SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF CIVIL ENGINEERING

QUESTION BANK

III SEMESTER

1903301 - APPLIED MECHANICS

Regulation – 2019

Academic Year 2021-2022

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SUBJECT CODE & NAME: 1903301 & APPLIED MECHANICS

YEAR & SEMSTER : II/III

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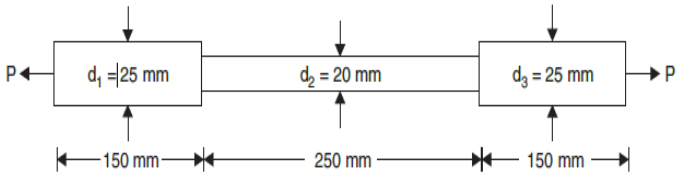
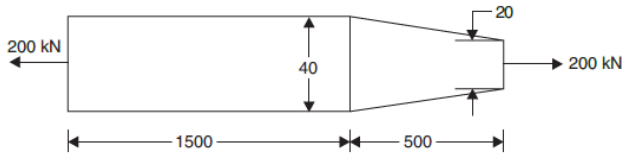
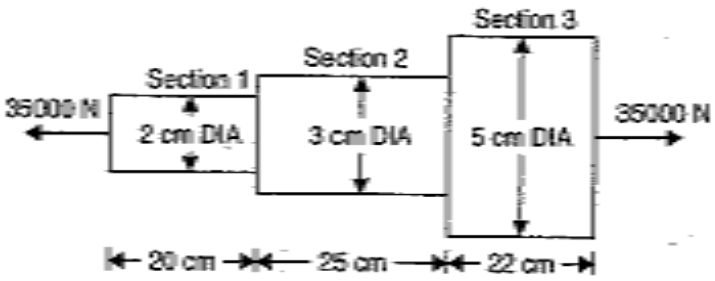
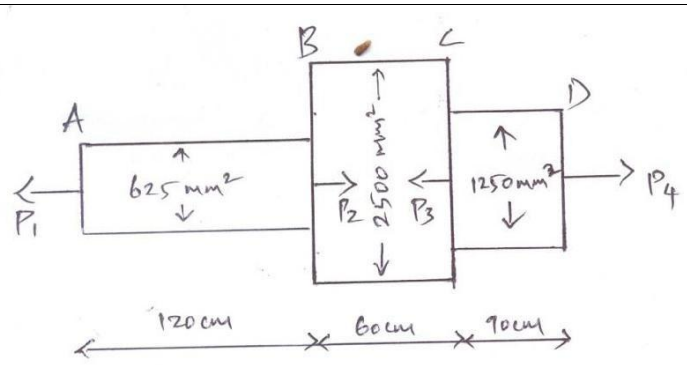
UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS			
Simple stresses and strains – Elastic constants (Problem) – Relationship between elastic constants – Stress Strain Diagram (Mild steel and concrete) – Ultimate Stress – Yield stress – Deformation of axially loaded member – Composite bars – Thermal Stresses – Hydrostatic Stresses.			
PART A			
Q. NO	**QUESTIONS**	**BT LEVEL**	**COMPETENCE**
1.	Define Elasticity.	BT-1	Remembering
2.	State Hooke's Law.	BT-1	Remembering
3.	Define stress & strain.	BT-1	Remembering
4.	Define thermal stress and strain.	BT-1	Remembering
5.	Differentiate Ultimate Stress and Yield stress	BT-2	Understanding
6.	Recall Poisson's ratio.	BT-1	Remembering
7.	Distinguish Lateral strain and Longitudinal strain.	BT-2	Understanding
8.	Show the different types of stress and strain.	BT-3	Applying
9.	Write an expression of volumetric strain	BT-1	Remembering
10.	Give the formulae for modulus of elasticity and rigidity modulus.	BT-2	Understanding
11.	Draw the stress strain curve for mild steel.	BT-2	Understanding
12.	Give the relationship between Elastic constants (3 Modulus)	BT-2	Understanding
13.	Define Hydrostatic stress.	BT-1	Remembering
14.	A hollow steel tube with an inside diameter of 100 mm must carry a tensile load of 400 kN. Determine the outside diameter of the tube if	BT-3	Applying

	the stress is limited to 120 MN/m^2.		
15.	Infer about the salient points of s stress strain curve in a loading response order.	BT-4	Analyzing
16.	The modulus of elasticity and rigidity modulus of a material are 200 GPa and 80 GPa respectively. Evaluate all other elastic moduli.	BT-5	Evaluating
17.	Sketch the stress-strain curve of an ideally elastic strain hardening material and perfectly plastic material.	BT-2	Understanding
18.	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-5	Evaluating
19.	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.	BT-5	Evaluating
20.	A circular bar 20 mm in diameter and 200 mm long is subjected to a force of 20 kN. Formulate the stress, strain and elongation in the bar if the value of E= 80GPa.	BT-6	Creating
21.	Outline Principle of superposition.	BT-1	Remembering
22.	Relate Elasticity and Plasticity.	BT-1	Remembering
23.	Distinguish between malleability and ductility.	BT-2	Understanding
24.	Give some examples for Ductile and Brittle materials.	BT-1	Remembering
25.	What do you understand by a compound bar?	BT-1	Remembering

PART B

1.	a) 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. b) A Surveyor's steel tape 30 m long has a cross-section of 15 mm × 0.75 mm. With this, line AB is measure as 150 m. If the force applied during measurement is 120 N more than the force applied at the time of calibration, what is the actual length of the line? Take modulus of elasticity for steel as 200 kN/mm^2	BT-1	Remembering
2.	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. 	BT-3	Applying

