SRM VALLIAMMAI ENGINEERING COLLEGE
(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF CIVIL ENGINEERING

QUESTION BANK

III SEMESTER

CE 3361 – APPLIED MECHANICS

Regulation – 2023

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Prepared by

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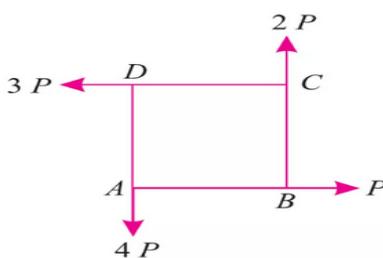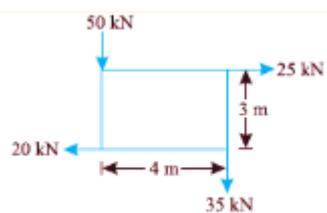
UNIT I - STATICS OF PARTICLES

Fundamental Concepts and Principles, Systems of Units, Statics of Particles -Forces in a Plane, Resultant of Forces, Resolution of a Force into Components. Equilibrium of a Particle - Newton's First Law of Motion, Free-Body Diagrams.

PART – A

| Q.NO	QUESTIONS	BT LEVEL	COMPETENCE
1.	Define Mechanics.	BT - 1	Remember
2.	Mention the classification of mechanics.	BT - 1	Remember
3.	Recall the terms space, mass and time.	BT - 1	Remember
4.	Give the Principal S.I. units and symbol of few physical quantities.	BT - 1	Remember
5.	Differentiate fundamental units and derived units with examples.	BT - 2	Understand
6.	Enlist the characteristics of a force.	BT - 1	Remember
7.	Differentiate statics and dynamics.	BT - 2	Understand
8.	Distinguish between particle and rigid body.	BT - 2	Understand
9.	State Newton's laws.	BT - 1	Remember
10.	Differentiate between S.I, C.G.S and M.K.S System	BT - 2	Understand
11.	State principle of transmissibility.	BT - 1	Remember
12.	Define parallelogram law of forces	BT - 1	Remember
13.	State Triangle law of forces.	BT - 1	Remember
14.	State Polygon law of forces.	BT - 1	Remember
15.	List different system of forces.	BT - 1	Remember
16.	Classify forces.	BT - 1	Remember
17.	Tell the Methods of Finding Resultant.	BT - 1	Remember
18.	State Lami's Theorem.	BT - 1	Remember
19.	State Newton's law of gravitational force.	BT - 1	Remember
20.	What do you mean by Resolution of a force?	BT - 1	Remember
21.	What do you mean by free body diagram?	BT - 1	Remember
22.	Differentiate action and reaction.	BT - 2	Understand
23.	What is the relationship between the sum of forces and the acceleration of a particle?	BT - 3	Apply
24.	How do you determine the resultant force of a system of coplanar forces?	BT - 3	Apply

PART – B

Q.NO	QUESTIONS	BT LEVEL	COMPETENCE
1.	Write about Types of forces and System of forces with neat sketch.	BT - 3	Apply
2.	a) Differentiate between Mass and Weight. b) Write about laws of mechanics.	BT - 2	Understand
3.	a) Two forces of 100 N and 150 N are acting simultaneously at a point. What is the resultant of these two forces, if the angle between them is 45°?	BT - 4	Analyse

|			
	b) Find the magnitude of the two forces, such that if they act at right angles, their resultant is√10 N. But if they Act at 60°, their resultant is √13 N. c) Two concurrent forces act at an angle of 30^0. The resultant force is 15N and one of the forces is 10N. Find the other force.		
4.	a) A triangle ABC has its side AB = 40 mm along positive x-axis and side BC = 30 mm along positive y-axis. Three forces of 40 N, 50 N and 30 N act along the sides AB, BC and CA respectively. Determine magnitude of the resultant of such a system of forces. b) The guy wire of the electric pole makes 60° to the horizontal and is subjected to 20 kN force. Find horizontal and vertical components of the force.	*BT - 4*	*Analyse*
5.	a) Find the resultant force an 800 N force acting towards eastern direction and a 500 N force acting towards north eastern direction by parallelogram and triangle law along with its direction. b) Two forces 60 N and 65 N act on a screw at an angle of 25° and 85° from the base. Determine the magnitude and direction of their resultant.	*BT - 4*	*Analyse*
6.	a) A man of weight W = 712 N holds one end of a rope that passes over a pulley vertically above his head and to the other end of which is attached a weight Q = 534 N. Find the force with which the man's feet press against the floor. b) A boat is moved uniformly along a canal by two horses pulling with forces P = 890 N and Q = 1068 N acting under an angle α = 60˚. Determine the magnitude of the resultant pull on the boat and the angles β and ν.	*BT - 4*	*Analyse*
7.	a) Four forces equal to P, 2P, 3P and 4P are respectively acting along the four sides of square ABCD taken in order. Find the magnitude, direction and position of the resultant force b) A system of forces is acting at the corners of a rectangular block as shown in Fig. Determine the magnitude and direction of the resultant force. 	*BT - 4*	*Analyse*
8.	a) Draw the FBD for the given figures below	*BT - 4*	*Analyse*

Smooth
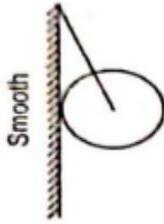
b) A gusset plate of roof truss is subjected to forces as shown in Fig. Determine the magnitude of the resultant force and its orientation measured counter clockwise from the positive x-axis.
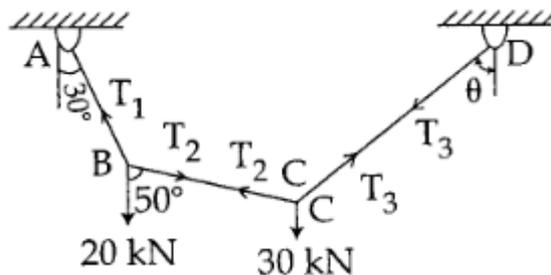

240 N

160 N   180 N

200 N   45°   45°   180 N
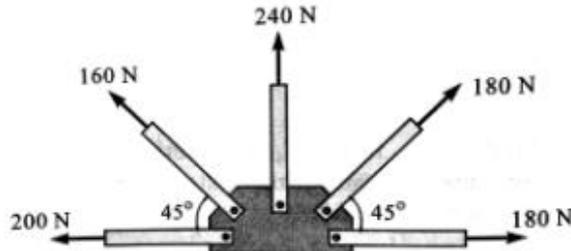
9.	a) An electric light fixture weighting 15 N hangs from a point C, by two strings AC and BC. The string AC is inclined at 60° to the horizontal and BC at 45° to the horizontal as shown in Fig. Using Lami's theorem, or otherwise, determine the forces in the strings AC and BC.	BT - 4	Analyse
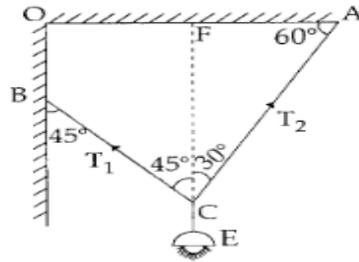
b) A wire rope is fixed at two points A and D as shown in figure. Two weights 20 kN and 30 kN are attached to it at B and C respectively. The weights rest with portions AB and BC inclined at angles 30° and 50°respectively; to the vertical as shown in figure. Find the tension in the wire in segments AB, BC and CD and also the inclination of the segments CD to vertical.

