SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF AGRICULTURE ENGINEERING

QUESTION BANK

IV SEMESTER

1902403 – STRENGTH OF MATERIALS

Regulation – 2019

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Prepared by

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SRM VALLIAMMAI ENGINEERING COLLEGE

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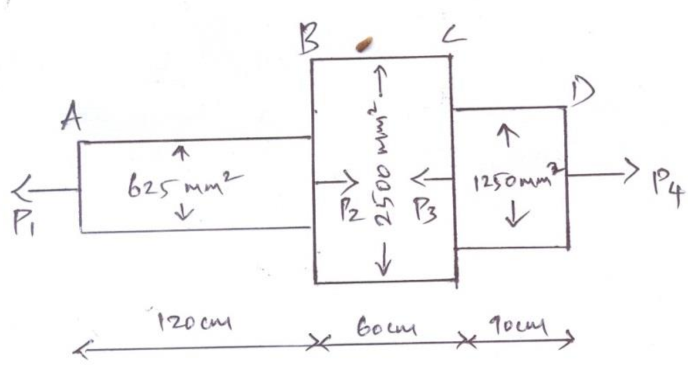
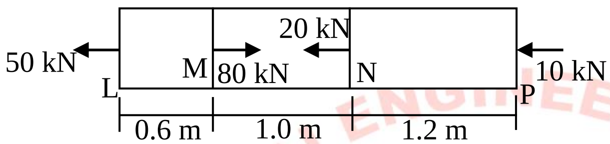
SUBJECT CODE/NAME: 1902403- STRENGTH OF MATERIALS

SEM/YEAR : IV / II YEAR

UNIT-I: STRESS, STRAIN AND DEFORMATION OF SOLIDS			
Rigid bodies and deformable solids - Tension, Compression and Shear Stresses - Deformation of simple and compound bars - Thermal stresses - Elastic constants - Volumetric strains - Thin shells - circumferential and longitudinal stresses in thin cylinders - Deformation of thin cylinder - Stresses in spherical shells - Deformation of spherical shells.			
PART A			
Q.NO	**QUESTIONS**	**BT LEVEL**	**COMPETENCE**
1.	Define young modulus.	BT-1	Remembering
2.	State Hooke's law.	BT-2	Understanding
3.	Recall modular ratio & Poisson's ratio.	BT-3	Applying
4.	Explain longitudinal strain and lateral strain with a neat sketch.	BT-3	Applying
5.	What do you mean by Stress?	BT-1	Remembering
6.	Discuss the relationship between Elastic Constants	BT-2	Understanding
7.	An alloy bar of 1m length has a square section throughout which tapers from one end of 10mmx10mm to other end of 20x20mm. Find the change in length due to an axial load of 30kN. Take E=120GPa.	BT-4	Analysis
8.	Discuss about thermal stresses.	BT-2	Understanding
9.	Define strain.	BT-2	Understanding
10.	Relate shear stress and shear strain.	BT-6	Creating
11.	Determine the Poisson's ratio and bulk modulus of a material for which young's modulus is 1.2 x 10^5N/mm^2 and modulus of rigidity is 4.8 x 10^4 N/mm^2.	BT-4	Analysis
12.	A brass rod 2m long is fixed at both its ends. If the thermal stress is not to exceed 76.5N/mm^2. Calculate the temperature through which the rod should be heated. Take the values of α= 17x10^{-6}/K and E =90Gpa.	BT-4	Analysis
13.	Differentiate thin cylinder & thick cylinder	BT-6	Creating

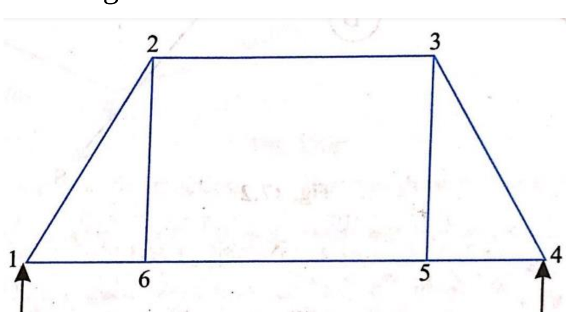
14.	What do you understand by the term wire winding of thin cylinder?	BT-6	Creating
15.	Sketch the stress-strain diagram for TOR Steel/HYSD bars and mark the salient points.	BT-4	Analysis
16.	Define the term limit of proportionality elastic limit and yield point.	BT-1	Remembering
17.	Define the terms a) resilience b) proof resilience c) modulus of resilience	BT-1	Remembering
18.	Summarize the procedure for finding the thermal stresses in a composite bar?	BT-5	Evaluating
19.	List the types of stresses developed in thin cylinders subjected to internal pressure?	BT-1	Remembering
20.	Distinguish between cylindrical shell and spherical shell.	BT-5	Evaluating
21.	What is meant by the term bulk modulus?	BT-3	Applying
22.	Distinguish between Rigid Bodies and Deformable Bodies.	BT-5	Evaluating
23.	Define shear modulus.	BT-2	Understanding
24.	Write down the formula for Maximum shear stress in thin cylinders.	BT-3	Applying
25.	Define Hoop stress.	BT-1	Remembering
	PART B		
1.	A tensile test was conducted on a mild steel bar. The following data was obtained from the test: (i) Diameter of the steel bar = 4 cm (ii) Gauge length of the bar = 22 cm (iii) Load at elastic limit = 250 kN (iv) Extension at a load of 160 kN = 0.235 mm (v) Maximum load = 390 kN (vi) Total extension = 70 mm (vii) Diameter of rod at failure = 2.35 cm Determine the Young's modulus, the stress at elastic limit, the percentage of elongation & the percentage decrease in area.	BT-1	Remembering
2.	A member ABCD is subjected to point loads P_1, P_2, P_3 and P_4 as shown. Find P_2 required for necessary equilibrium, if P_1 = 45kN, P_3 = 450kN and P_4=130kN. Determine the total elongation of the member.  	BT-5	Evaluating