3.	Derive the relationship between modulus of elasticity and modulus of rigidity	BT-2	Understanding
4.	A steel rod tapers in diameter from 18 mm at one end to 9 mm at the other over a length of 900 mm. Determine the elongation in the length of the bar if E = 200 GPa and the load applied on the rod is 15 kN	BT-3	Applying
5.	A 2.0 m long steel bar is having uniform diameter of 40 mm for a length of 1 m and in the next 0.5 m its diameter gradually reduces from 40 mm to 20 mm as shown in Fig.  Solve for the elongation of this bar when subjected to an axial tensile load of 200 kN. Given E = 200 GN/m^2.	BT-6	Creating
6.	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 guage 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	Analyzing
7.	A circular rod of 25 mm diameter and 500 mm long is subjected to a tensile force of 60 kN. Estimate modulus of rigidity, bulk modulus and change in volume if Poisson's ratio = 0.3 and Young's modulus E = 2×10^5 N/mm^2.	BT-5	Evaluating
8.	A compound bar of length 600 mm consists of a strip of aluminium 40 mm wide and 20 mm thick and a strip of steel 60 mm wide × 15 mm thick rigidly joined at the ends. If elastic modulus of aluminium and steel are 1×10^5 N/mm^2 and 2×10^5 N/mm^2, determine the stresses developed in each material and the extension of the compound bar when axial tensile force of 60 kN acts.	BT-3	Applying
9.	Solve for the total elongation of the member shown 	BT-6	Creating
10.	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-3	Applying

			
11.	A reinforced concrete column is 300mm x 300mm in section. The column is provided with 8 bars each of 20mm diameter. The column carries a load of 360kN. Find the stresses in concrete and the steel bars. Take Es=210 GN/m^2 and Ec=14 GN/m^2	BT-3	Applying
12.	Obtain a relation for change in length of a bar hanging freely under its own weight	BT-2	Understanding
13.	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-5	Evaluating
14.	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: **a)** The Young's modulus **b)** The stress at elastic limit c) The percentage of elongation d) The percentage decrease in area.	BT-5	Evaluating

PART C

1.	A specimen of steel 20 mm diameter with a gauge length of 200 mm is tested to destruction. It has an extension of 0.25 mm under a load of 80 kN and the load at elastic limit is 102 kN. The maximum load is 130 kN. The total extension at fracture is 56 mm and diameter at neck is 15 mm. Find	BT-3	Applying

	(i) The stress at elastic limit. (ii) Young's modulus. (iii) Percentage elongation. (iv) Percentage reduction in area. (v) Ultimate tensile stress.		
2.	a) A bar of uniform thickness 't' tapers uniformly from a width of b1 at one end to b2 at other end in a length 'L'. Derive the expression for the change in length of the bar when subjected to an axial force P. b) A tapering rod has diameter d1 at one end and it tapers uniformly to a diameter d2 at the other end in a length L. If modulus of elasticity of the material is E, derive its change in length formula when it is subjected to an axial force of P	BT-2	Understanding
3.	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-5	Evaluating
4.	Draw stress – strain diagram for mild steel and for a brittle material and indicate salient points	BT-1	Remembering

UNIT II – TRANSFER OF LOADS AND STRESSES IN BEAMS

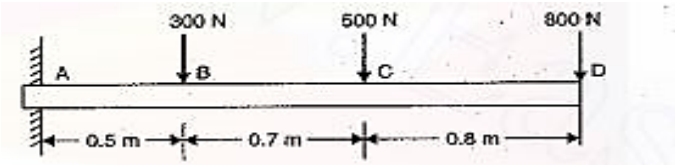
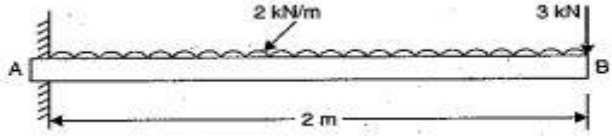
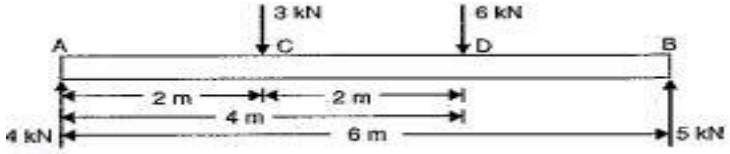
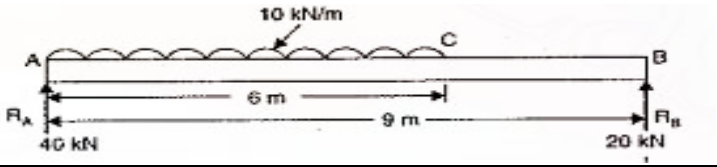
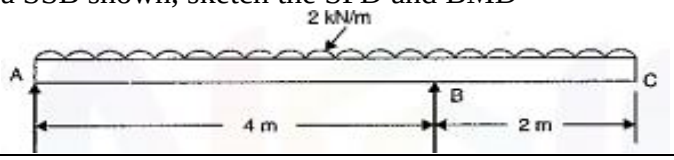
Types of Loads, supports, beams – concept of shearing force and bending moment Relationship between intensity of load, Shear force and Bending moment – Shear force and Bending Moment Diagrams for Cantilever, Simply supported and overhanging beams with concentrated load, uniformly distributed load, uniformly varying load and concentrated moment. Theory of Simple Bending – Stress distribution due to bending moment and shearing force- Flitched Beams

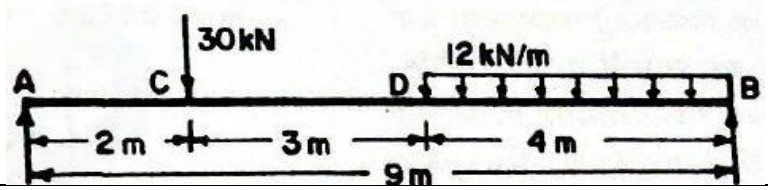
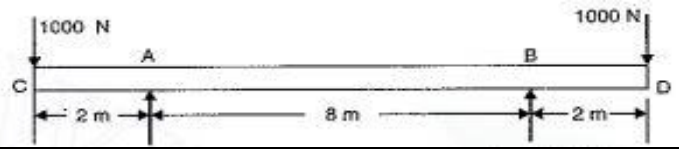
PART A