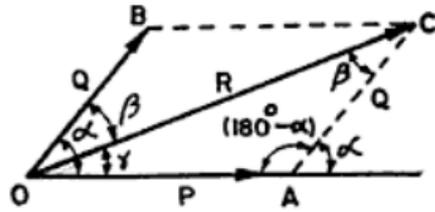A   D
  30° T_1 θ
      T_2 T_2 C T_3
B T_3
  50°   C
20 kN   30 kN

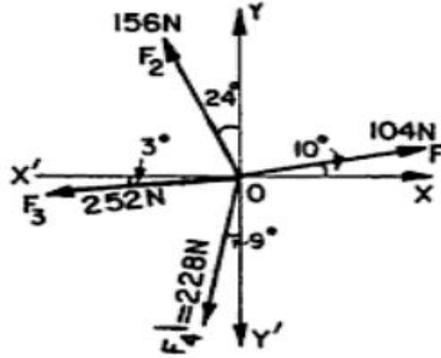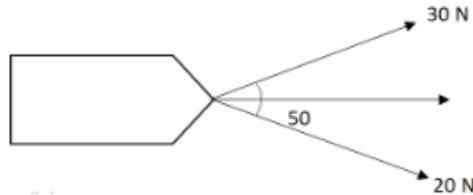| 10.	Two forces P and Q are acting at a point O as shown in figure. The force P = 240 N and Q = 200 N. If the resultant is 400 N, the find the values of α, β and γ.	BT - 4	Analyse

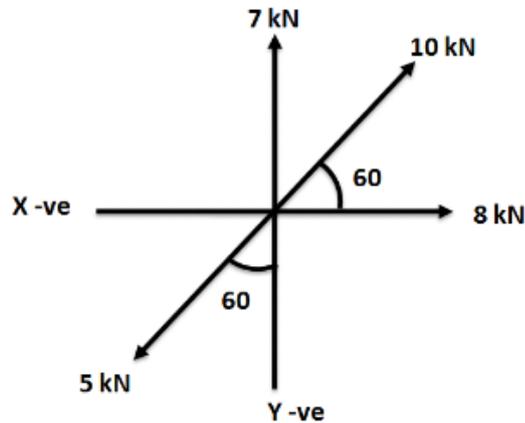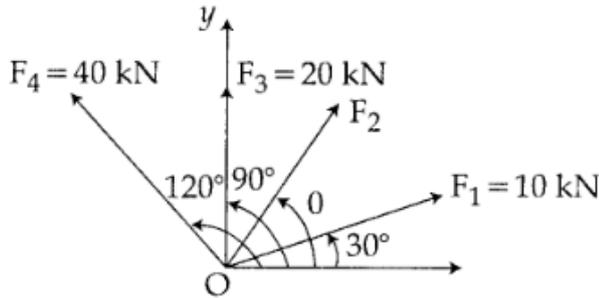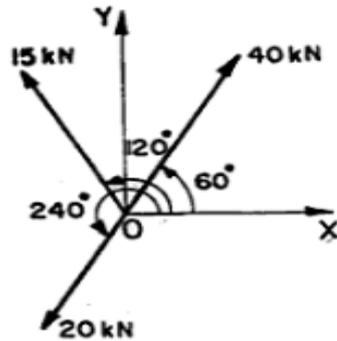|			
11.	a) Find the resultant and magnitude for the system of force given in below. b) A boat kept in position by two ropes as shown in figure. Find the drag force on the boat.	*BT - 4*	*Analyse*
12.	a) Draw the FBD for the given figures below b) Find resultant of a force system shown in Figure	*BT - 4*	*Analyse*
13.	The resultant of forces which are acting at a point 0 as shown in figure 2 is along y - axis. The magnitude of forces F1, F3, and F4 are 10kN, 20kN	*BT - 4*	*Analyse*

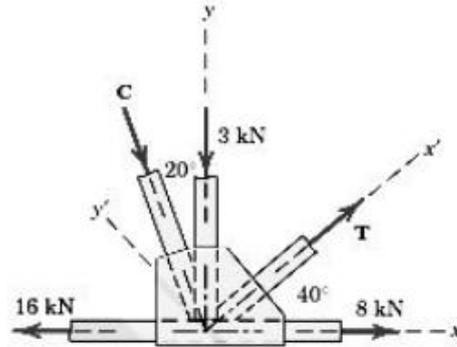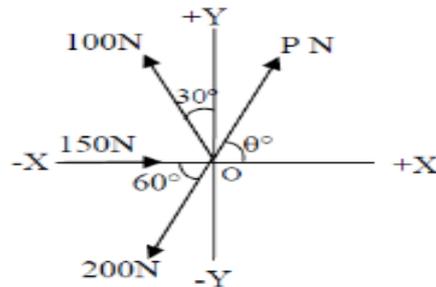|			
	and 40kN respectively, the angles made by 10kN , 20kN and 40kN with x - axis are 30°, 90° and 120° respectively. Find the magnitude and direction of force F2 if resultant is 72 kN. along y axis.		
14.	Determine the magnitude and direction of the resultant force for the system of forces shown below.	BT - 4	Analyse
15.	Find the magnitude of the force C and T which along with the other three forces act on the bridge truss joint as shown in figure below	BT - 4	Analyse
16.	A system of four forces shown in Fig. has resultant 50 kN along + X - axis. Determine magnitude and inclination of unknown force P.	BT - 4	Analyse
17.	a) A cylindrical roller 600mm diameter and weighing 1000 N is resting on a smooth inclined surface, tied firmly by a rope AC of length 600mm as shown in fig. Find tension in rope and reaction at B	BT - 4	Analyse
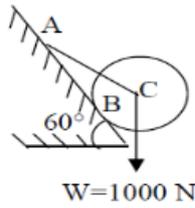
b) Find the magnitude of the force P, required to keep the 100 kg mass in the position by strings as shown in the Figure
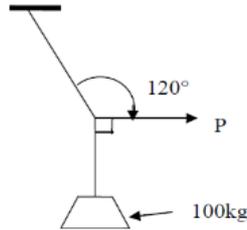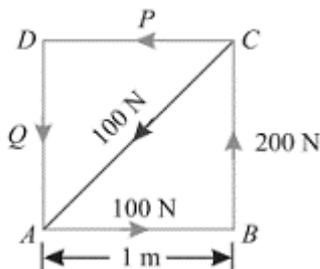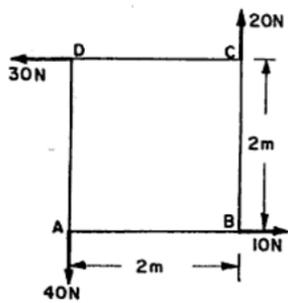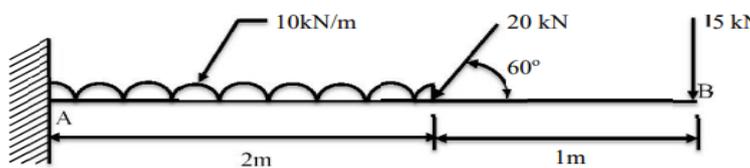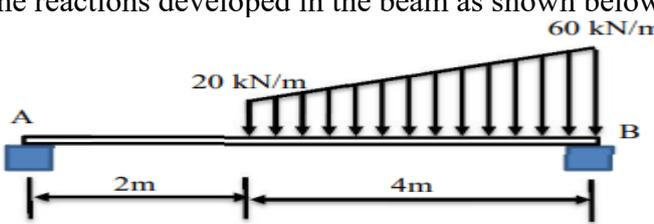

UNIT II - EQUILIBRIUM OF RIGID BODIES

Moment of a Force about a Point, Varignon's Theorem, Resolution of a Given Forces, Moment of a Forces & Couple, Equilibrium in Two and Three Dimensions - Reactions at Supports and Connections.