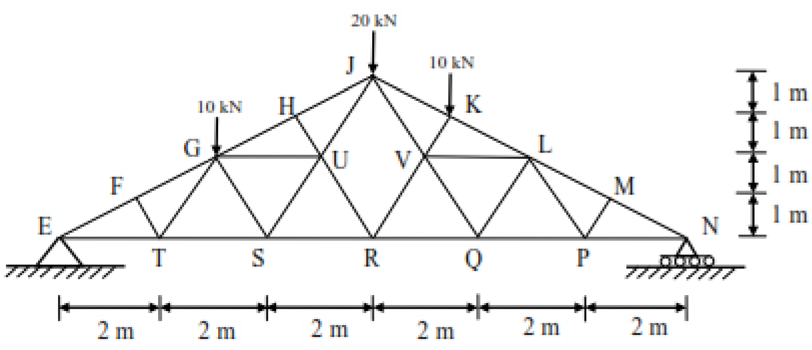
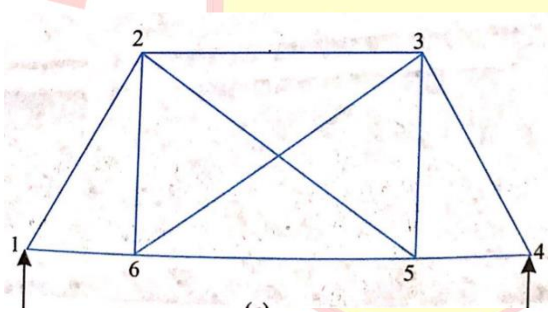
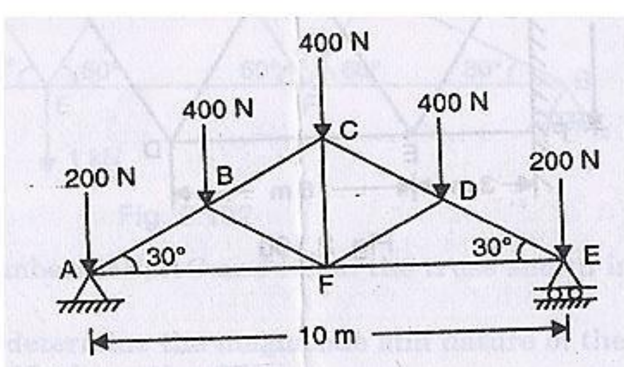
3.	Estimate the values of change in length, breadth and thickness of a steel bar 4.2m long, 35mm wide and 25mm thick. When subjected to an axial pull of 130kN in the direction of its length. Take E=200Gpa and poisson's ratio = 0.3	BT-1	Remembering
4.	Three bars made of copper, zinc and aluminium are of equal length and have cross section 555, 705, and 1020 sq.mm respectively. They are rigidly connected at their ends. If this compound member is subjected to a longitudinal pull of 255kN, estimate the proportional of the load carried on each rod and the induced stresses. Take the value of E for copper = 1.3×10^{5} N/mm^2, for zinc = 1×10^5 N/mm^2 and for aluminium = 0.8×10^5 N/mm^2	BT-2	Understanding
5.	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-2	Understanding
6.	**i)** Obtain a relation for change in length of a bar hanging freely under its own weight. (7) **ii)** Derive the relationship between modulus of elasticity and modulus of rigidity. (6)	BT-1	Remembering
7.	A cylindrical vessel, whose ends are closed by means of rigid flange plates, is made up of steel plate 3 mm thick. The length and internal diameter of the vessel are 55 cm and 25.5 cm respectively. Determine the longitudinal and hoop stresses in the cylindrical shell due to an internal fluid pressure of 3.5 N/mm^2. Also calculate the increase in length, diameter and volume of vessel. Take E = 2×10^5 N/mm^2 and μ=0.3.	BT-3	Applying
8.	**i)** Draw stress – strain diagram for mild steel, brittle material and a ductile material and indicate salient points. (8) **ii)** A circular alloy bar 2m long uniformly tapers from 30mm diameter to 20mm diameter. Calculate the elongation of the rod under the axial force of 50kN. Take E=140GPa (5)	BT-5	Evaluating
9.	**i)**A steel flat plate of thickness 10mm tapers uniformly from 60mm at one end to 40mm at the other end in a length of 600mm. if the bar is subjected to a load of 60kN find the extension take E=205 Mpa. (6) **ii)** Derive the relationship between bulk modulus and young's modulus. (7)	BT-4	Analyzing
10.	A square steel bar 50 mm on a side and 1 m long is subject to an axial tensile force of 250 kN. Determine the decrease Δt in the lateral dimension due to this load. Use E = 200 GPa and Poisson's ratio is 0.3	BT-6	Creating
11.	A steel rod of 3.6cm diameter and 5m long is connected to two grips and the rod is maintained at a temperature of 105^{o}C. Determine the stress and pull exerted when the temperature falls to 40^{o}C if, **a)** The ends do not yield **b)** The ends yield by 0.13cm	BT-5	Evaluating

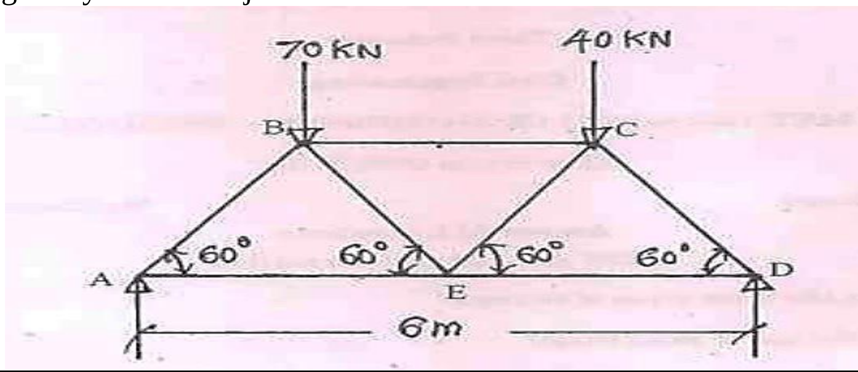
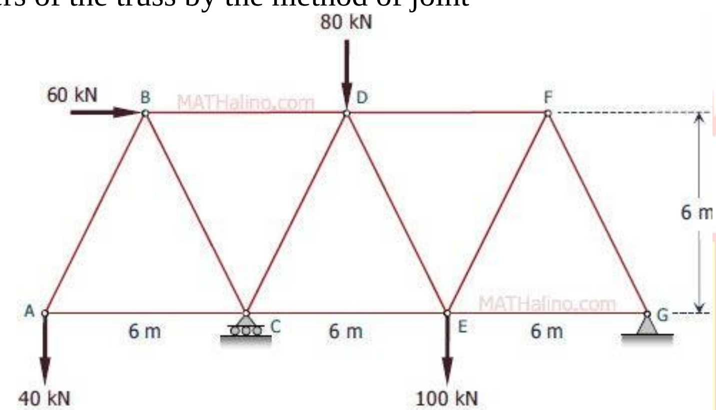
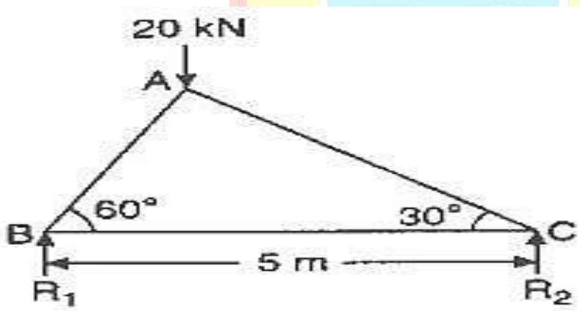
12.	A spherical shell of 1.5 m diameter has 1 cm thick wall. Determine the pressure that can increase its volume by 100 cm^3. Take: E= 200 GN/m^2 ; 1/m=0.3	BT-3	Applying
13.	A copper tube 30 mm bore and 3 mm thick is plugged at its ends. It is just filled with water at atmospheric pressure. If an axial compressive load of 8 kN is applied to the plugs, find by how much the water pressure will increase? The plugs are assumed to be rigid and fixed to the tube. Take: E= 100 GN/m^2; Bulk modulus= 2.2 GN/m^2; Poisson's ratio= 0.33	BT-4	Analyzing
14.	A brass bar having cross-sectional area of 1000 mm2 is subjected to axial forces as shown in the figure. 	BT-6	Creating
	PART C		
1.	A steel bar is placed between two copper bars, each having the same area and length as steel bar at 20°C. At this stage, they are rigidly connected together at both the ends. When the temperature is raised to 320°C, the length of the bars increases by 1.5 mm. Determine the original length and final stresses in the bars. Take: Es= 220 GN/m^2; Ec= 110 $GN/^{m2}$ α_s=0.000012 per °C α_c= 0.0000175 per °C	BT-2	Understanding
2.	A steel wire 2 m long and 3 mm in diameter is extended by 0.75 mm when a weight W is suspended from the wire. If the same weight is suspended from a brass wire, 2.5 m long and 2 mm in diameter, it is elongated by 4.64 mm. Determine the modulus of elasiticity of brass if that of steel be 2.0 x 10^5 N/mm^2.	BT-1	Remembering
3.	A steel tube of 30mm external diameter and 20mm internal diameter encloses a copper rod of 15.5mm diameter to which it is rigidly joined at each end. If, at a temperature of 10°C there is no longitudinal stress, calculate the stresses in the rod and the tube when the temperature is raised to 200°C. Take Es = 2.1x10^5 N/mm^2 and Ec = 1x10^5 N/mm^2 Co-efficient of linear expansion 11x10^{-6} per °C and 18x10^{-6} per °C	BT-3	Applying
4.	A thin spherical shell 1.5 m diameter, with its wall of 1.25 cm thickness is filled with the fluid at atmospheric pressure. What intensity of pressure will be developed in it if 160 cm3 more fluid is pumped into it? Also calculate the hoop stress at that pressure and increase in diameter. Take: E= 200 GN/m^2 ; m=10/3	BT-6	Creating
	UNIT-II: ANALYSIS OF PLANE TRUSSES		
	Determinate and indeterminate plane trusses - Determination of member forces by method of joints, method of sections		