Q.NO	QUESTIONS	BT LEVEL	COMPETENCE
1.	What is a Beam?	BT-1	Remembering
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.	Outline a fixed beam.	BT-2	Understanding
5.	Define Shear force and Bending moment.	BT-1	Remembering

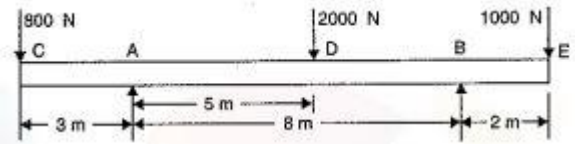
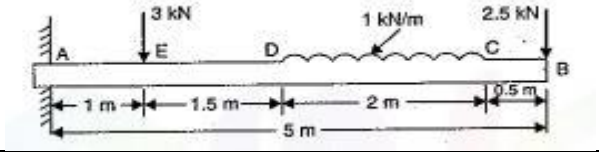
6.	Sketch the SFD and BMD line pattern for various loads	BT-2	Understanding
7.	Sketch the types of supports used for a beam indicating the reactions in each case	BT-2	Understanding
8.	Compare hogging and sagging bending moment.	BT-4	Analyzing
9.	Infer about point of contra flexure?	BT-3	Applying
10.	Compose the SFD and Bending moment diagram for a cantilever beam carrying a point load at its free end.	BT-6	Creating
11.	Compose the shape of the bending moment diagram for a uniform cantilever beam carrying a uniformly distributed load over its length.	BT-6	Creating
12.	Compose 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-6	Creating
13.	Draw the shape of the bending moment diagram for a uniform SS beam carrying a uniformly distributed load over its length.	BT-2	Understanding
14.	Draw the shape of the bending moment diagram for a SS beam carrying a concentrated load at centre.	BT-2	Understanding
15.	Evaluate SFD for a 6m cantilever beam carrying a clockwise moment of 6 kN-m at its free end.	BT-5	Evaluating
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-4	Analyzing
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-3	Applying
18.	List the assumptions used to in theory of simple bending	BT-1	Remembering
19.	Recall the Theory of Bending Equation.	BT-1	Remembering
20.	What are Flitched Beams?	BT-1	Remembering
21.	Define section modulus	BT-1	Remembering
22.	Find the section modulus of a circular section whose section diameter is 28 mm	BT-3	Applying
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-3	Applying
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-1	Remembering
25.	Identify the formulae for section modulus of solid and hollow circular section	BT-3	Applying

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-3	Applying
2.	Predict SF and BM at A,B,C & D for the beam shown 	BT-6	Creating
3.	Figure out the SF and BM for the beam shown 	BT-6	Creating
4.	For the beam shown below solve for the reactions and B.M 	BT-5	Evaluating
5.	For a SSB shown, Estimate the reaction & B.M at A,B & C 	BT-6	Creating
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-3	Applying
7.	For a SSB shown, sketch the SFD and BMD 	BT-3	Applying
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-3	Applying

			
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	Analyzing
10.	Sketch the SFD and BMD for the overhanging beam shown below 	BT-3	Applying
11.	Develop the section modulus for (a) Rectangular (b) Hollow rectangular (c) Circular (d) Hollow circular	BT-6	Creating
12.	A simply supported beam of span 4m carries audl of 6kN/m over the entire span. If the maximum allowable stress due to bending is restricted to 150 N/mm^2, 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-5	Evaluating
13.	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/cm^2. (ii) The combined moment of resistance if the modular ratio is 18	BT-5	Evaluating
14.	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	Analyzing

PART C

Q.NO	QUESTIONS	BT LEVEL	COMPETENCE
1.	Develop SFD and BMD for the beam shown 	BT-6	Creating
2.	Develop SFD and BMD for the beam shown 	BT-6	Creating
3.	Derive the expression for theory of simple bending.	BT-2	Understanding
4.	(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/mm^2. Take I=8×10^4 mm^4 (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-3	Applying

UNIT - III SLOPE AND DEFLECTION

Elastic curve - Governing Differential Equation - Double integration method - Macaulay's method - Area moment method - conjugate beam method for computation of slope and deflection of Determinant beams

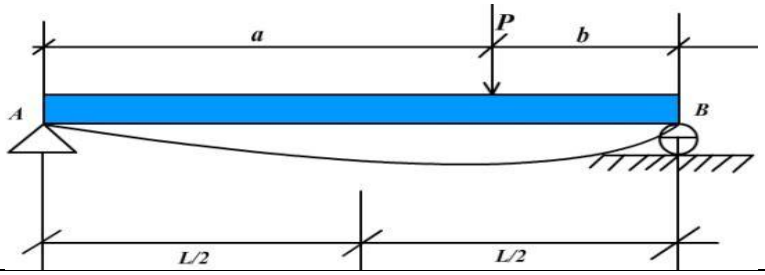
PART A

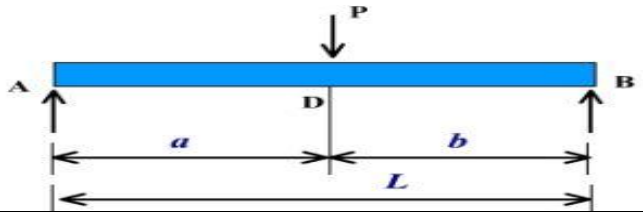
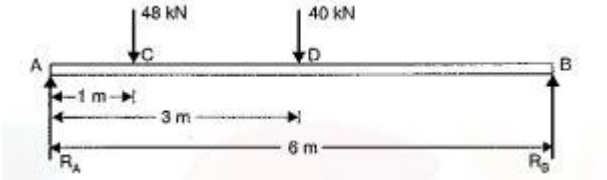
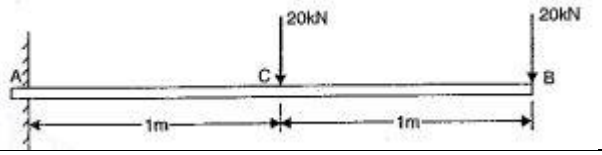
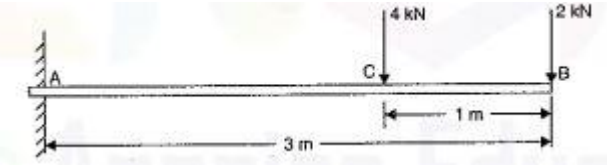
Q.NO	QUESTIONS	BT LEVEL	COMPETENCE
1.	What is meant by deflection of a beam with a neat sketch?	BT-1	Remembering
2.	Recall the methods for finding out the slope and deflection at a section?	BT-1	Remembering
3.	Recall method of Singularity functions.	BT-1	Remembering

