16	BT3	Apply
14	Find the moment of inertia of the section shown in figure about its horizontal centroidal axis 	16	BT3	Apply

15.	Find the moment of inertia of the section shown below. 	16	BT3	Apply
16.	Find the moment of inertia of a channel section shown in figure. 	16	BT3	Apply

17.	Locate the centroid of the plane area shown in figure below. 	16	BT3	Apply
18	An area in the form of L section is shown in figure below. Find the moment of inertia Ixx, Iyy and Ixy about its centroidal axes. Also determine the principal moments of inertia. 	16	BT3	Apply

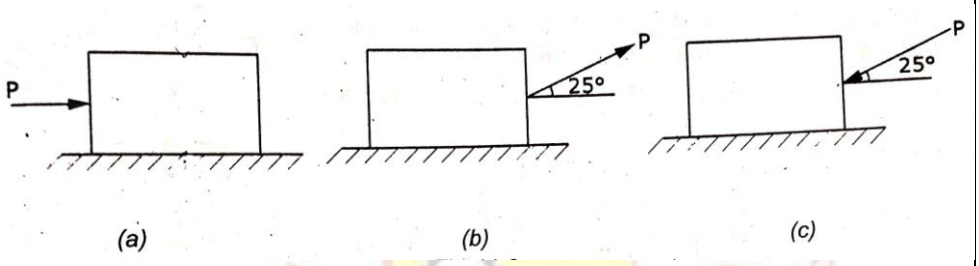
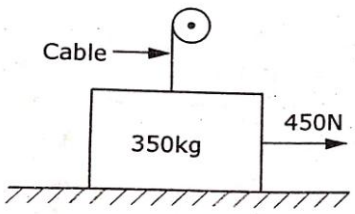
UNIT IV - FRICTION

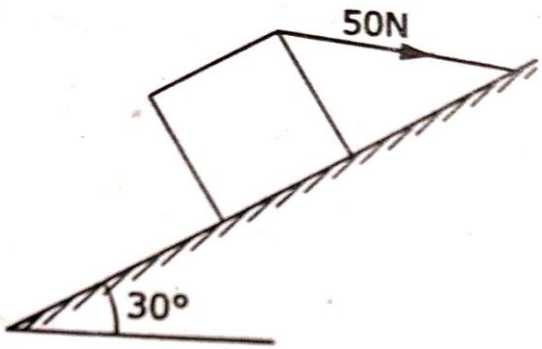
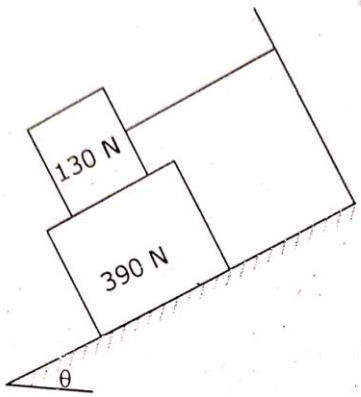
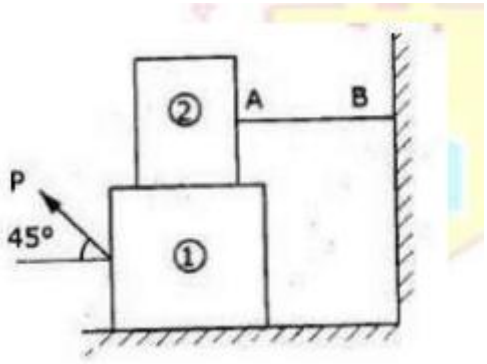
The Laws of Dry Friction, Coefficients of Friction, Angles of Friction, Wedge friction, Wheel Friction, Rolling Resistance, Ladder friction.