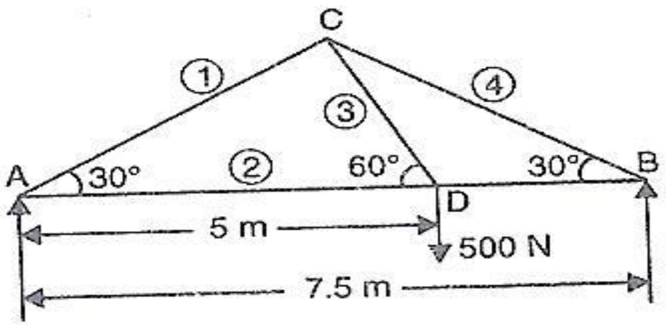
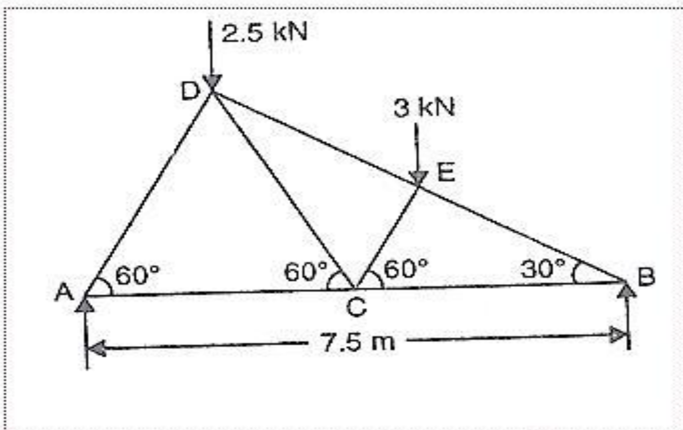
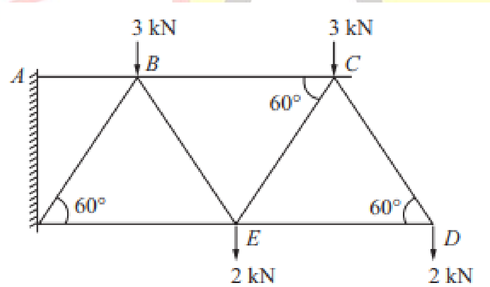
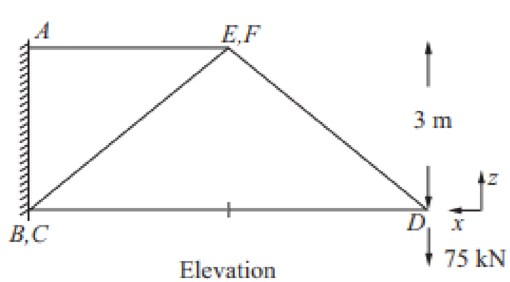
and method of tension coefficient.

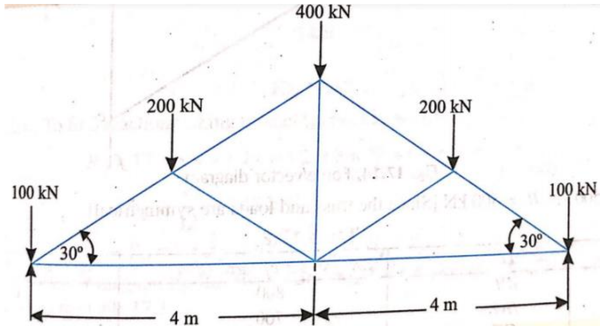
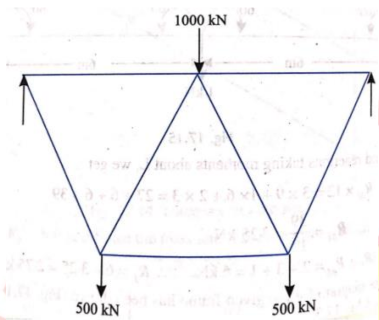
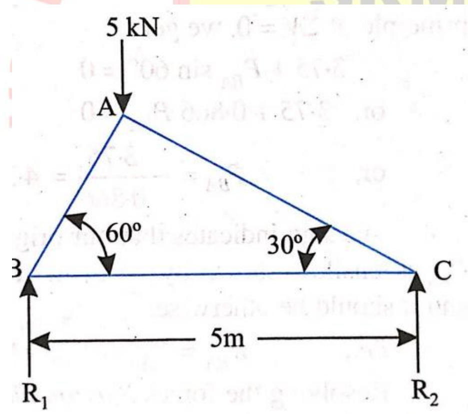
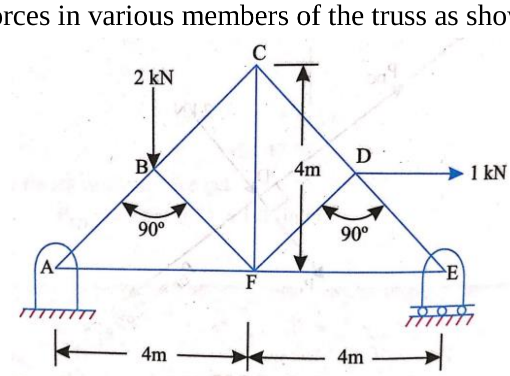
PART A