PART – A

| Q.NO	QUESTIONS	BT LEVEL	COMPETENCE
1.	State the difference between internal and external forces.	*BT - 1*	*Remember*
2.	Define equilibrium.	*BT - 1*	*Remember*
3.	State the difference between 3 force and 4 force equilibrium principles.	*BT - 1*	*Remember*
4.	What are the three equations of equilibrium?	*BT - 1*	*Remember*
5.	State Varignon's theorem.	*BT - 1*	*Remember*
6.	Distinguish between the resultant and equilibrant.	*BT - 2*	*Understand*
7.	How free body diagram constructed?	*BT - 1*	*Remember*
8.	Define couple.	*BT - 1*	*Remember*
9.	Define moment of a force.	*BT - 1*	*Remember*
10.	Distinguish between a couple and a moment.	*BT - 2*	*Understand*
11.	What are the necessary and sufficient conditions of equilibrium of rigid bodies in two dimensions and in three dimensions?	*BT - 1*	*Remember*
12.	Why the couple moment is said to be a free vector?	*BT - 1*	*Remember*
13.	Distinguish between scalar and vector quantity.		
14.	State the principle of resolution.	*BT - 1*	*Remember*
15.	Draw the free body diagram of a ladder of weight W, leaning against a smooth wall.	*BT - 2*	*Understand*
16.	What are the common types of supports used in two dimensions?	*BT - 1*	*Remember*
17.	What are the common types of supports used in three dimensions?	*BT - 1*	*Remember*
18.	What are the common types of loads?	*BT - 1*	*Remember*
19.	Sketch the types of supports used for a beam indicating the reactions in each case.	*BT - 2*	*Understand*
20.	Define a beam.	*BT - 1*	*Remember*

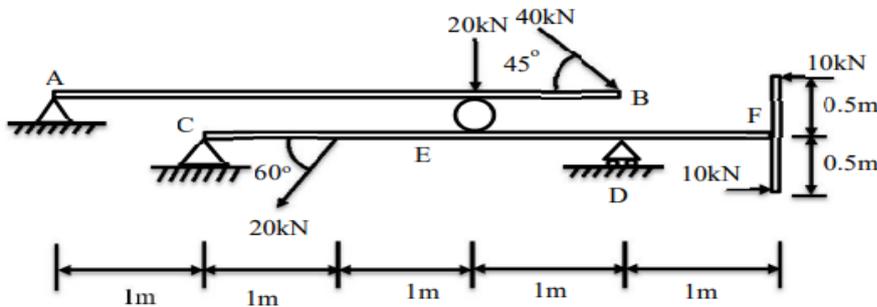| 21.	Define unit vector.	*BT - 1*	*Remember*
22.	A vector F starts at point (2, -1, 2) and passes through the point (-1, 3, 5) find its unit vector.	*BT - 3*	*Apply*
23.	Why the couple moment is said to be a free vector?	*BT - 1*	*Remember*
24.	What is the difference between a fixed vector and a free vector?	*BT - 1*	*Remember*

PART – B

Q.NO	QUESTIONS	BT LEVEL	COMPETENCE
1.	Write about different types of beams and loads with neat sketch.	*BT - 3*	*Apply*
2.	A square ABCD has forces acting along its sides as shown in Fig. Find the values of P and Q, if the system reduces to a couple. Also find magnitude of the couple, if the side of the square is 1 m.	*BT - 4*	*Analyse*
3.	Determine the resultant moment about point A for the figure shown below	*BT - 4*	*Analyse*
4.	a) Find the reactions developed in the cantilever beam as shown below b) Find the reactions developed in the beam as shown below	*BT - 4*	*Analyse*
5.	a) Find out the support reactions for the beam.	*BT - 4*	*Analyse*
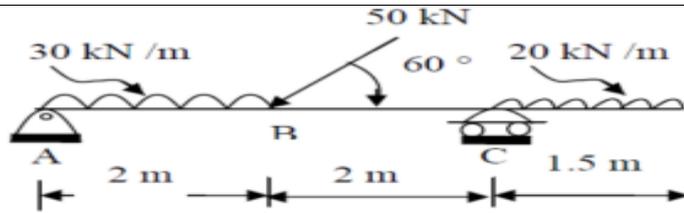
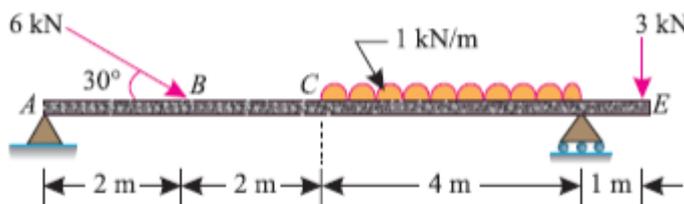**b)** Determine the reactions at support A and B for the beam loaded as shown in figure
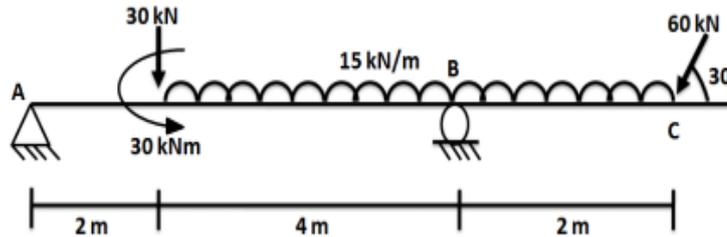
6.	The beam AB and CF are arranged as shown in fig. Find the reactions at A, C and D due to the loads acting on the beam	BT - 4	Analyse