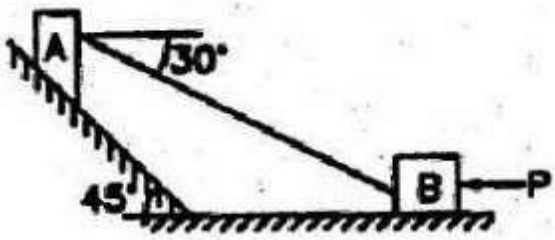
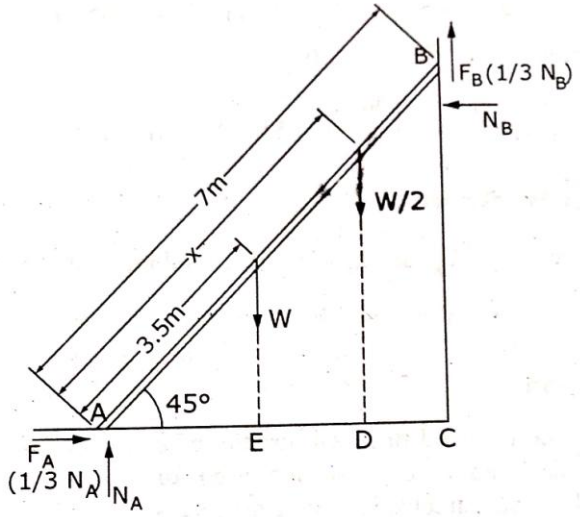
PART - A (2Marks)

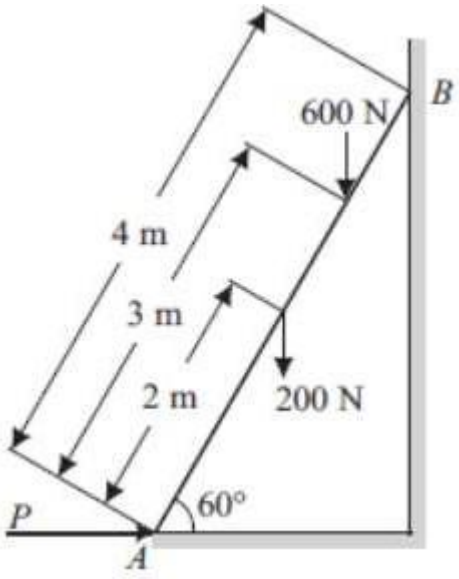
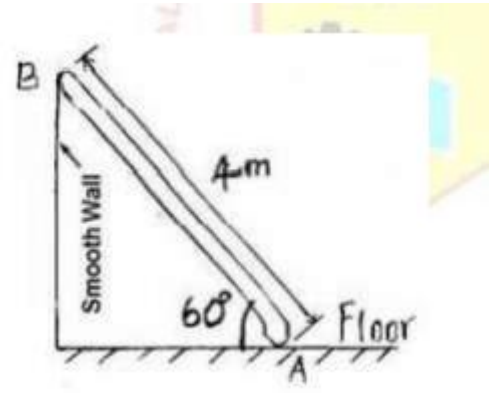
S.No	QUESTION	LEVEL	COMPETENCE
1.	Define friction.	BT1	Remember
2.	Classify the type of friction.	BT1	Remember
3.	Describe limiting friction.	BT1	Remember
4.	Define the co-efficient of static friction.	BT1	Remember
5.	State Coulomb's laws of dry friction.	BT1	Remember
6.	What is impending motion?	BT1	Remember
7.	Define the angle of repose.	BT1	Remember
8.	Define cone of friction.	BT1	Remember
9.	What is the co-efficient of Rolling resistance?	BT1	Remember
10.	Define rolling resistance.	BT1	Remember
11.	Analyze the coefficient of friction and express its relationship with angle of friction.	BT1	Remember
12.	Define ladder friction.	BT1	Remember
13.	Compare and contrast Ladder friction and Wedge friction.	BT2	Understand
14.	Compare Co-efficient of friction and angle of friction	BT2	Understand
15.	Define frictional force and its direction.	BT1	Remember
16.	State any two important law of dry friction.	BT1	Remember
17.	Why is static coefficient of friction μ, always greater than kinetic coefficient of friction μ_k.	BT2	Understand
18.	State the equilibrium conditions to be satisfied by a ladder at just start of sliding?	BT1	Remember
19.	Define the belt friction and write the relation between ratio of tensions and coefficient of belt friction.	BT1	Remember
20.	Define wedge and wedge friction.	BT1	Remember
21.	Give the expression to calculate coefficient of friction in V-belt.	BT1	Remember