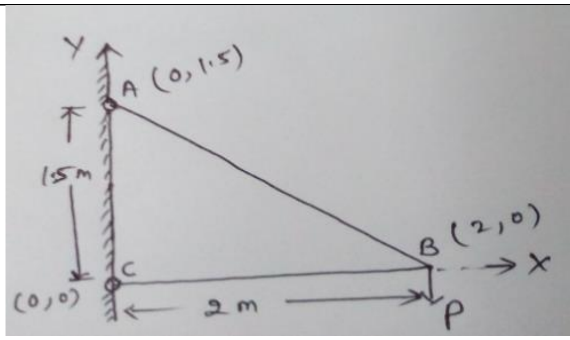
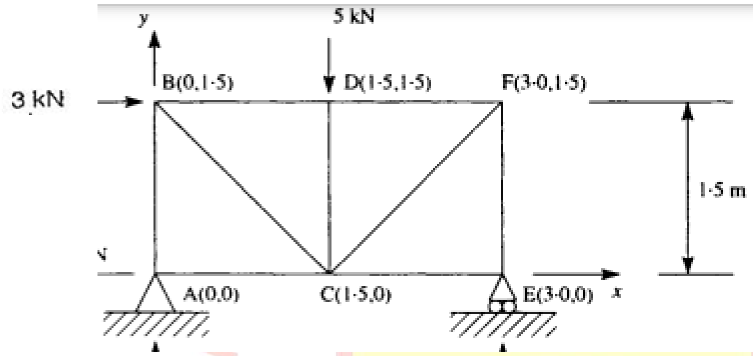
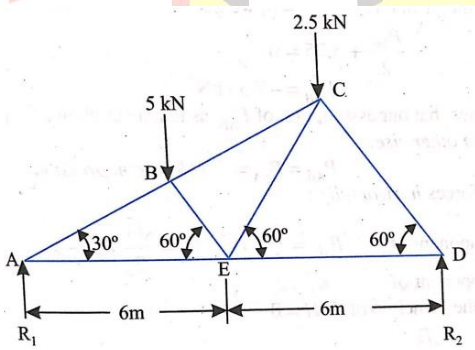
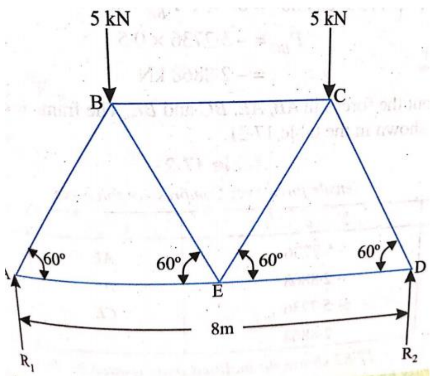
Q.NO	QUESTIONS	BT LEVEL	COMPETENCE
1.	Distinguish between perfect and imperfect frame?	BT-2	Understanding
2.	Compare and contrast deficient and redundant frame.	BT-1	Remembering
3.	Justify how method of joints applied to Trusses carrying Horizontal and inclined loads	BT-1	Remembering
4.	Discuss the assumptions made in finding out the forces in a frame?	BT-1	Remembering
5.	List the methods available for analyzing the frames.	BT-2	Understanding
6.	Differentiate a frame and truss.	BT-2	Understanding
7.	State the advantages of method of section over method of joints.	BT-4	Analyzing
8.	A perfect frame consists of 7 members. Decide the number of joints.	BT-6	Creating
9.	Show the difference between a cantilever and simply supported frame? How will you find the reactions in both the cases?	BT-4	Analyzing
10.	Differentiate a strut from tie	BT-2	Understanding
11.	What are the types of framed structures?	BT-5	Evaluating
12.	What are the methods used in determining the stresses in a framed structure?	BT-3	Applying
13.	What is a frame?	BT-3	Applying
14.	How are frames classified?	BT-4	Analyzing
15.	What is a perfect frame?	BT-4	Analyzing
16.	Define strut.	BT-1	Remembering
17.	Define tie.	BT-2	Understanding
18.	A perfect frame consists of 4 joints. Decide the number of members.	BT-5	Evaluating
19.	Identify whether the given truss is determinate or indeterminate. 	BT-2	Understanding

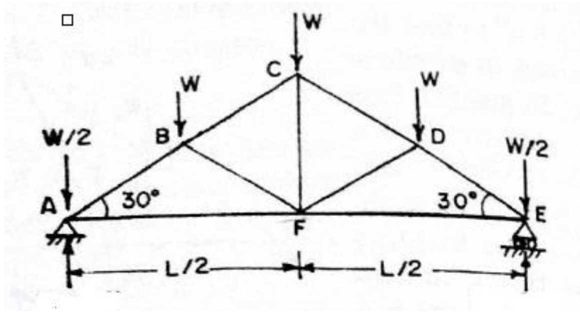
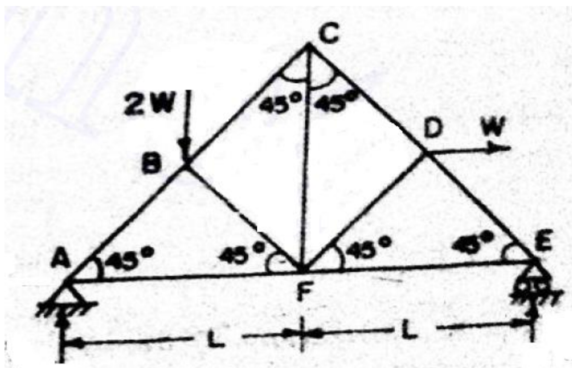
20.	List out the types of analytical methods in determining the forces in a frame.	BT-3	Applying
21.	Name any two types of trusses with a neat sketch.	BT-1	Remembering
22.	List down the types of trusses.	BT-2	Understanding
23.	What is a truss?	BT-1	Remembering
24.	A plane truss with applied loads is shown in the figure.  List out the members which do not carry any force.	BT-3	Applying
25.	Identify whether the given truss is determinate or indeterminate. 	BT-5	Evaluating
	PART B		
1.	Analyze and predict the forces in all members of the truss shown in figure by method of sections 	BT-1	Remembering

<table>
<tr><td>2.</td><td>Analyze and predict the forces in all members of the truss shown in figure by method of joints

</td><td>BT-5</td><td>Evaluating</td></tr>
<tr><td>3.</td><td>A truss is shown in fig. conclude the forces and its nature in the members of the truss by the method of joint

</td><td>BT-1</td><td>Remembering</td></tr>
<tr><td>4.</td><td>Analyze the forces in all members of the truss shown in figure by method of joints

</td><td>BT-2</td><td>Understanding</td></tr>
<tr><td>5.</td><td>A truss loaded shown in fig. Analyze and find the reaction and forces in the members by using method of section</td><td>BT-2</td><td>Understanding</td></tr>
</table>

			
6.	Analyze the truss by method of sections 	BT-1	Remembering
7.	Determine the forces in various members of the truss as shown in figure by method of tension coefficient. 	BT-3	Applying
8.	Determine the forces in various members of the truss as shown in figure by method of tension coefficient. 	BT-5	Evaluating
9.	Determine the forces in various members of the truss as shown in figure by	BT-4	Analyzing

	method of joints.  		
10.	Determine the forces in various members of the truss as shown in figure by method of joints.  	BT-6	Creating
11.	Determine the forces in various members of the truss as shown in figure.  	BT-5	Evaluating
12.	Determine the forces in various members of the truss as shown in figure.  	BT-3	Applying
13.	Determine the forces in various members of the truss as shown in figure by method of tension coefficient.	BT-4	Analyzing