7.	**a)** A beam ABCDE hinged at A and supported on rollers at D, is loaded as shown in Fig. Find the reactions at A and D.	BT - 4	Analyse

b) A simply supported beam AB of span 6 m is loaded as shown in Fig. Determine the reactions at A and B.
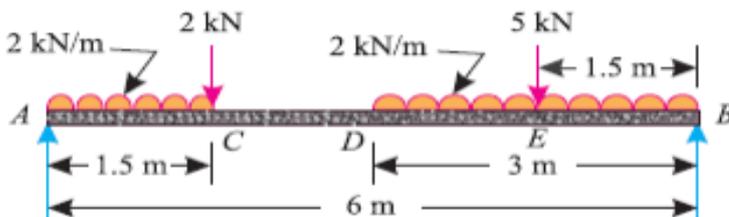
8.	**a)** Three forces of 2P, 3P and 4P act along the three sides of an equilateral triangle of side 100 mm taken in order. Find the magnitude and position of the resultant force.	BT - 4	Analyse

b) Find the reactions for the beam below

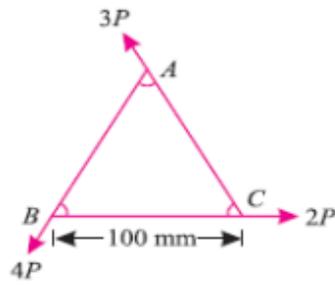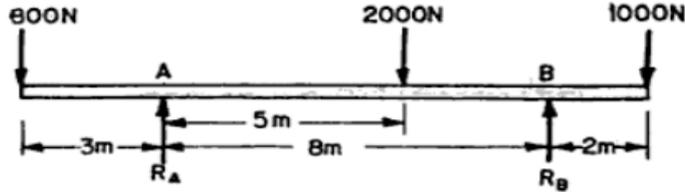| 9.	Find the support reactions for the beam shown below A B 	BT - 4	Analyse
10.	**a)** Determine the reaction for the beam shown below **b)** Determine the reaction for the beam shown below 	BT - 4	Analyse
11.	Find the reactions at supports for the L-Bent shown below.	BT - 4	Analyse
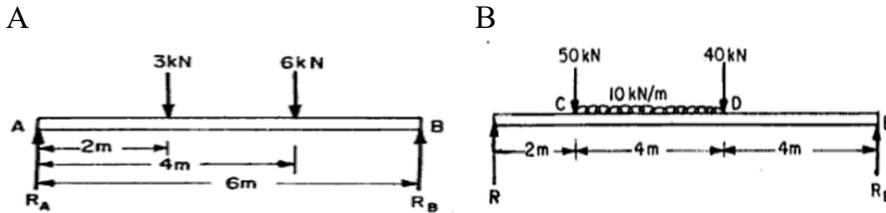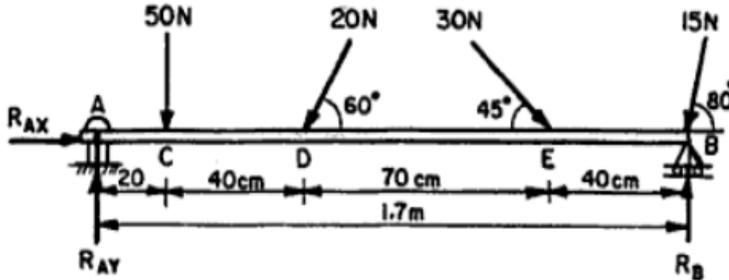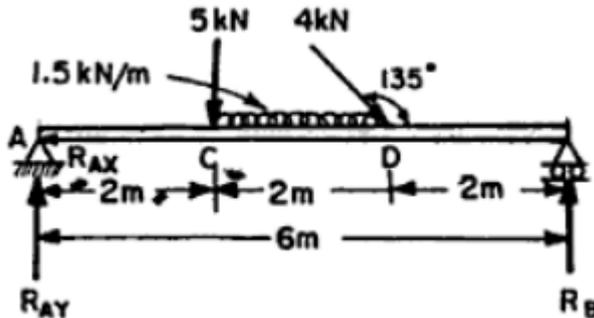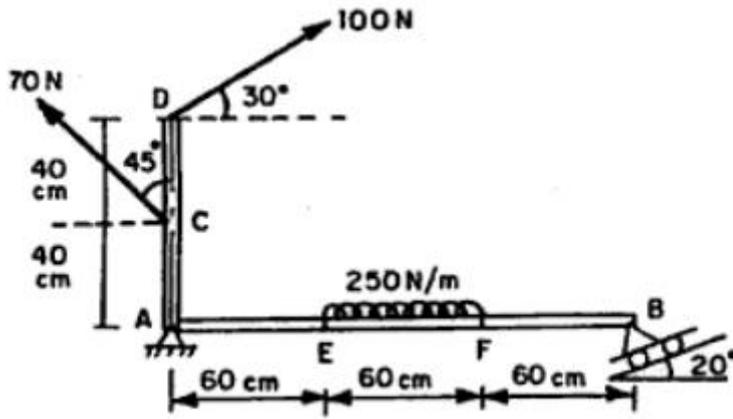
15.			
12.	Two spheres, each of weight 1000N and of radius 25cm rest in a horizontal channel of width 90cm as shown in figure. Find the reactions on the point of contact A, B, and C. 	BT - 4	Analyse
13.	Two identical rollers each of weight 65N are supported by an inclined plane and a vertical wall as shown in fig. Find the reactions at the points of supports A, B, C and between the spheres. Assume all the surfaces are smooth. 	BT - 4	Analyse
14.	Determine the reaction at A and C 	BT - 4	Analyse
15.	Determine the reaction at A, B and C	BT - 4	Analyse
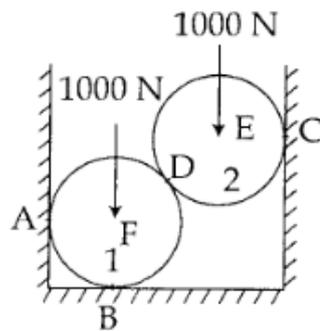
16.	Two cylinders P and Q rest in a channel as shown in Fig. The cylinder P has diameter of 100 mm and weighs 200 N, whereas the cylinder Q has diameter of 180 mm and weighs 500 N. If the bottom width of the box is 180 mm, with one side vertical and the other inclined at 60°, determine the pressures at all the four points of contact.	*BT - 4*	*Analyse*
17.	Two spheres of weight P and Q rest inside a hollow cylinder which is resting on a horizontal force. Draw the free body diagram of both the spheres, together and separately.	*BT - 3*	*Apply*

UNIT III - DISTRIBUTION AND TRANSFER OF LOADS IN BEAMS

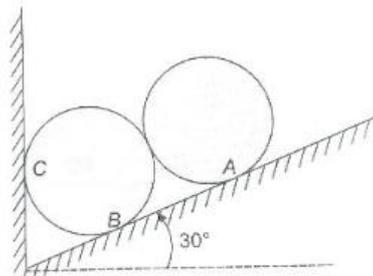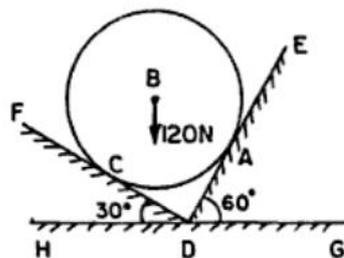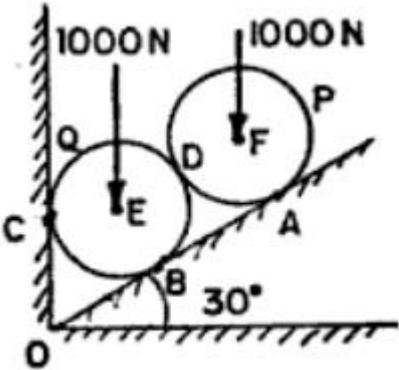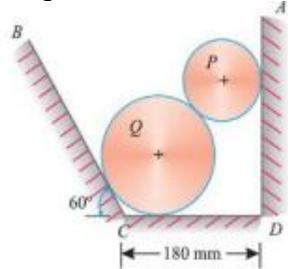*Centroids of lines and areas – symmetrical and unsymmetrical shapes, Distributed Loads on Beams, Centre of Gravity & Centroid of a Volume. Moments of Inertia of Areas - Polar Moment of Inertia, Radius of Gyration of an Area, Parallel & Perpendicular axis Theorem. Stresses in simple and compound bars – Elastic constants.*