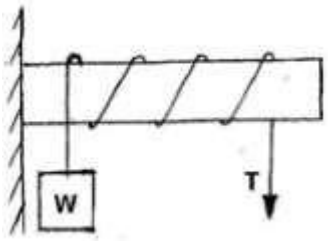
22.	Define friction and classify its types.	BT1	Remember
23.	Define screw friction.	BT1	Remember
24.	What is meant by fluid friction?	BT1	Remember
25.	What are two types of dynamics friction?	BT1	Remember

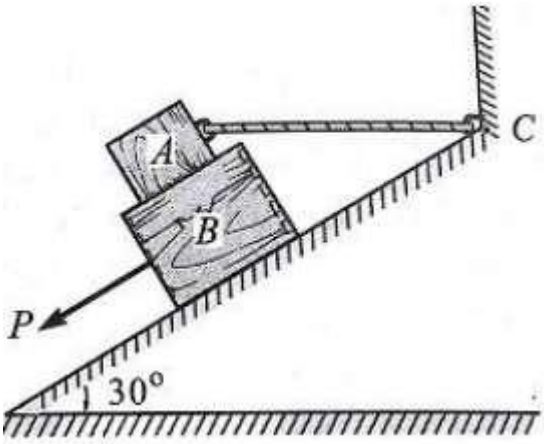
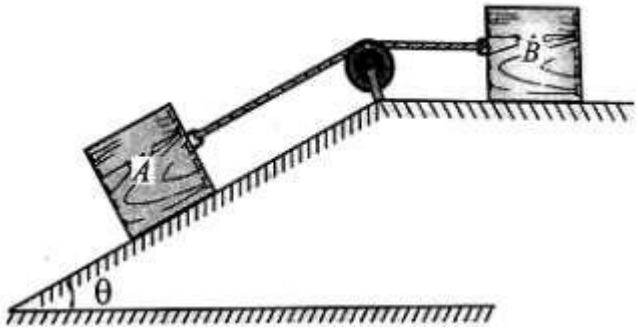
	PART - B (16 Marks)			
S.No	**QUESTIONS**	**Marks**	**Level**	**Competence**
1	A body if weight 100 N is placed on a rough horizontal plane, and pushed by a force of 45 N as shown in figure, (a), (b), (c), to just cause sliding over the horizontal plane. Determine the Co-efficient of friction in all the three cases. 	16	BT3	Apply
2	A man can pull horizontally with a force of 450 N. A mass of 350 kg is resting on a horizontal surface for which the coeffiecient of friction is 0.20. The vertical cable of a crane is attached to the top of the block as shown in figure. What will be the tension in the cable if the man is just able to start the block to the right. 	16	BT3	Apply
3	A block of weight 150 N is resting on a rough inclined plane as shown in figure. The block is tied up by a horizontal string, which has a tension of 50 N. Find (i) The frictional force on the block (ii) The normal reaction of the inclined plane (iii) The coefficient of friction between the surface of contact.	16	BT5	Evaluate

				
4	What should be the value of the angle □ so that motion of the 390 N block impends down the plane? The coefficient of friction μ for all surfaces is 1/3. 	16	BT3	Apply
5	Block (2) rests on block (1) and is attached by a horizontal rope AB to the wall as shown in fig. What force P is necessary to cause motion of block (1) to impend? The co-efficient of friction between the blocks is ¼ and between the floor and block (1) is 1/3. Mass of blocks (1) and (2) are 14kg and 9 kg respectively. 	16	BT3	Apply

6	Block A weighing 1000 N rests on a rough inclined plane whose inclination to the horizontal is 45°. It is connected to another block B, weighing 3000 N rests on a rough horizontal plane by a weightless rigid bar inclined at an angle of 30° to the horizontal as shown in fig. Find the horizontal force required to be applied to the block B just to move the block A in upward direction. Assume angle of friction as 15° at all surfaces where there is sliding. 	16	BT3	Apply
7	A 7m long ladder rests against a vertical wall, with which it 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 coefficient of friction between the ladder and the wall is 1/3 and that between the ladder and the floor is ½. 	16	BT3	Apply