			
14.	Determine the forces in various members of the truss as shown in figure by method of tension coefficient. 	BT-6	Creating
PART C			
1.	Determine the forces in various members of the truss as shown in figure by method of joints. 	BT-4	Analyzing
2.	Determine the forces in various members of the truss as shown in figure. 	BT-6	Creating

3.	Determine the forces in various members of the truss as shown in figure. 	BT-3	Applying
4.	A truss is loaded as shown in the figure. Determine the forces in all the members of truss. 	BT-5	Evaluating

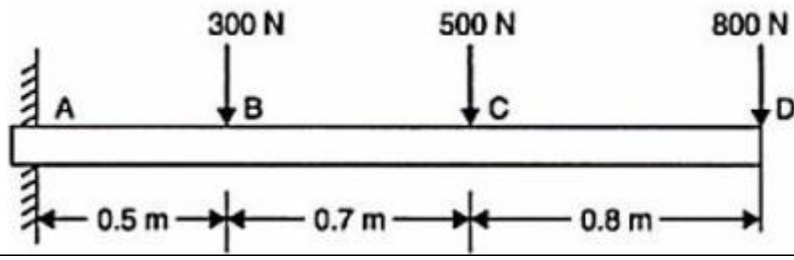
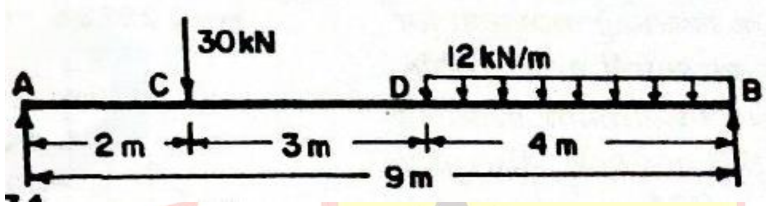
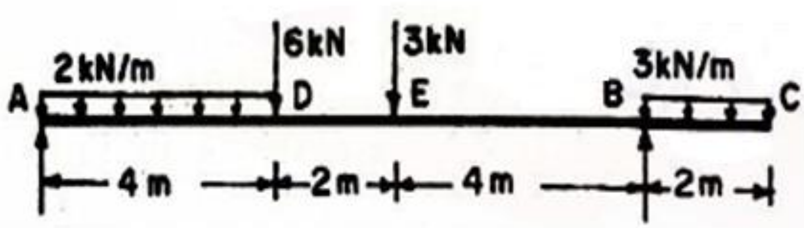
UNIT-III: TRANSVERSE LOADING AND STRESSES IN BEAM

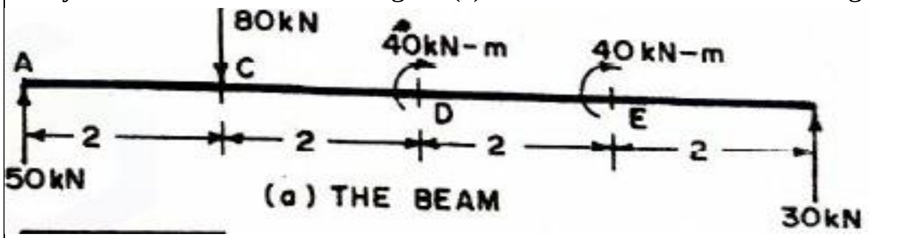
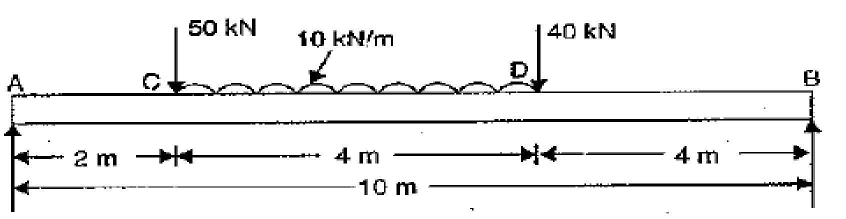
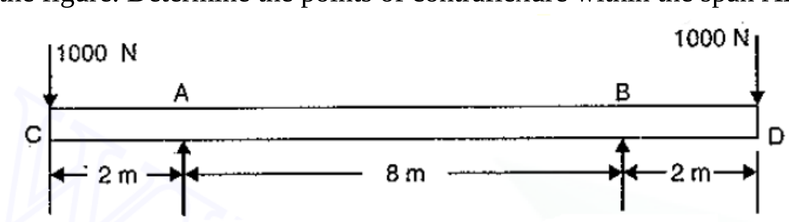
Beams - Types transverse loading on beams - Shear force and bending moment in beams - Cantilevers - Simply supported beams and over-hanging beams. Theory of simple bending - bending stress distribution - Shear stress distribution - Flitched beams - Carriage springs.

PART A

Q.NO	QUESTIONS	BT LEVEL	COMPETENCE
1.	What is a Beam?	BT-2	Understanding
2.	What are the different types of beams?	BT-1	Remembering
3.	List out the types of load acting on a beam.	BT-1	Remembering
4.	What is a fixed beam?	BT-1	Remembering
5.	Define Shear force and Bending moment.	BT-2	Understanding
6.	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. Draw the S.F diagram.	BT-2	Understanding
7.	Summarize and sketch the types of supports used for a beam indicating the reactions in each case.	BT-4	Analyzing

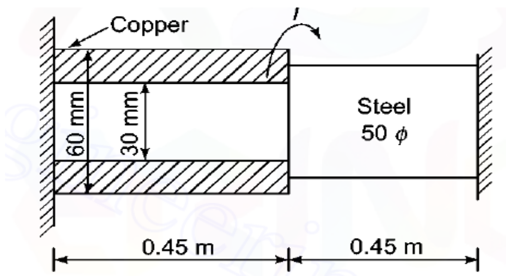
8.	Differentiate between hogging and sagging bending moment.	BT-6	Creating
9.	Sketch the SFD and Bending moment diagram for a cantilever beam carrying a point load at its free end.	BT-4	Analyzing
10.	Draw the shape of the bending moment diagram for a uniform cantilever beam carrying a uniformly distributed load over its length.	BT-2	Understanding
11.	Determine the maximum shear force for the SSB subjected to a distributed loading as shown in the diagram given below.	BT-5	Evaluating
12.	Draw and label the shear force and bending moment diagram for the cantilever beam carrying uniformly varying load of zero intensity at the free end and w kN/m at the fixed end.	BT-3	Applying
13.	Draw SFD for a 6m cantilever beam carrying a clockwise moment of 6 kN-m at its free end.	BT-3	Applying
14.	A concentrated load of P acts on a simply supported beam of span L at a distance L/3 from the left support. What will be the bending moment at the point of application of the load?	BT-4	Analyzing
15.	A simply supported beam of span length 6m and 75mm diameter carries a uniformly distributed load of 1.5 kN/m. Compute the maximum value of bending moment.	BT-4	Analyzing
16.	What do you mean by point of contra flexure?	BT-1	Remembering
17.	Explain what you mean by a neutral axis in a beam subjected to a bending moment.	BT-2	Understanding
18.	A T-section beam is simply supported and subjected to a uniform distributed load over its whole span. Find out at which portion of the beam the maximum longitudinal stress occurs.	BT-5	Evaluating
19.	What do you Understand by neutral axis & neutral plane? How do you locate Neutral axis?	BT-2	Understanding
20.	List out the assumptions used to derive the simple bending equation.	BT-3	Applying
21.	Recall the Theory of Bending Equation.	BT-1	Remembering
22.	What are Flitched Beams?	BT-2	Understanding
23.	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-1	Remembering
24.	Two beams of equal cross-sectional area are subjected to equal bending moment. If one beam has a square cross-section and the other has a circular section, then determine using the bending equation formula, which section will be stronger?	BT-3	Applying
25.	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-5	Evaluating
PART B			