PART – A

Q.NO	QUESTIONS	BT LEVEL	COMPETENCE
1.	Define Centre of Gravity & Centre of mass	*BT - 1*	*Remember*
2.	Define Centroid.	*BT - 1*	*Remember*
3.	Distinguish between centroid and centre of gravity.	*BT - 2*	*Understand*
4.	When centroid and centre of mass coincide?	*BT - 1*	*Remember*
5.	Mention the methods of determining the centre of gravity.	*BT - 1*	*Remember*
6.	State the Pappus and Guldinus area theorem.	*BT - 1*	*Remember*
7.	State the Pappus and Guldinus volume theorem.	*BT - 1*	*Remember*
8.	Define Radius of gyration.	*BT - 1*	*Remember*
9.	Distinguish between reference axes and centroidal axes.		
10.	Tell about Axis of Symmetry.	*BT - 1*	*Remember*

11.	Define polar moment of inertia.	*BT - 1*	*Remember*
12.	State parallel axis theorem.	*BT - 1*	*Remember*
13.	State perpendicular axis theorem.	*BT - 1*	*Remember*
14.	Write the formula of Moment of interia of Circular and semi-circular section.	*BT - 3*	*Apply*
15.	Write the formula of Moment of interia of triangular section.	*BT - 3*	*Apply*
16.	State Hooke's Law.	*BT - 1*	*Remember*
17.	Define stress & strain.	*BT - 1*	*Remember*
18.	Recall Poisson's ratio.	*BT - 1*	*Remember*
19.	Distinguish Lateral strain and Longitudinal strain.	*BT - 2*	*Understand*
20.	Show the different types of stress and strain.	*BT - 1*	*Remember*
21.	Give the relationship between Elastic constants (3 Modulus).	*BT - 1*	*Remember*
22.	Relate Elasticity and Plasticity.	*BT - 2*	*Understand*
23.	Distinguish between malleability and ductility.	*BT - 2*	*Understand*
24.	Outline Principle of superposition.	*BT - 1*	*Remember*

PART – B

Q.NO	QUESTIONS	BT LEVEL	COMPETENCE
1.	Determine co-ordinates of centroid with respect to 'o' of the section as shown in figure.	*BT - 4*	*Analyse*
2.	a) Find the centre of gravity of a channel section of size 100 mm × 50 mm × 15 mm. b) A body consists of a right circular solid cone of height 40 mm and radius 30 mm placed on a solid hemisphere of radius 30 mm of the same material. Find the position of centre of gravity of the body.	*BT - 4*	*Analyse*
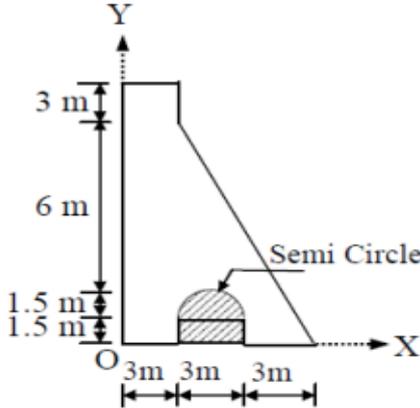
3.	**a)** Find the centre of gravity of a 100mm x 150mm x 30mm of T section.	*BT - 4*	*Analyse*
	b) Locate the centroid of the shaded area.		
	 Dimensions in millimeters		
4.	**a)** A semicircle of 90 mm radius is cut out from a trapezium as shown in Figure. Find the position of the centre of gravity of the figure	*BT - 4*	*Analyse*
	b) Find the centroid of an unequal angle section 100mm x 80mm x 20mm.		
5.	**a)** An I-section has the following dimensions in mm units : Bottom flange = 300 × 100 Top flange = 150 × 50, Web = 300 × 50. Determine mathematically the position of centre of gravity of the section.	*BT - 4*	*Analyse*
	b) Give the formula of Moment of interia of rectangular and hollow rectangular section.		
6.	**a)** Find the moment of inertia of a hollow rectangular section about its centre of gravity if the external dimensions are breadth 60 mm, depth 80 mm and internal dimensions are breadth 30 mm and depth 40 mm respectively.	*BT - 4*	*Analyse*
	b) Find the moment of inertia of a circular section of 50 mm diameter about an axis passing through its centre.		
	c) A hollow circular section has an external diameter of 80 mm and internal diameter of 60 mm. Find its moment of inertia about the horizontal axis passing through its centre.		
7.	**a)** A hollow triangular section shown in Fig is symmetrical about its vertical axis. Find the moment of inertia of the section.	*BT - 4*	*Analyse*
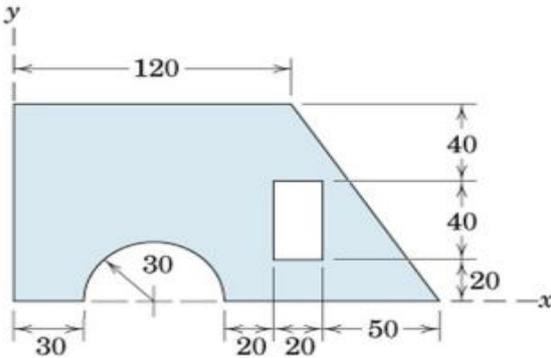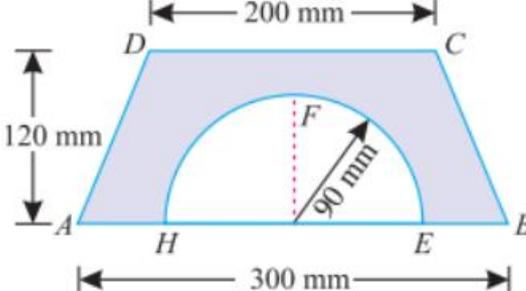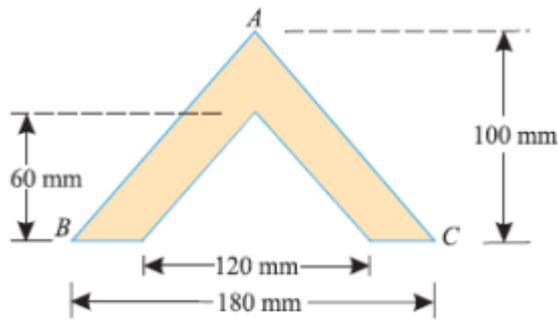
b) A hollow semi circular section has its outer and inner diameter of 200 mm and 120 mm respectively as shown in Fig. What is its moment of inertia about the base AB?
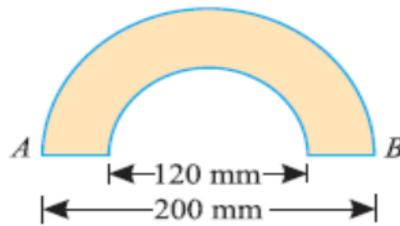
8.	An I-section is made up of three rectangles as shown in Fig. Find the moment of inertia of the section about the horizontal axis passing through the centre of gravity of the section.	BT - 4	*Analyse*
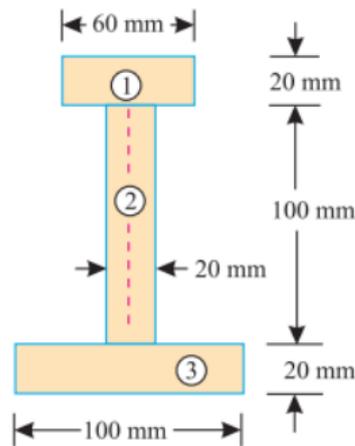
9.	Find the moment of inertia about the centroidal X-X and Y-Y axes of the angle section shown in Figure	BT - 4	*Analyse*