8	An effort of 200 N is required just to move a certain body up an inclined plane of angle 15°, the force is acting parallel to the plane. If the angle of inclination of the plane is made 20°, the effort required being again parallel to the plane, is found to be 230 N. Predict the weight of the body and coefficient of friction.	16	BT3	Apply
9	A ladder of length 4 m, weighing 200 N is placed against a vertical wall as shown in Fig.10. The coefficient of friction between the wall and the ladder is 0.2 and that between floor and the ladder is 0.3. The ladder, in addition to its own weight, has to support a man weighing 600 N at a distance of 3m from A. Calculate the minimum horizontal force to be applied at A to prevent slipping. 	16	BT3	Apply
10	A ladder of weight 1000 N and length 4 m rests as shown in figure. If a 750 N weight is applied at a distance of 3 m from the top of ladder, it is at the point of sliding. Determine the coefficient of friction between ladder and the floor. 	16	BT3	Apply

11	A rope is wrapped 3 times around the rod as shown in the fig. Design the force required at the free end of the rope to stope the load w=20KN.Takeμ=0.3 	16	BT3	Apply
12	A cylinder of radius 80 mm rolls down on an inclined plane at an angle of 2° with the horizontal. Determine the co-efficient of rolling resistance of the cylinder.	16	BT3	Apply
13	A screw jack has a pitch of 12 mm with a mean radius of thread equal to 22.5 mm. a lever 600 mm long is used to raise a load of 1800 kg. if the co-efficient of friction is 0.10, what force is necessary when applied normal to the lever at its free end?	16	BT3	Apply
14	A body of weight 16 N rests on a rough inclined plane at an angle of 30◦ to the horizontal. If a force of 2N acting up the plane is just sufficient to prevent the body from slipping downwards, find the force in the same direction which will make the body on the point of moving upwards.	16	BT3	Apply
15	A ladder 5 meters long rests on a horizontal ground and leans against a smooth vertical wall at an angle 70° with the horizontal. The weight of the ladder is 900 N and acts at its middle. The ladder is at the point of sliding, when a man weighing 750N stands on a rung 1.5 meter from the bottom of the ladder. Calculate the coefficient of friction between the ladder and the floor.	16	BT3	Apply

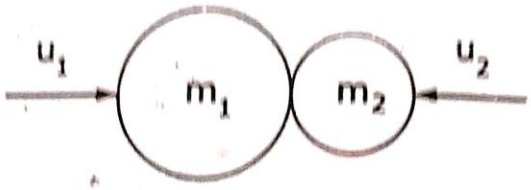
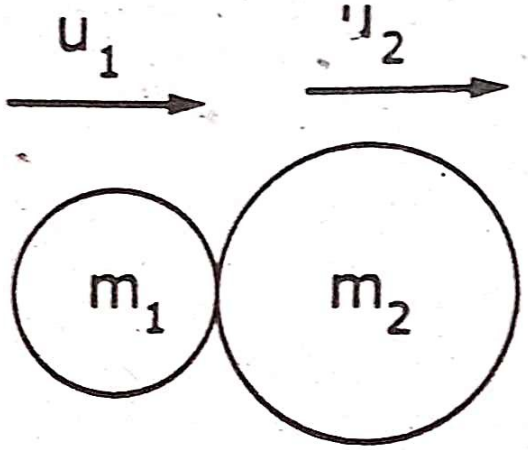
16	Block A of mass 30 kg rests on block B of mass 40 kg as shown in Fig. Block A is restrained from moving by a horizontal rope tied at point C, what force P applied to the plane inclined at 30o with horizontal is necessary to start block B down the plane. Take coefficient of friction for all surfaces as 0.35. 	16	BT3	Apply
17	Find the value of 'Θ' if the block 'A' and 'B' shown in Fig. have impending motion. Given block A = 20 kg, block B = 20 kg, μA = μB = 0.25	16	BT3	Apply
				
18	A uniform ladder of weight 1000 N and of length 4m rests on horizontal ground and leans against a smooth vertical wall. The ladder makes an angle of 60◦ with horizontal. When a mean of weight 750 N stands on the ladder at a distance 3m from the top of the ladder, the ladder is at the point of sliding. Determine the co-efficient of friction between the ladder and the floor.	16	BT3	Apply