1.	A cantilever beam of length 2 m carries the point loads as shown in Fig. Draw the shear force and B.M. diagrams for the cantilever beam.  	BT-2	Understanding
2.	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-5	Evaluating
3.	Write the expression for S.F and B.M of a simply supported beam carrying : (i) Point load at its midspan (7) (i) Eccentric Point load (6)	BT-1	Remembering
4.	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-2	Understanding
5.	A cantilever beam of span L carries a uniformly varying load varying from zero at the free end to w kN/m at the fixed end. Draw the shear force and bending moment diagrams.	BT-2	Understanding
6.	A cantilever beam of length 2 m carries a uniformly distributed load of 2 kN/m over the whole length and a point load of 3 kN at the free end. Construct the S.F and B.M diagrams for the beam.	BT-1	Remembering
7.	The simply supported beam carries a vertical load that increases uniformly from zero at the left end to a maximum value of 8000 N/m at the right end. Draw the shearing force and bending moment diagrams.	BT-3	Applying
8.	Consider a cantilever beam loaded by a concentrated force P at the free end together with a uniformly distributed load w/m over one half of the beam near the fixed end. Write equations for the shearing force and bending moment at any point in the beam and plot the shear and moment diagrams.	BT-5	Evaluating
9.	Locate and plot the shear force and bending moment diagram for the overhanging beam given in the figure.  	BT-4	Analyzing

10.	Analyse the beam as shown in figure (a) and draw the S.F and B.M diagram. 	BT-6	Creating
11.	Derive the expression for bending stress with a neat sketch.	BT-5	Evaluating
12.	A 500 x 500 mm timber is strengthened by the addition of 500 x 8 mm steel plates secured at its top and bottom surfaces. The composite beam is simply supported at its ends and carries a uniformly distributed load of 100kN/m run over an effective span of 6 m. Find the maximum bending stresses in steel and timber at the mid-span. Take $E_s = 2 \times 10^5$ N/mm^{2}and $E_T = 0.1 \times 10^5$ N/mm^2.	BT-3	Applying
13.	Find out the section modulus for the following a) Rectangular section (4) b) Hollow rectangular section (3) c) Circular section (3) d) Hollow circular section (3)	BT-4	Analyzing
14.	A beam of square section is used as a beam with one diagonal horizontal. Find the magnitude and location of maximum shear stress in the beam. Also, sketch the shear stress distribution across the section.	BT-6	Creating
	PART C		
1.	Obtain an expression showing the relationship between load, shear force and bending moment.	BT-2	Understanding
2.	A simply supported beam of length 10 m carries both udl and point loads as shown in the figure below. Analyse the beam and plot its shear force and bending moment diagram. 	BT-1	Remembering
3.	Draw the S.F and B.M diagrams for the beam which is loaded as shown in the figure. Determine the points of contraflexure within the span AB. 	BT-3	Applying

4.	Two rectangular bars, one of brass and the other of steel, each of 80 mm x 20 mm are placed together, to form a beam of 80 mm wide and 40 mm deep, on two supports 2 m apart, the brass being on the top of steel. Determine the maximum central load which can be applied to the beam if the bars are separate and can bend independently.	BT-6	Creating
UNIT-IV: TORSION			
Torsion formula - Stresses and deformation in circular and hollows shafts - Stepped shafts - Deflection in shafts fixed at the both ends - Stresses in helical springs - Deflection of helical springs - carriage springs.			
PART A			
Q.NO	**QUESTIONS**	**BT LEVEL**	**COMPETENCE**
1.	Compare and contrast between torsion, bending and torque.	BT-2	Understanding
2.	List the assumptions made in the theory of torsion.	BT-1	Remembering
3.	Write about Torsional equation and torsional rigidity.	BT-1	Remembering
4.	Write the expression for power transmitted by a shaft.	BT-1	Remembering
5.	Quote the expressions for polar modulus of solid and hollow circular shaft.	BT-2	Understanding
6.	What is called a torsional moment?	BT-2	Understanding
7.	Maximum shear stress developed on the surface of a solid circular shaft under pure torsion is 240 MPa. If the shaft diameter is doubled then the maximum shear stress developed corresponding to the same torque will be equal to?	BT-4	Analyzing
8.	A solid circular shaft of 60 mm diameter transmits a torque of 1600 N.m. Determine the value of maximum shear stress developed.	BT-6	Creating
9.	If two shafts of the same length, one of which is hollow, transmit equal torque and have equal maximum stress, then they should have equal.	BT-4	Analyzing
10.	A solid shaft of diameter 'D' carries a twisting moment that develops maximum shear stress τ. If the shaft is replaced by a hollow one of outside diameter 'D' and inside diameter D/2, then find out the maximum shear stress?	BT-2	Understanding
11.	The outside diameter of a hollow shaft is twice its inside diameter. What is the ratio of its torque carrying capacity to that of a solid shaft of the same material and the same outside diameter?	BT-5	Evaluating
12.	Sketch the shear stress variation along the radius of a hollow shaft is subjected to torsion.	BT-3	Applying
13.	Write the formula for the equivalent bending moment under combined action of bending moment M and torque T.	BT-3	Applying
14.	For a circular shaft of diameter d subjected to torque T, what is the maximum value of the shear stress?	BT-4	Analyzing
15.	A hollow circular shaft having outside diameter 'D' and inside diameter "d" subjected to a constant twisting moment 'T' along its length. If the maximum shear stress produced in the shaft is S_s then, calculate the twisting moment 'T'.	BT-4	Analyzing