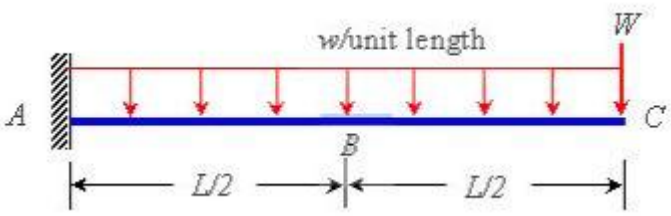
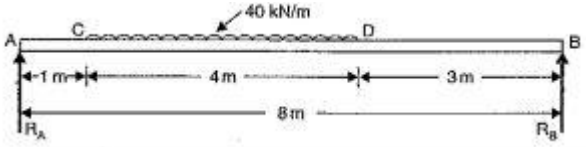
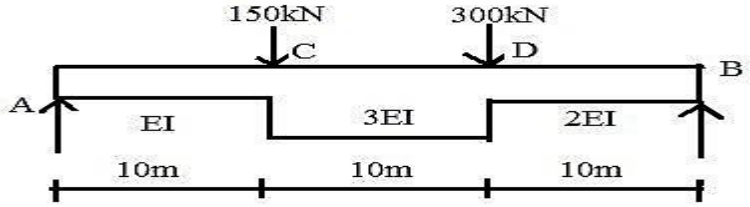
4.	State the two theorems in moment area method.	BT-1	Remembering
5.	Give the differential relation between bending moment, slope and the deflection.	BT-1	Remembering
6.	Write the maximum slope and maximum deflection of a cantilever beam subjected to UDL	BT-1	Remembering
7.	Identify the values of slope and deflection for a cantilever beam of length 'L' subjected to Moment 'M' at the free end.	BT-2	Understanding
8.	Distinguish between statically determinate and indeterminate beams.	BT-2	Understanding
9.	Formulate the slope at the support for a simply supported beam of length L, constant EI and carrying central concentrated load.	BT-3	Applying
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-1	Remembering
12.	Draw conjugate beam for a cantilever beam fixed at the right end.	BT-2	Understanding
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-2	Understanding
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-1	Remembering
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 δ_1: δ_2?	BT-1	Remembering
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-1	Remembering
18.	Distinguish between actual beam and conjugate beam.	BT-1	Remembering
19.	When do you prefer the Moment area method?	BT-1	Remembering
20.	Determine the slope and deflection of a cantilever beam with a point load at free end by using Mohr's Theorem.	BT-1	Remembering
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	BT-3	Applying

	dimension is vertical.		
22.	Tell when Macaulay's method is preferred?	BT-1	Remembering
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	Applying
24.	Tell when conjugate method is preferred?	BT-1	Remembering
25.	Discuss the two rules used to find out the slope and deflection of the actual beam by conjugate beam method.	BT-4	Analyzing

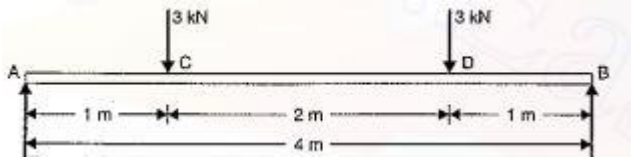
PART B

Q.NO	QUESTIONS	BT LEVEL	COMPETENCE
1.	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 $I=85\times10^6$ mm^4 $E = 2\times10^5$ N/mm^2	BT-4	Analyzing
2.	A steel joist, simply supported over a span of 6 m carries a point load of 50 kN at 1.2 m from the left hand support. Find the position and magnitude of the maximum deflection. Take EI = 14 X 10^{12} N/mm^2	BT-3	Applying
3.	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 = $1.3x10^8 mm^4$. E = $2x10^5$ N/mm^2	BT-3	Applying
4.	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	Analyzing

5.	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-3	Applying
6.	Solve for the deflection of the beam shown below I = $85x10^5 mm^4$. E = $2x10^5$ N/mm^2 	BT-4	Analyzing
7.	Solve for the deflection of the beam shown below by moment area method 	BT-4	Analyzing
8.	Solve for the deflection of the beam shown below I = $10^8 mm^4$. E = $2x10^5$ N/mm^2 	BT-4	Analyzing
9.	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-3	Applying
10.	Differentiate between actual beam and conjugate beam	BT-2	Understanding
11.	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-3	Applying

			
12.	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-3	Applying
13.	Solve for the deflection of the beam shown below $I = 4.3x10^8 mm^4$. $E = 2x10^5$ N/mm^2 	BT-4	Analyzing
14.	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 $I = 2x10^{-2}$ m^4. 	BT-4	Analyzing

PART C

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-2	Understanding
2.	Derive an expression for slope & deflection of a simply supported beam carrying UDL throughout its span	BT-2	Understanding
3.	Obtain an expression for Slope and deflection of a simply supported beam carrying point load at mid-span	BT-3	Applying
4.	Using conjugate beam method, obtain the slope and deflections at each end and centre. 	BT-6	Creating

UNIT IV TORSION AND SPRINGS

Theory of Torsion - Stresses and Deformations in Solid and Hollow Circular shafts - Combined bending moment and torsion shafts - Power transmitted to shaft - Shaft in series and parallel - Closed and Open Coiled helical springs - springs in series and parallel - Design of buffer springs.