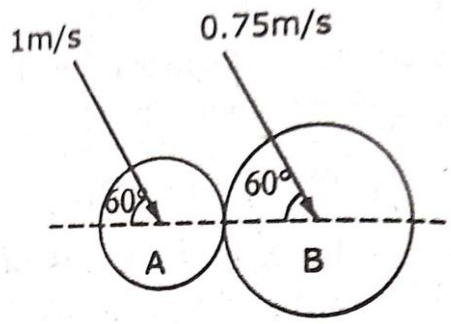
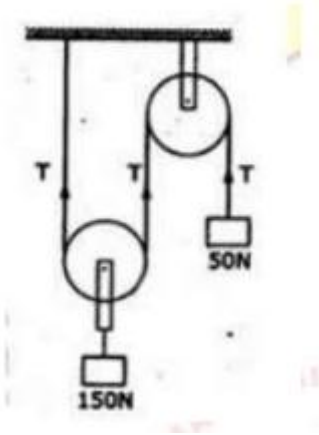
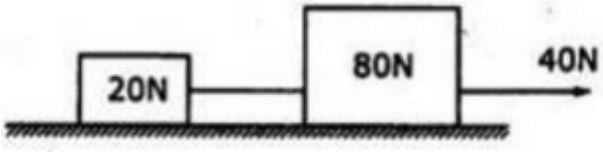
UNIT V - DYNAMICS OF PARTICLES			
Kinematics - Rectilinear Motion and Curvilinear Motion of Particles. Kinetics- Newton's Second Law of Motion - Equations of Motions, Dynamic Equilibrium, Energy and Momentum Methods - Work of a Force, Kinetic Energy of a Particle, Principle of Work and Energy, Principle of Impulse and Momentum, Impact of bodies.			
PART - A (2Marks)			
S.No	**QUESTIONS**	**LEV**	**COMPETENCE**
1.	Write down the equations of motion of a body	BT1	Remember
2.	What is uniform motion?	BT2	Understand
3.	List out the types of motion	BT1	Remember
4.	Define rectilinear and curvilinear motion.	BT1	Remember
5.	Define Velocity.	BT3	Apply
6.	What is the difference between speed and velocity?	BT1	Remember
7.	Describe Acceleration.	BT3	Apply
8.	Describe Work.	BT3	Apply
9.	What is work energy principle.	BT1	Remember
10.	Illustrate the impulse momentum equation?	BT1	Remember
11.	Distinguish between kinetics and kinematics.	BT2	Understand
12.	Distinguish between impulse and impulsive force.	BT2	Understand
13.	Analyze the impulse momentum equation.	BT2	Understand
14.	Compare and contrast the rectilinear and curvilinear motion.	BT2	Understand
15.	Define inertia force.	BT1	Remember
16.	What differences exist between impulse and momentum?	BT1	Remember
17.	Compare and contrast the impact and elastic impact.	BT3	Apply
18.	Define Co-efficient of restitution.	BT1	Remember
19.	State Newton's law of collision of elastic bodies.	BT2	Understand
20.	Define range of projectile.	BT1	Remember
21.	A point P moves along a straight line according to the equation $x= 4t^3+2t+5$, where x is in meters and t is in secs. Determine the velocity and acceleration at t=3 secs.	BT3	Apply
22.	The particle moving with $S= 9t^3 + 2t + 2$. Find velocity and acceleration when time t=6sec.	BT3	Apply
23.	How do you define the moment of the particle?	BT1	Remember

24.	Define Law of conservation of momentum.	BT1	Remember
25.	Define law of conservation of angular momentum.	BT1	Remember

PART - B (16 Marks)

S.No	QUESTIONS	Marks	Level	Competence
1	A car is moving with a velocity of 20 m/s. The car is brought to rest by applying brakes in 6 seconds. Find (i) Retardation, (ii) Distance travelled by the car after applying the brakes.	16	BT3	Apply
2	A train starts from rest and attains a velocity of 45 km per hour in 2 minutes, with uniform acceleration. Calculate (i) acceleration, (ii) Distance travelled in this time, 2 mins, (iii) time required to reach a velocity of 36 km per hour.	16	BT3	Apply
3	Water drips from a tap fitted to a barrel at the rate of four drops per second. Find the vertical separation between two consecutive drops after the lower drop has attained a velocity of 3m/s	16	BT3	Apply
4	A train is traveling from A to D along the track. Its initial velocity at A is zero. The train takes 5 min to cover the distance AB, 2250 m length and 2.5 minutes to cover, the distance BC, 3000 m in length, on reaching the station C, the brakes are applied and the train stops 2250 m beyond, at D (i) Find the retardation on CD, (ii) the time it takes the train to get from A to D, and (iii) its average speed for the whole distance.	16	BT3	Apply
5	A motor moving with an uniform acceleration covers a distance of 20m in 4 seconds and 40 m in 6 seconds. Find the uniform acceleration of the motor?	16	BT3	Apply
6	A motor starts from rest and uniformly accelerated to speed of 20 kmph over a distance of 200 m. calculate the acceleration and time taken. If further acceleration raise the speed of 50 kmph in 8 seconds, find the acceleration and further distance moved?	16	BT3	Apply