10.	Find out moment of inertia at horizontal and vertical centroid axes of the given lamina.	BT - 4	Analyse
11.	**a)** A steel bar of 40 mm × 40 mm square cross-section is subjected to an axial compressive load of 200 kN. If the length of the bar is 2 m and E = 200 GPa, Estimate the elongation of the bar. **b)** A Member ABCD is subjected to point loads P1, P2, P and P4 as shown in Fig	BT - 4	Analyse
12.	**a)** A brass bar, having cross-sectional area of 1000 mm^2 , is subjected to axial forces as shown in Fig. **b)** A circular rod of diameter 16 mm and 500 mm long is subjected to a tensile force 40 kN. The modulus of elasticity for steel may be taken as 200 kN/mm^2. Identify the stress, strain and elongation in the bar due to applied load.	BT - 4	Analyse
13.	**a)** A rod 150cm long and of diameter 2.0cm is subjected to an axial pull of 20 kN. If the modulus of elasticity of the material of the rod is 2 x 10^5 N/mm^2, determine: (i) the stress (ii) the strain, and (iii) the elongation of the rods. **b)** Find the minimum diameter of a steel wire, which is used to raise σ load of 4000 N if the stress in the rod is not to exceed 95MN/m^2	BT - 4	Analyse
14.	**a)** A prismatic bar has a cross-section of 25 mm x 50 mm and a length of 2 m. Under an axial tensile force of 90 kN, the measured elongation of the bar is 1.5 mm. Evaluate the tensile stress and strain in the bar.	BT - 4	Analyse
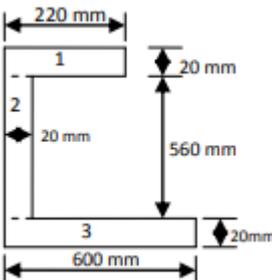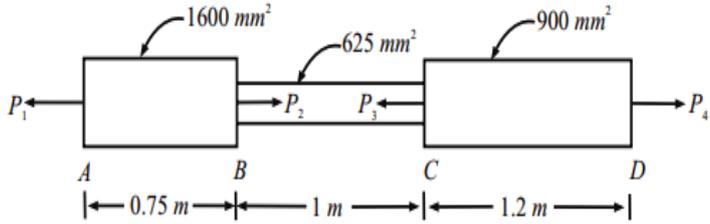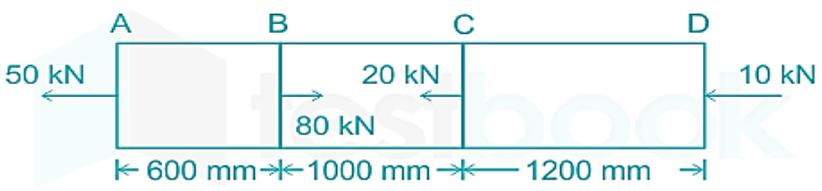
	b) The bar shown in figure is tested in universal testing machine. It is observed that at a load of 40 kN the total extension of the bar is 0.280 mm. Determine the Young's modulus of the material. 		
15.	A bar of 25mm diameter is subjected to a pull of 40kN. The measured extension on gauge length of 200mm is 0.085mm and the change in diameter is 0.003mm. Estimate the values of Poisson's ratio and the three moduli.	*BT - 4*	*Analyse*
16.	Estimate the values of change in length, breadth and thickness of a steel bar 4.2m long, 35mm wide and 25mm thick. When subjected to an axial pull of 130kN in the direction of its length. Take E=200Gpa and poisson's ratio = 0.3.	*BT - 4*	*Analyse*
17.	A bar of 25 mm diameter is tested in tension. It is observed that when a load of 60 kN is applied, the extension measured over a gauge length of 200 mm is 0.12 mm and contraction in diameter is 0.0045 mm. Examine the Poisson's ratio and elastic constants E, G, K.	*BT - 4*	*Analyse*
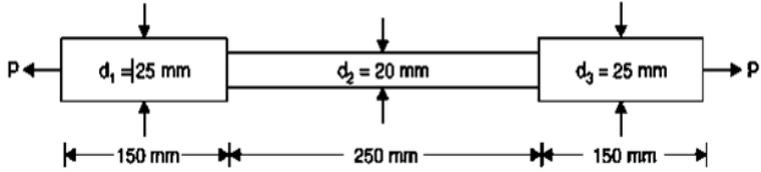
UNIT IV - BENDING OF BEAMS

Types of beams and transverse loadings, Shear force and bending moment for simply supported, cantilever and over-hanging beams. Theory of simple bending – Bending stress distribution – Shear stress distribution.

PART – A

Q.NO	QUESTIONS	BT LEVEL	COMPETENCE
1.	What is a Beam?	*BT - 1*	*Remember*
2.	What are the different types of beams?	*BT - 1*	*Remember*
3.	List out the types of load acting on a beam.	*BT - 1*	*Remember*
4.	Outline a fixed beam.	*BT - 1*	*Remember*
5.	Define Shear force and Bending moment.	*BT - 1*	*Remember*
6.	Sketch the SFD and BMD line pattern for various loads	*BT - 1*	*Remember*
7.	Sketch the types of supports used for a beam indicating the reactions in each case	*BT - 1*	*Remember*
8.	Compare hogging and sagging bending moment.	*BT - 2*	*Understand*
9.	Infer about point of contra flexure?	*BT - 1*	*Remember*
10.	Compose the SFD and Bending moment diagram for a cantilever beam carrying a point load at its free end.	*BT - 2*	*Understand*
11.	Compose the shape of the bending moment diagram for a uniform cantilever beam carrying a uniformly distributed load over its length.	*BT - 2*	*Understand*
12.	Compose and label the shear force and bending moment diagram for the cantilever beam carrying uniformly varying	*BT - 2*	*Understand*

	load of zero intensity at the free end and w kN/m at the fixed end.		
13.	Draw the shape of the bending moment diagram for a uniform SS beam carrying a uniformly distributed load over its length.	BT - 2	Understand
14.	Draw the shape of the bending moment diagram for a SS beam carrying a concentrated load at centre.	BT - 2	Understand
15.	Evaluate SFD for a 6m cantilever beam carrying a clockwise moment of 6 kN-m at its free end.	BT - 2	Understand
16.	A concentrated load of P acts on a simply supported beam of span L at a distance L/3 from the left support. Inspect for the bending moment at the point of application of the load?	BT - 2	Understand
17.	Solve and sketch SFD for a cantilever beam of length 2 m carries the point loads of 800N at its free end, 600N at 0.8 m and 300N at 1.5 m from its free end.	BT - 2	Understand
18.	List the assumptions used to in theory of simple bending	BT - 1	Remember
19.	Recall the Theory of Bending Equation.	BT - 1	Remember
20.	What are Flitched Beams?	BT - 1	Remember
21.	Define section modulus	BT - 1	Remember
22.	Find the section modulus of a circular section whose section diameter is 28 mm.	BT - 2	Understand
23.	Find out the maximum bending stress of a simply supported beam of span length 6m and 75mm diameter carrying a uniformly distributed load of 1.5 kN/m	BT - 2	Understand
24.	A pipe of external diameter 3 cm and internal diameter 2 cm and of length 4 m is supported at its ends. It carries a point load of 65 N at its Centre. What will be its sectional modulus?	BT - 2	Understand