PART A

Q.NO	QUESTIONS	BT LEVEL	COMPETENCE
1.	Compare and contrast between torsion, bending and torque.	BT-1	Remembering
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-1	Remembering
6.	What is called a torsional moment?	BT-1	Remembering
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-4	Analyzing
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. Identify the ratio of its torque carrying capacity to that of a solid shaft of the same material and the same outside diameter?	BT-3	Applying
12.	Sketch the shear stress variation along the radius of a hollow shaft is subjected to torsion.	BT-2	Understanding

13.	Compose the formula for the equivalent bending moment under combined action of bending moment M and torque T.	BT-6	Creating
14.	For a circular shaft of diameter d subjected to torque T, what is the maximum value of the shear stress?	BT-1	Remembering
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-4	Analyzing
17.	A member is subjected to the combined action of bending moment 400 Nm and torque 300 Nm. Solve for the value of equivalent torque?	BT-4	Analyzing
18.	Differentiate between closed coil helical spring and open coil helical spring.	BT-2	Understanding
19.	Discuss about spring index.	BT-3	Applying
20.	Give any two functions of spring.	BT-1	Remembering
21.	Formulate the mathematical expression for deflection of an open coiled helical spring.	BT-5	Evaluating
22.	What is a spring? Name the two important types of springs.	BT-1	Remembering
23.	Write down the formula for the central deflection of a laminated spring.	BT-1	Remembering
24.	Classify springs with examples.	BT-1	Remembering
25.	What is leaf spring? List the uses of leaf spring.	BT-1	Remembering

PART B

Q.NO	QUESTIONS	BT LEVEL	COMPETENCE
1.	A solid steel shaft is subjected to a torque of 45kNm. If the angle of twist is 0.5^0 per metre length of the shaft and the shear stress is not to be allowed to exceed $90MN/m^2$. & C= $80GN/m^2$. Evaluate a) Suitable diameter for the shaft b) Final maximum shear stress c) Angle of twist d) Maximum shear strain in the shaft	BT-3	Applying
2.	In a tensile test, a test piece of 25mm diameter, 200mm gauge length stretched 0.0950mm under a pull of 50kN. In a	BT-3	Applying

	torsion test, the same rod is twisted about 0.03radian over a length of 150mm when a torque of 0.5kN.m was applied. Evaluate a) Poission's ratio b) Young's modulus c) Bulk modulus and d) Rigidity modulus for a material		
3.	A steel shaft ABCD having a total length of 2400mm is contributed by three different sections as follows. The portion AB is hollow having outside and inside diameters 80mm and 50mm respectively, BC is solid and 80mm diameter. CD is also solid and 70mm in diameter. If the angle of twist is same for each section, Solve for the length of each portion and the total angle of twist. Maximum permissible shear stress is 50 MPa and shear modulus $0.82x10^5$MPa.	BT-3	Applying
4.	A composite shaft consists of copper rod of 25mm diameter enclosed in a steel tube of external diameter 45mm and 5mm thick. The shaft is required to transmit a torque of 1100N.m and both the shaft have equal lengths, welded to a plate at each end so that their twists are equal. If the modulus of rigidity for the steel as twice that of copper, find a) Shear stress developed in copper b) Shear stress developed in steel	BT-3	Applying
5.	A solid circular shaft transmits 75kW power at 200rpm. Estimate the values of shaft diameter, if the twist in the shaft is not to exceed one degree in 2m length of shaft and shear stress is not exceed 50 N/mm^2. Assume the modulus of rigidity of the material of the shaft as 100 kN/mm^2	BT-3	Applying
6.	A shaft has to transmit 245 kW power at 240 rpm. The maximum torque may be 1.5 times the mean torque. The shear stress in the shaft is not to exceed 40 N/mm^2 and the twist must not exceed 1^0 per metre length, find a suitable diameter. If a) Tha shaft is solid b) The shaft is hollow with external diameter twice the internal diameter Take C = $8x10^4$ N/mm^4	BT-3	Applying
7.	A helical spring in which mean diameter of the coil is 8times the wire diameter is to be designated to observe 0.2 KN of energy with an extension of 100mm. the maximum shear stress is not to exceed 125N/mm^2 . determine the mean diameter of wire and diameter of springs and number of turns also find the load with an extension of 40 mm could	BT-3	Applying

	be produced in the spring assume G= 84KN/mm^2		
8.	A closely coiled helical spring made out of a 10mm diameter steel bar has 12 complete coils, each of mean diameter of 100mm. Calculate a) the stress induced in the section of rod, b) the deflection under the pull and c) Amount of energy stored in the spring during the extension If It is subjected to an axial pull of 200N. Modulus of rigidity is 0.84x10^5 N/mm^2	BT-3	Applying
9.	A close coiled helical spring has a stiffness of 5N/mm. its length when fully compressed with adjacent coils touching each other is 40 cm. the modulus of rigidity of the material of the spring is 8x10^4 N/mm^2. Determine the wire diameter and mean coil diameter if their ratio is 1/10. What is the corresponding maximum shear stress in the spring	BT-3	Applying
10.	a) A circular shaft of 1000mm diameter and 2m length is subjected to a twisting moment. This creates a shear stress of 20N/mm^2 at 30mm from the axis of the shaft. Calculate the angle of twist and the strain energy stored in the shaft. Take G=8x10^4 N/mm^2 b) A leaf spring 750mm long is required to carry a central load of 8kN. If the central deflection is not to exceed 20mm and the bending stress is not to be greater than 200N/mm^2. Determine the thickness, width and number of plates. Assume the width of the plates is 12 times, their thickness and modulus of elasticity of the springs material as 200kN/mm^2	BT-3	Applying
11.	a) A solid shaft is subjected to a bending moment of 2.3 KN-m and twisting moment of 3.45KN-m find the diameter of shaft if the permissible tensile and shear stress for the material of the shaft are limited to 703 MN/m^2 and 421.8 MN/m^2. b) A open coil helical spring is made up 5mm diameter wire has 16 coils 100mm diameter with helix angel of 16^0 calculate the deflection maximum direct and shear stress induced due to an axial load of 300N. Take G=90GPa and E=200GPa.	BT-3	Applying
12.	Two solid shafts AB and BC of aluminum and steel respectively are rigidly fastened together at B and attached to two rigid supports at A and C. Shaft AB is 7.5cm in diameter and 2m in length. Shaft BC is 5.5 cm in diameter and 1m in length. A torque of 20000 N-cm is applied at the junction B. compute the maximum shearing stresses in each	BT-3	Applying