16.	A shaft is subjected to a bending moment M = 400 N.m and torque T = 300 N.m Compute the equivalent bending moment.	BT-6	Creating
17.	A member is subjected to the combined action of bending moment 400 Nm and torque 300 Nm. What is the value of equivalent torque?	BT-2	Understanding
18.	Differentiate between closed coil helical spring and open coil helical spring.	BT-5	Evaluating
19.	Explain the term spring index.	BT-3	Applying
20.	Give any two functions of spring.	BT-3	Applying
21.	Formulate the mathematical expression for deflection of an open coiled helical spring.	BT-1	Remembering
22.	What is a spring? Name the two important types of springs.	BT-2	Understanding
23.	Write down the formula for the central deflection of a laminated spring.	BT-5	Evaluating
24.	Classify springs with examples.	BT-3	Applying
25.	What is leaf spring? State the uses of leaf spring.	BT-5	Evaluating
	PART B		
1.	The ratio of inside to outside diameter of a hollow shaft is 0.6. If there is a solid shaft with the same torsional strength, what is the ratio of the outside diameter of hollow shaft to the diameter of the equivalent solid shaft?	BT-1	Remembering
2.	What do you mean by the strength of the shaft? Compare the strength of solid and hollow circular shafts.	BT-6	Creating
3.	What are the assumptions made in the torque equations?	BT-2	Understanding
4.	Write about the compound shafts both in series and in parallel.	BT-2	Understanding
5.	A hollow shaft of diameter ratio 3/8 required to transmit 600 kW at 110 rpm, the maximum torque being 20% greater than the mean. The shear stress is not to exceed 63 MPa and the twist in a length of 3 m not to exceed 1.4 degrees. Determine the diameter of the shaft. Assume modulus of rigidity for the shaft material as 84 GN/m^2	BT-1	Remembering
6.	In a torsion test, the specimen is a hollow shaft with 50 mm external and 30 mm internal diameter. An applied torque of 1.6 kN-m is found to produce an angular twist of 0.4° measured on a length of 0.2 m of the shaft. The Young"s modulus of elasticity obtained from a tensile test has been found to be 200 GPa. Find the values of Modulus of rigidity and Poisson's ratio.	BT-3	Applying
7.	A solid shaft of aluminium of length 1.5 m and of 60 mm diameter is to be replaced by a tubular steel shaft of the same length and the same outside diameter, such that each of the shafts have the same angle of two shafts have the same angle of twist per unit torsional moment over the total length. Determine the inner diameter of the tubular steel shaft, if the modulus of rigidity of steel is three times that of aluminium.	BT-5	Evaluating
8.	A hollow steel rod 200 mm long is to be used as a torsional spring. The ratio of inside to outside diameter is 1 : 2. The required stiffness of this spring is 100 N.m /degree. Determine the outside diameter of the rod. Value of G is 8	BT-4	Analyzing

	x 10^4 N/mm^2		
9.	A hollow, circular copper shaft of 60 mm external and 30 mm internal diameter and a steel solid shaft of 50 mm radius are rigidly connected in series and subjected to a torque of 5000 Nm as shown in Figure. Determine the maximum stresses in the two shafts. G = 80 GPa for steel and 40 GPa for copper. Length of the copper shaft is 0.5 m and that of the steel shaft is 0.45 m. 	BT-4	Analyzing
10.	A solid circular steel shaft of diameter 20 mm is enclosed within a brass hollow circular shaft of external diameter 30 mm and internal diameter 20 mm. If the two shafts are rigidly connected and the angle of twist due to a torque of 410 Nm is 2^o in a length of 300 mm, find the value of G for brass if G for steel is 80 GPa. Also find the maximum shearing stress in the two materials.	BT-5	Evaluating
11.	Derive the expression for the maximum shear stress induced in a closed-coiled helical spring and also its stiffness.	BT-2	Understanding
12.	A closely coiled helical spring made of 10 mm diameter steel wire has 15 coils of 100 mm mean diameter. The spring is subjected to an axial load of 100 N. Calculate the maximum shear stress induced, deflection and stiffness of the spring. Take modulus of rigidity , C = 8.16 x 10^4 N/mm^2	BT-4	Analyzing
13.	A closely coiled helical spring of round wound steel wire 10 mm in diameter having 10 complete turns with a mean diameter of 12 cm is subjected to an axial load of 200 N. Determine the deflection of the spring, maximum shear stress in the wire and the stiffness of the spring. Take C = 8 x 10^4 N/mm^2	BT-6	Creating
14.	Derive an expression for the maximum bending stress developed in the plate of a leaf spring.	BT-1	Remembering
	PART C		
1.	Derive the expression for the shear stress produced in a circular solid shaft subjected to torsion.	BT-2	Understanding
2.	Deduce the expression for strain energy stored in a closed coil helical spring when subjected to axial loading.	BT-3	Applying
3.	A hollow steel shaft 5 m long is to transmit 160 kN of power at 120 r.p.m. The total angle of twist is not to exceed 2^o in this length and the allowable shear stress is 50 N/mm^2	BT-4	Analyzing

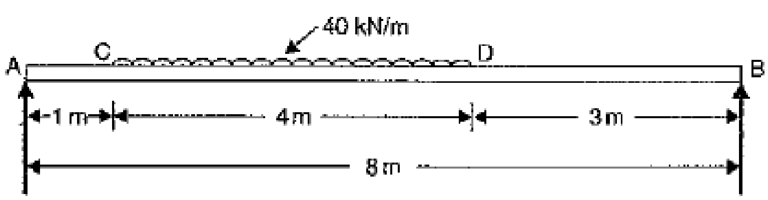
4.	The stiffness of a close-coiled helical spring is 1.5 N/mm of compression under a maximum load of 60 N. The maximum shearing stress produced in the wire of the spring is 125 N/mm^2 . The solid length of the spring (when the coils are touching) is given as 5 cm. Find the diameter of wire, mean diameter of the coils and the number of coils required.	BT-5	Evaluating

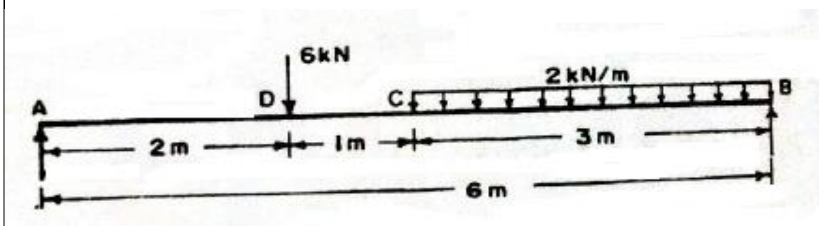
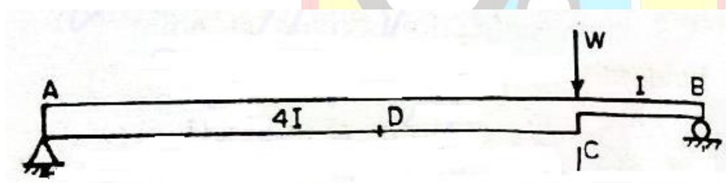
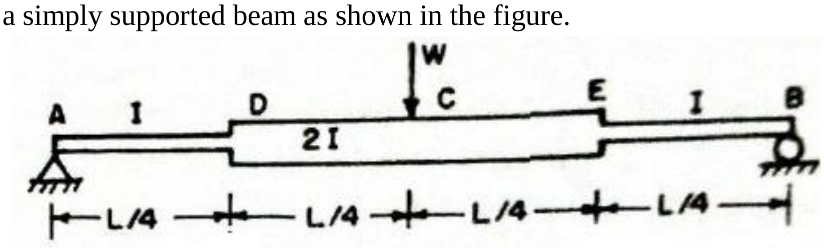
UNIT-V: DEFLECTION OF BEAMS