PART B

Q.NO	QUESTIONS	BT LEVEL	COMPETENCE
1.	A cantilever beam of 2 m long carries a uniformly distributed load of 1.5 kN/m over a length of 1.6 m from the free end. Draw shear force and bending moment diagrams for the beam.	BT - 4	Analyse
2.	Predict SF and BM at A,B,C & D for the beam shown	BT - 4	Analyse
3.	Figure out the SF and BM for the beam shown	BT - 4	Analyse
4.	For the beam shown below solve for the reactions and B.M	BT - 4	Analyse
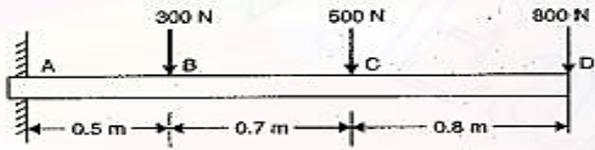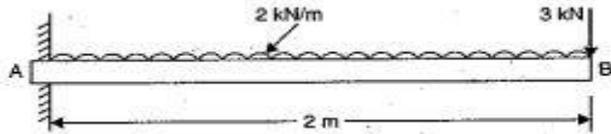
5.	For a SSB shown, Estimate the reaction & B.M at A,B & C	BT - 4	Analyse
6.	The intensity of loading on a simply supported beam of 7m span increases gradually from 8.25kN/m run at one end to 2.5kN/m run at the other end. Find the position and the amount of maximum bending moment. Also Sketch the Shear force and bending moment diagram.	BT - 4	Analyse
7.	For a SSB shown, sketch the SFD and BMD	BT - 4	Analyse
8.	A simply supported beam of 9 m span is as shown in figure given below. Draw the B.M and S.F diagram indicating principal values.	BT - 4	Analyse
9.	Derive an expression for shear force and bending moment of a simply supported beam carrying a UDL of w/metre length throughout its span with neat sketch	BT - 4	Analyse
10.	Sketch the SFD and BMD for the overhanging beam shown below	BT - 4	Analyse
11.	Develop SFD and BMD for the beam shown	BT - 4	Analyse
12.	Develop SFD and BMD for the beam shown	BT - 4	Analyse

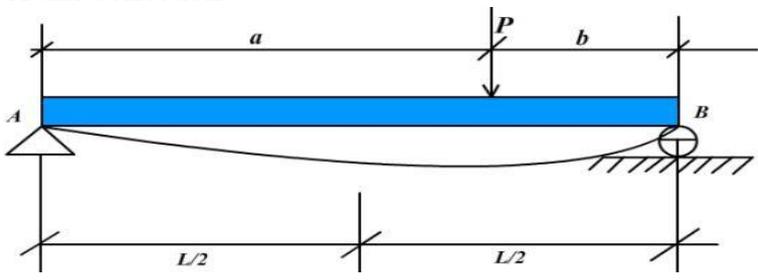| 13.	Develop the section modulus for
	    (a) Rectangular
	    (b) Hollow rectangular
	    (c) Circular
	    (d) Hollow circular
		BT - 4	Analyse

14.	A simply supported beam of span 4m carries a udl of 6kN/m over the entire span. If the maximum allowable stress due to bending is restricted to 150 N/mm², Evaluate the cross sectional dimensions if the section is
	    (i) Rectangular with depth twice the breadth
	    (ii) Solid circular section
	    (iii) Hollow circular section having a diameter ratio of 0.6
		BT - 4	Analyse

15.	A flitched beam consists of two timber joist 100mm wide and 240mm deep with a steel plate 180mm deep and 10mm thick placed symmetrically between the timber joists and well clamped. Formulate
	    (i) The maximum fibre stress when the maximum fibre stress in wood is 80 kg/cm².
	    (ii) The combined moment of resistance if the modular ratio is 18
		BT - 4	Analyse

16.	The cross section of T beam is as follows:
	    • Flange thickness = 10mm
	    • width of the flange = 100mm
	    • thickness of the web = 10mm
	    • depth of the web = 120mm
	If a shear force of 2kN is acting at a particular section of the beam. Analyze for shear stress distribution across the section.
		BT - 4	Analyse

17.	Derive the expression for theory of simple bending.	BT - 4	Analyse
18.	(a) A rectangular beam 300 mm deep is simply supported over the span of 4 m. Determine the uniformly distributed load per metre which the beam may carry, if the bending stress should not exceed 120N/mm². Take I=8×10⁴ mm⁴ (b) A simply supported beam of span 6m is subjected to a UDL of 15kN/m over its entire length. The cross section of beam is 20 cm wide and 30cm deep. Sketch the variation of bending stress and shear stress in the beam cross section	BT - 4	Analyse