	material. What is the angle of twist at the junction? Take C_{al} = $0.3x10^5$ N/mm^2 and C_{st} = 0.9 N/mm^2.		
13.	a) Find the size of a square shaft to transmit 75kW at 120 rpm if shear stress is not to exceed 50N/mm^2 b) Hollow shaft having inside diameter 60% of its outside diameter is to replace a solid shaft transmitting a same power at the same speed calculate the % saving in material, if the materials to be used is also the same. c) Calculate the maximum torque that a shaft of 125 mm diameter can transmit, if the maximum angle of twist 1^0 in a length of 1.5 m. C=$7x10^5$ N/mm^2	BT-3	Applying
14.	Two close coiled helical springs wound from the same wire, but with different core radii having equal no.of coils are compressed between rigid plates at their ends. Calculate the maximum shear stress induced in each spring, if the wire diameter is 10mm and the load applied between the rigid plates is 500N. the core radii of the spring 100 mm and 75mm respectively.	BT-3	Applying

PART C

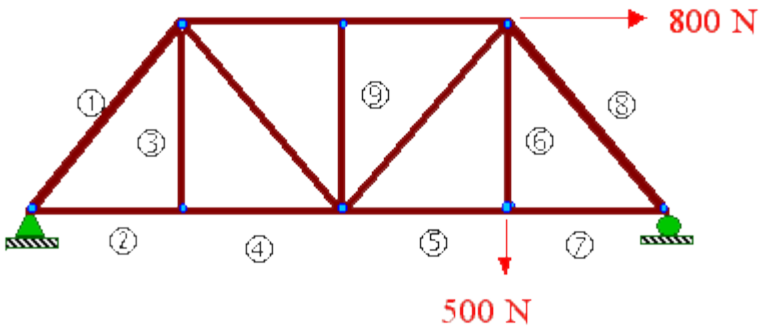
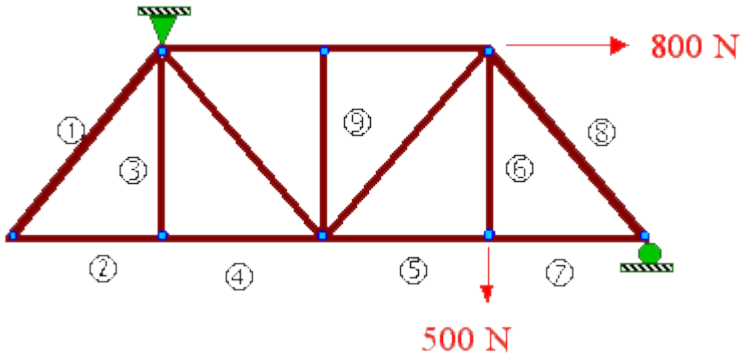
Q.NO	QUESTIONS	BT LEVEL	COMPETENCE
1.	Derive the following torsional equation $\frac{T}{J} = \frac{G\theta}{L} = \frac{\tau}{r}$	BT-2	Understanding
2.	Derive an expression for strain energy stored in a body due to torsion	BT-2	Understanding
3.	A close coiled helical spring is to carry a load of 5000N with a deflection of 50 mm and a maximum shearing stress of 400 N/mm2 .if the number of active turns or active coils is 8. Estimate the following: (i) wire diameter (ii) mean coil diameter (iii) weight of the spring Assume G = 83,000 N/mm^2 ; = 7700 kg/m^3	BT-4	Analyzing
4.	Discuss about **(i)** springs in series and parallel **(ii)** Buffer springs	BT-4	Analyzing

UNIT V STATE OF STRESS AND TRUSSES

State of Stress in two dimensions - Stresses in inclined planes - Principal Stresses and Principal Planes - Mohr's circle method - Analysis of pin jointed plane determinate trusses by method of joints, method of sections and tension coefficient - Space trusses - Tension coefficient method..

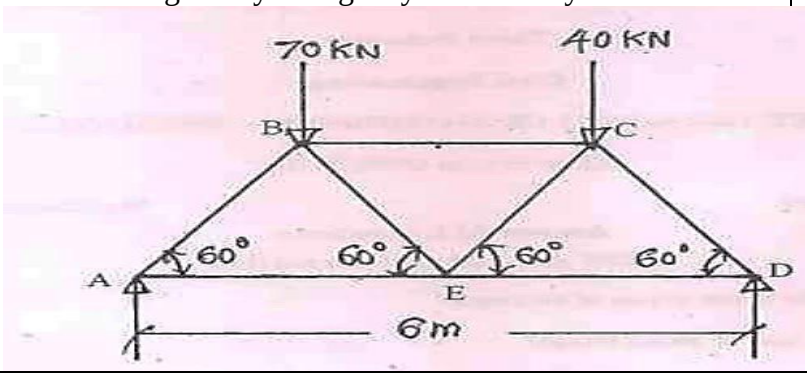
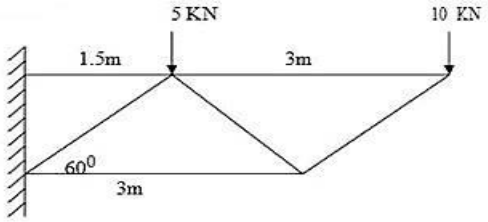
PART A