7	Two bodies one of masss 30 kg, moves with a velocity of 9 m/s strikes on an another body of mass 15 kg, moving in the opposite direction with the velocity of 9 m/s centrally. Find the velocity of each body after impact, if the coefficient of restitution is 0.8. 	16	BT3	Apply
8	A ball strikes centrally on another ball of mass twice the mass of first ball but moving with a velocity 1/7 of the velocity of first ball and in the same direction. Show that, the first ball comes to rest after impact. The coefficient of restitution between them is ¾. 	16	BT3	Apply
9	A Ball of mass 500 grams , moving with a velocity of 1 m/s impinges on a ball of mass 1 kg, moving with a velocity of 0.75 m/s. At the time of impact, the velocities of the balls are parallel and inclined at 60^o to the line joining their centres. Determine the velocities and directions of the balls after impact. Take e = 0.6.	16	BT3	Apply

				
10	A Car of mass 150 kg is travelling on horizontal track at 36 km/hour. Determine the time needed to stop the car. The co-efficient of friction between the tyres and the road is 0.45. find the solution by applying Impulse- Momentum equation, D'Alembert's principle and Work energy method.	16	BT3	Apply
11	Two blocks of weight 150 N and 50 N are connected by a string and passing over a frictionless pulley as shown in figure. Predict the acceleration of blocks A and B and the tension in the string. 	16	BT3	Apply
12	Two weights 80 N and 20 N are connected by a thread and move along a rough horizontal plane under the action of a force 40 N, applied to the first weight of 80 N as shown in figure. The coefficient of friction between the sliding surfaces of the wrights and the plane is 0.3. Design the acceleration of the weights and the tension in the thread using D'Alembert's principle. 	16	BT3	Apply

13	A ball of mass 2 kg, moving with a velocity of 3 m/s, impinges on a ball of mass 4 kg moving with a velocity of 1 m/s. The velocities of the two balls are parallel and inclined at 30◦ to the line of joining their centers at the instant of impact. If the coefficient of restitution is 0.5, Explain I. Direction, in which the 4 kg ball will move after impact; (5) II. Velocity of the 4 kg ball after impact; (2) III. Direction, in which the 2 kg ball will move after impact; (4) IV. Velocity of the 2 kg ball after impact. (2)	16	BT3	Apply
14	A Rigid body rotates about a fixed axis and slows down from 300 rpm to 150 rpm in 2 minutes. (i) Determine the angular acceleration? (ii) Determine the number of revolutions completed in 2 minutes.	16	BT3	Apply
15	A Pulley with two loads, connected by an inextensible cord is shown in figure. If the load B moves download with an initial velocity of 1.5 m/s, and uniform acceleration of 0.75 m/s^2, determine (i) Number of revolutions executed by the pulley in 2 sec.	16	BT3	Apply
16	The position of the particle is given by the relation $S=1.5t^3-9t^2-22.5t+60$, where S is expressed in meters and t in seconds. Determine (i) the time at which the velocity will be zero (ii) the position and distance travelled by the particle at that time (iii) the acceleration of the particle at that time and (iv) the distance travelled by the particle from t = 5s to t = 7s.	16	BT3	Apply
17	A body A is projected vertically upwards from the top of a tower with a velocity of 40 m/s, the tower being 180m high. After t sec, another body B is allowed to fall from the same point. Both the bodies reach the ground simultaneously. Calculate t and the velocities of A and B on reaching the ground	16	BT3	Apply
18	A cricket ball hit at a height of 1.5m from the ground by a batsman with a velocity of 20 m/s, at an angle of 30◦ to the horizontal was caught by field man at a height of 50 cm from the ground. Find out the distance between the two players.	16	BT3	Apply