UNIT V - DEFLECTION

Double Integration method – Macaulay's method –Moment Area method – Conjugate beam method - Strain energy methods for determinate beams.
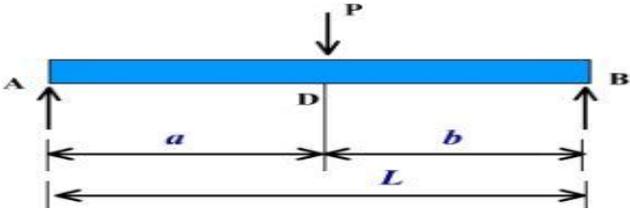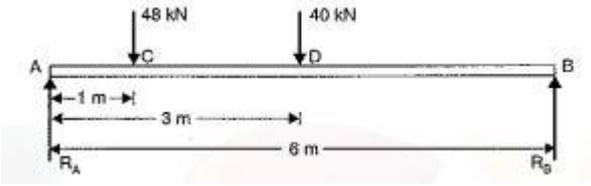
PART – A
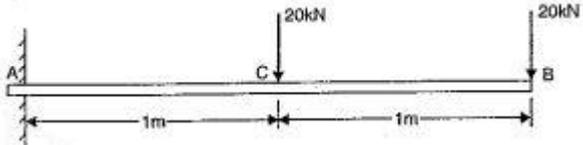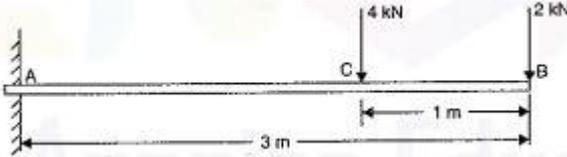
Q.NO	QUESTIONS	BT LEVEL	COMPETENCE
1.	What is meant by deflection of a beam with a neat sketch?	BT - 1	Remember
2.	Recall the methods for finding out the slope and deflection at a section?	BT - 1	Remember
3.	Recall method of Singularity functions.	BT - 1	Remember
4.	State the two theorems in moment area method.	BT - 1	Remember
5.	Give the differential relation between bending moment, slope and the deflection.	BT - 1	Remember
6.	Write the maximum slope and maximum deflection of a cantilever beam subjected to UDL	BT - 1	Remember
7.	Identify the values of slope and deflection for a cantilever beam of length 'L' subjected to Moment 'M' at the free end.	BT - 1	Remember
8.	Distinguish between statically determinate and indeterminate beams.	BT - 2	Understand
9.	Formulate the slope at the support for a simply supported beam of length L, constant EI and carrying central concentrated load.	BT - 3	Apply
10.	State the theorems of conjugate beam method.	BT - 1	Remember
11.	Write the maximum value of deflection for a cantilever beam of length L, constant EI and carrying concentrated load W at the end.	BT - 3	Apply
12.	Draw conjugate beam for a cantilever beam fixed at the right end.	BT - 3	Apply
13.	A cantilever beam of length "l" is subjected to a concentrated load P at a distance of l/3 from the free end. What is the deflection of the free end of the beam?	BT - 3	Apply
14.	A simply supported beam with width 'b' and depth "d" carries a central load W and undergoes deflection δ at the centre. If the width and depth are interchanged, what will be the deflection at the centre of the beam?	BT - 3	Apply
15.	A simply supported beam carrying a concentrated load W at its mid-span deflects by δ_1 under the load. If the same beam carries the load such that it is distributed uniformly over the entire length and undergoes a deflection δ_2 at mid-span. What is the ratio of $\delta_1 : \delta_2$?	BT - 3	Apply
16.	Write down the formula used to find the deflection of beam by Moment-Area method.	BT - 3	Apply
17.	Among 4 methods of analysing the beams for deflection and slope, relate the situations when each method is used.	BT - 3	Apply
18.	Distinguish between actual beam and conjugate beam.	BT - 2	Understand
19.	When do you prefer the Moment area method?	BT - 1	Remember
20.	Determine the slope and deflection of a cantilever beam with a point load at free end by using Mohr's Theorem.	BT - 3	Apply
21.	A simply supported beam of length 4 m and rectangular cross section 2 cm × 8 cm carries a uniform load of 2000 N/m. The beam is titanium, having E = 100 GPa. Solve for the maximum deflection of the beam if the 8-cm dimension is vertical.	BT - 3	Apply

22.	Tell when Macaulay's method is preferred?	BT - 1	Remember
23.	A simply supported beam, loaded at the midpoint, is 4 m long and of circular cross section of 10 cm in diameter. If the maximum permissible deflection is 5 mm, determine the maximum value of the load P. The material is steel for which E = 200 GPa.	BT - 3	Apply
24.	Tell when conjugate method is preferred?	BT - 1	Remember

PART B

Q.NO	QUESTIONS	BT LEVEL	COMPETENCE
1.	Derive an expression for slope and deflection of a cantilever beam carrying point load at free end	BT - 4	Analyse
2.	Derive an expression for slope & deflection of a simply supported beam carrying UDL throughout its span	BT - 4	Analyse
3.	Obtain an expression for Slope and deflection of a simply supported beam carrying point load at mid-span	BT - 4	Analyse
4.	A beam of length 5 m is simply supported at its ends and carries two point loads of 47 kN and 30 kN at a distance of 1.1 m and 3.2 m respectively from the left support. Solve for (i) Deflection under each load (ii) Maximum deflection (iii) The point at which the maximum deflection occurs Take I=85×10⁶ mm⁴ E = 2×10⁵ N/mm²	BT - 4	Analyse
5.	A steel cantilever beam of 6m long carries 2 point loads 15KN at the free end and 25KN at the distance of 2.5m from the free end. To determine the slope at free end & also deflection at free end I = 1.3x10⁸mm⁴. E = 2x10⁵ N/mm²	BT - 4	Analyse
6.	A simply supported prismatic beam AB carries a concentrated load P as shown in the figure. Locate the point of maximum deflection on the elastic line and find the value of this deflection. 	BT - 4	Analyse
7.	A simply supported beam AB carries a concentrated load P at point D as shown in figure. Find the deflection d of point D from the cord line and the tangent at A . Use Moment Area method.	BT - 4	Analyse

8.	Solve for the deflection of the beam shown below $I = 85 \times 10^5 \text{mm}^4$. $E = 2 \times 10^5 \text{ N/mm}^2$ 	BT - 4	Analyse
9.	Solve for the deflection of the beam shown below by moment area method 	BT - 4	Analyse
10.	Solve for the deflection of the beam shown below $I = 10^8 \text{mm}^4$. $E = 2 \times 10^5 \text{ N/mm}^2$ 	BT - 4	Analyse
11.	A beam of length 5 m and of uniform rectangular section is supported at its ends and carries uniformly distributed load over the entire length. Calculate the depth of the section if the maximum permissible bending stress is 8 N/mm^2 and the central deflection is not to exceed 10 mm.	BT - 4	Analyse
12.	Differentiate between actual beam and conjugate beam	BT - 4	Analyse
13.	Using the moment area method, determine the slope at B and C and deflection at C of the cantilever beam as shown in Figure. The beam is subjected to uniformly distributed load over entire length and point load at the free end 	BT - 4	Analyse
14.	Determine the slope and deflection of point A of the of a cantilever beam AB of length L and uniform flexural rigidity EI. A concentrated force P is applied at the free end of beam. Use conjugate beam method.	BT - 4	Analyse
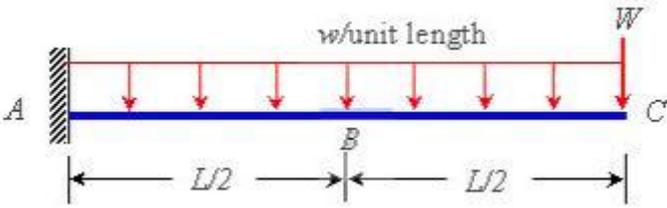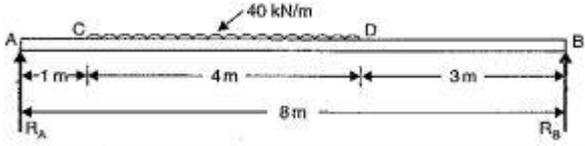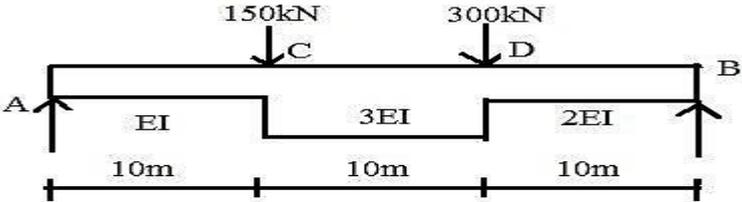
15.	Solve for the deflection of the beam shown below $I = 4.3 \times 10^8 mm^4$. $E = 2 \times 10^5 N/mm^2$	BT - 4	*Analyse*
16.	Using conjugate beam method, obtain the slope and deflections at A, B, C and D of the beam shown in fig. Take $E = 200GPa$ and $I = 2 \times 10^{-2} m^4$.	BT - 4	*Analyse*
17.	Using conjugate beam method, obtain the slope and deflections at each end and centre.	BT - 4	*Analyse*