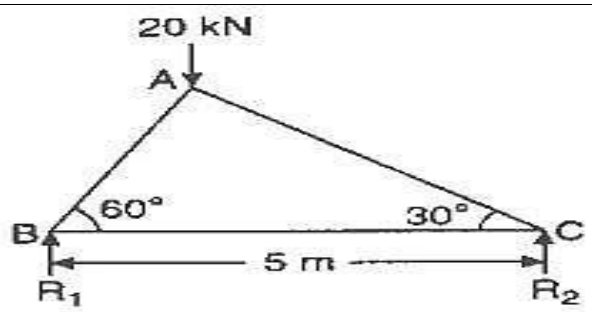
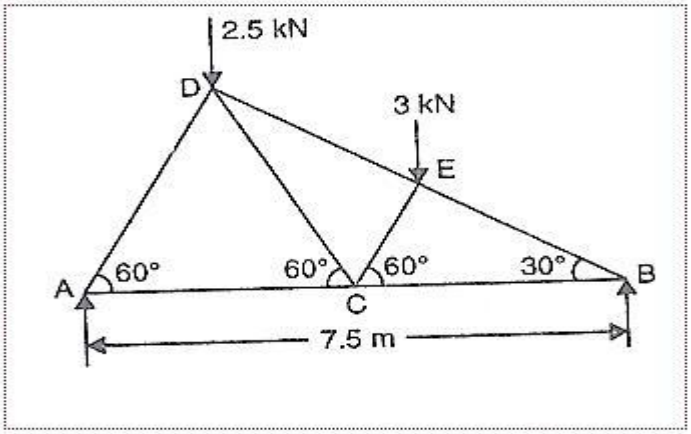
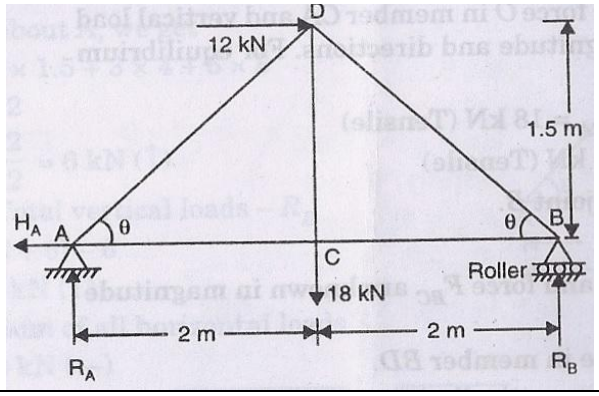
Q.NO	QUESTIONS	BT LEVEL	COMPETENCE
1.	Distinguish between Circumferential stress (or hoop stress) and Longitudinal stress?	BT-2	Understanding
2.	Differentiate a frame and truss.	BT-2	Understanding
3.	Define state of stress at a point	BT-1	Remembering
4.	Define principal plane.	BT-1	Remembering
5.	Define principal stress.	BT-1	Remembering
6.	Generalize the formula for finding circumferential strain and longitudinal strain?	BT-1	Remembering
7.	Define plane stress problem with example	BT-1	Remembering
8.	Define plane strain problem with example	BT-1	Remembering
9.	Relate uniform and non-uniform state of stress	BT-1	Remembering
10.	Draw the Mohr's circle for a state of pure shear and indicate the principal stresses	BT-2	Understanding
11.	Distinguish between perfect and imperfect frame?	BT-2	Understanding
12.	Compare and contrast deficient and redundant frame.	BT-2	Understanding
13.	Justify how method of joints applied to Trusses carrying Horizontal and inclined loads	BT-1	Remembering
14.	Discuss the assumptions made in finding out the forces in a frame?	BT-3	Applying
15.	Draw the Mohr's circle for the following state of stress: Principal stresses = 50MPa, -50MPa. Maximum shear stress = 50MPa.	BT-3	Applying
16.	What are the different types of trusses?	BT-1	Remembering
17.	State the advantages of method of section over method of joints	BT-1	Remembering
18.	Enlist the methods are available for the analysis of pin connected plane frames.	BT-1	Remembering
19.	Show the difference between a cantilever and simply supported frame? How will you find the reactions in both the	BT-2	Understanding

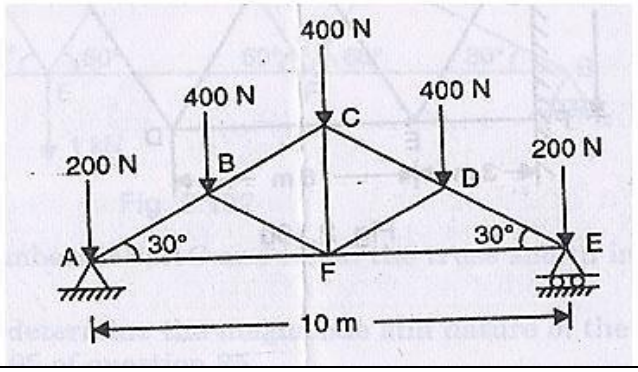
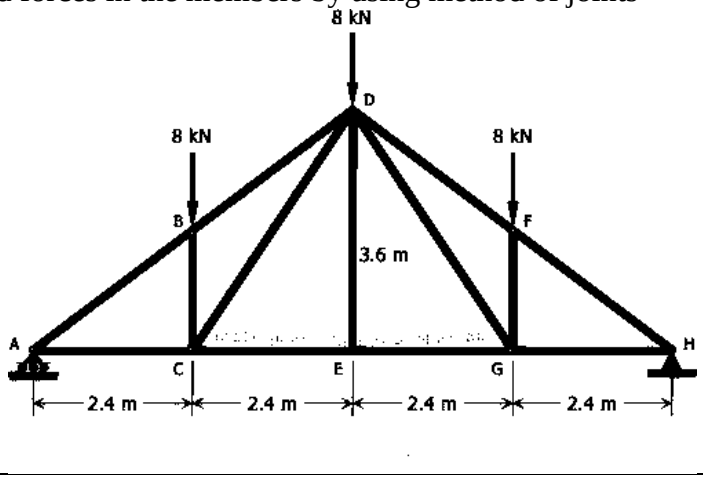
	cases?		
20.	List the methods available for analyzing the frames.	BT-1	Remembering
21.	How do you identify Zero force members in a truss?	BT-1	Remembering
22.	Identify the zero force members for the truss shown 	BT-4	Analyzing
23.	A perfect frame consists of 7 members. Decide the number of possible joints.	BT-6	Creating
24.	Identify the zero force members for the truss shown 	BT-4	Analyzing
25.	List out the steps involved in analysis of frames.	BT-1	Remembering