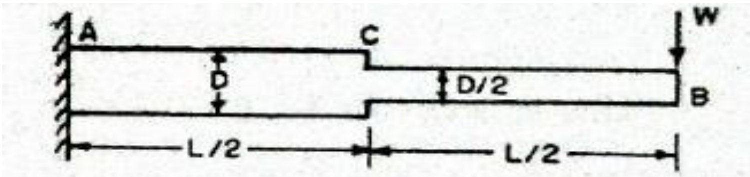
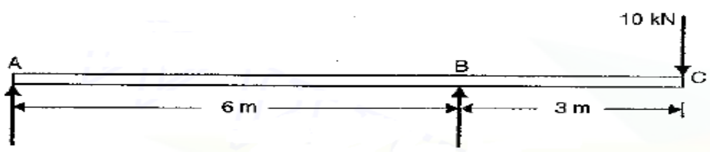
Computation of slopes and deflections in determinate beams - Double Integration method –Macaulay's method - Area moment method - Conjugate beam method

PART A

Q.NO	QUESTIONS	BT LEVEL	COMPETENCE
1.	Illustrate what is meant by deflection of a beam with a neat sketch.	BT-2	Understanding
2.	Recall the methods for finding out the slope and deflection at a section?	BT-1	Remembering
3.	Analyze double integration method.	BT-1	Remembering
4.	State the two theorems in moment area method.	BT-4	Analyzing
5.	Give the differential relation between bending moment, slope and the deflection.	BT-2	Understanding
6.	Write the maximum slope and maximum deflection of a cantilever beam subjected to UDL	BT-1	Remembering
7.	Identify the values of slope and deflection for a cantilever beam of length 'L' subjected to Moment 'M' at the free end.	BT-4	Analyzing
8.	Distinguish between statically determinate and indeterminate beams.	BT-6	Creating
9.	Formulate the slope at the support for a simply supported beam of length L, constant EI and carrying central concentrated load.	BT-5	Evaluating
10.	State the theorems of conjugate beam method.	BT-2	Understanding
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-5	Evaluating
12.	Draw conjugate beam for a cantilever beam fixed at the right end.	BT-3	Applying
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	Applying
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-4	Analyzing
15.	A simply supported beam carrying a concentrated load W at its mid-span deflects by $\delta_1$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 atmid-span. What is the ratio of δ_1: δ_2?	BT-4	Analyzing

16.	Write down the formula used to find the deflection of beam by Moment-Area method.	BT-1	Remembering
17.	Among 4 methods of analysing the beams for deflection and slope, relate the situations when each method is used.	BT-2	Understanding
18.	Distinguish between actual beam and conjugate beam.	BT-5	Evaluating
19.	When do you prefer the Moment area method?	BT-2	Understanding
20.	Determine the slope and deflection of a cantilever beam with a point load at free end by using Mohr's Theorem.	BT-3	Applying
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. Determine the maximum deflection of the beam if the 8-cm dimension is vertical.	BT-6	Creating
22.	Illustrate when Macaulay's method is preferred?	BT-2	Understanding
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-6	Creating
24.	Derive the expression for maximum slope of a simply supported beam with point load at its mid span by using Area moment method.	BT-3	Applying
25.	Mention the two rules used to find out the slope and deflection of the actual beam by conjugate beam method.	BT-5	Evaluating
	PART – B		
1.	A cantilever of uniform section has a length AB = L. End B is free end and carries a point load W, while end A is fixed end. Find the slope and deflection at a point at a distance of L/4 from the free end A.	BT-1	Remembering
2.	Derive the expression for the deflection of a cantilever beam with uniformly distributed load over its entire span by using Double integration method.	BT-5	Evaluating
3.	A beam 3 m long, simply supported at its ends, is carrying a point load W at the centre. If the slope at the ends of the beam should not exceed 1°, find the deflection at the centre of the beam.	BT-6	Creating
4.	Write down the expression for the deflection of a simply supported beam carrying a point load at its midspan.	BT-2	Understanding
5.	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-2	Understanding
6.	A beam of length 8 m is simply supported at its ends. It carries a uniformly distributed load of 40 kN/m as shown in figure. Determine the deflection of the beam at its mid-span and also position of maximum deflection. Take E = 2×10^5 N/mm^2 and I = 4.3×10^8 mm^4 	BT-1	Remembering

7.	A horizontal beam of uniform section and length L rests on supports at its ends. It carries a U.D.L w per unit length which extends over a length l from the right end. Determine the value of l in order that the maximum deflection may occur at the left end, and if the maximum deflection is wL^4/kEI, determine the value of k.	BT-3	Applying
8.	A beam, simply supported at ends A and B is loaded with point loads of 30 kN each at a distance of 2 m and 3 m respectively from end A. Determine the position and magnitude of the maximum deflection. Take E = 2 x 10^5 N/mm^2 and I = 7200 cm^4	BT-5	Evaluating
9.	A beam AB of 6 m is simply supported at the ends and is loaded as shown in figure. Determine (a)deflection at C , (b) maximum deflection , (c) slope at end A. Take E = 2 x 10^5 N/mm^2 and I = 2000 cm^4 	BT-4	Analyzing
10.	Determine the slope and deflection of a simply supported beam carrying a uniformly distributed load by Mohr's theorem.	BT-4	Analyzing
11.	A beam ACB as shown in the figure, simply supported at the ends, has moment of inertia 4I for the length AC and I for the length CB, and is loaded with point load W at C. Determine the slope at end A and maximum deflection 	BT-5	Evaluating
12.	Determine the angle of rotation and deflection at the free end of a cantilever beam AB with a uniform load w acting over the middle third of the length.	BT-3	Applying
13.	Using conjugate beam method, find slopes at the ends and central deflection for a simply supported beam as shown in the figure. 	BT-4	Analyzing
14.	A beam, simply supported at the ends, is subjected to a point load W, eccentrically placed. Determine slope at the ends, maximum deflection, its location and also the central deflection using conjugate method..	BT-6	Creating
PART – C			

1.	Derive an expression for deflection of a simply supported beam carrying UDL throughout its span.	BT-2	Understanding
2.	Obtain the relationship between slope, deflection and radius of curvature.	BT-5	Evaluating
3.	A cantilever of length L carries a point load W at its free end. The member is circular in section, having diameter D for a distance L/ from the fixed end and a diameter D/2 for the remaining length. Find the deflection at the free end. 	BT-3	Applying
4.	A beam ABC of length 9 m as shown in figure carries 12 kN load at its right end and also a uniformly distributed load of 4 kN/m over a length of 3 m. Determine the slope and deflection at point C. 	BT-6	Creating

BT – ALLOTMENT

S.No	Unit No.		BT1	BT2	BT3	BT4	BT5	BT6	Total Question
1	Unit-1	Part-A	6	5	4	4	3	3	25
		Part-B	4	3	2	3	1	1	14
		Part-C	1	1	1	-	-	1	4
2	Unit-2	Part-A	6	5	4	4	3	3	25
		Part-B	4	3	2	3	1	1	14
		Part-C	-	-	1	1	1	1	4
3	Unit-3	Part-A	6	5	4	4	3	3	25
		Part-B	4	3	2	3	1	1	14
		Part-C	1	1	1	-	-	1	4
4	Unit-4	Part-A	6	5	4	4	3	3	25
		Part-B	4	3	2	3	1	1	14
		Part-C	-	1	1	1	1	-	4
5	Unit-5	Part-A	6	5	4	4	3	3	25
		Part-B	4	3	2	3	1	1	14
		Part-C	-	1	1	-	1	1	4

TOTAL NUMBER OF QUESTIONS

PART-A	125
PART-B	70
PART-C	20
TOTAL	215