PART B

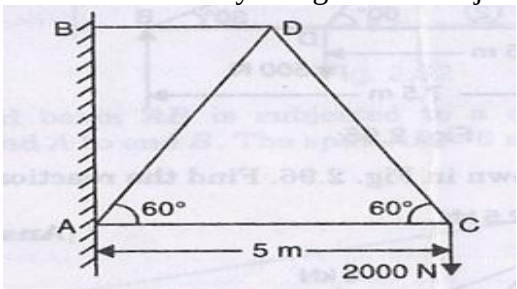
Q.NO	QUESTIONS	BT LEVEL	COMPETENCE
1.	A rectangular block of material is subjected to a tensile stress of 110N/mm^2 on one plane and a tensile of 47 N/mm^2 on a plane at right angles to the former. Each of the above stresses is accompanies by a shear stress of 63N/mm^2. Determine the principal stresses, principal planes and the maximum shear stresses.	BT-5	Evaluating
2.	At a point in a strained material, the principal stresses are100 N/mm^2 (T) and 40 N/mm^2 (C). Determine the resultant stress in magnitude and direction in a plane inclined at 60^0 to the axis of major principal stress. What is	BT-1	Remembering

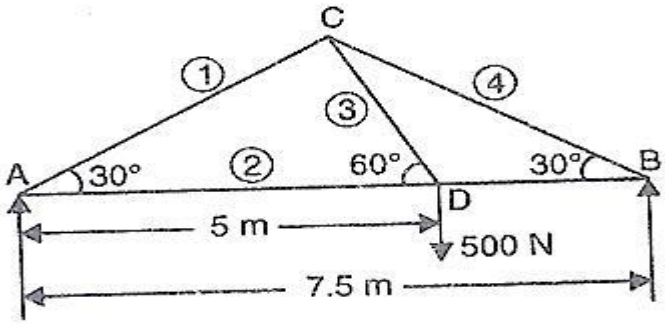
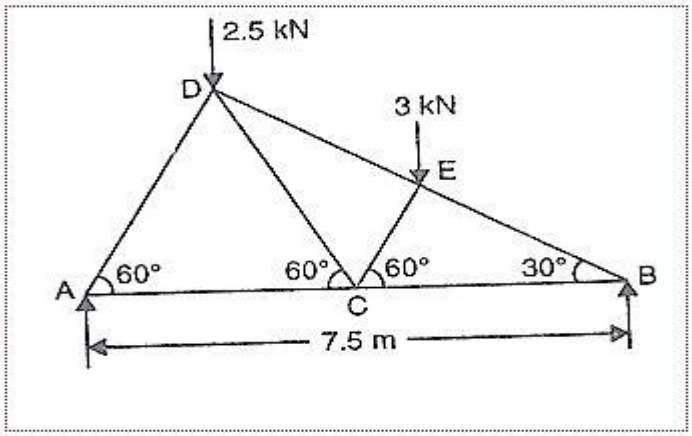
	the maximum intensity of shear stress in the material at the point?		
3.	The stresses at a point in a strained material is P_x= 200 N/mm^2, P_y = -150N/mm^2 and Q = 80 N/mm^2. Construct Mohr's circle and verify with the analytical results.	BT-6	Creating
4.	The principal stresses in the wall of a container are 40 MN/m^2 and 80 MN/m^2. Determine the normal, shear and resultant stresses in magnitude and direction in a plane, the normal of which makes an angle of 30^o with the direction of maximum principal stress	BT-3	Applying
5.	An elemental cube is subjected to tensile stresses of 30 N/mm^2 and 10 N/mm^2 acting on two mutually perpendicular planes and a shear stress of 10N/mm^2 on these planes. Draw the mohr's circle if stresses and hence determine the magnitudes and direction of principal stresses and also the greatest shear stress.	BT-3	Applying
6.	Analyze and predict the forces in all members of the truss shown in figure by using any one analytical methods 	BT-4	Analyzing
7.	A cantilever truss is show in fig. conclude the forces and its nature in the members of the truss by the method of joint 	BT-3	Applying
8.	Discuss about tension coefficient method and steps involved in analysis of space trusses using method of tension coefficients.	BT-2	Understanding
9.	A truss loaded shown in fig. Analyze and find the reaction and forces in the members by using any one analytical methods	BT-4	Analyzing

			
10.	Analyze the truss by method of Joints 	BT-4	Analyzing
11.	A short metallic column of 500mm^2 cross sectional area carries a axial compressive load of 100kN.For a plane inclined at 60^o with the direction of the load. Evaluate the **a)** Normal stress **b)** Resultant stress **c)** Tangential stress **d)** Maximum shear stress **e)** Obliquity of resultant stress	BT-5	Evaluating
12.	A truss loaded shown in fig. Analyze and find the reaction and forces in the members by using anyone analytical methods 	BT-4	Analyzing

13.	Analyze and predict the forces in all members of the truss shown in figure by method of sections 	BT-4	Analyzing
14.	A truss loaded shown in fig. Analyze and find the reaction and forces in the members by using method of joints 	BT-4	Analyzing

PART C

Q.NO	QUESTIONS	BT LEVEL	COMPETENCE
1.	Derive relations for normal and shear stresses acting on an inclined plane at a point in a stained material subjected to two mutually perpendicular direct stresses	BT-2	Understanding
2.	A truss loaded shown in fig. Analyze and find the reaction and forces in the members by using method of joints 	BT-4	Analyzing

3.	Investigate the truss shown below using method of joints 	BT-4	Analyzing
4.	Investigate the truss shown below using method of Sections 	BT-4	Analyzing