SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF MECHANICAL ENGINEERING

QUESTION BANK

IV SEMESTER

1909403 STRENGTH OF MATERIALS

Regulation – 2019

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Prepared by

Mr.S.SIVALINGAM , Assistant Professor/MECHANICAL ENGINEERING

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QUESTION BANK

SUBJECT : 1909403 – STRENGTH OF MATERIALS

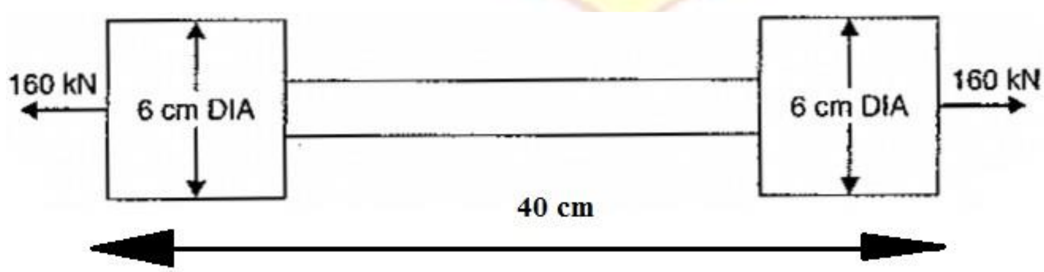
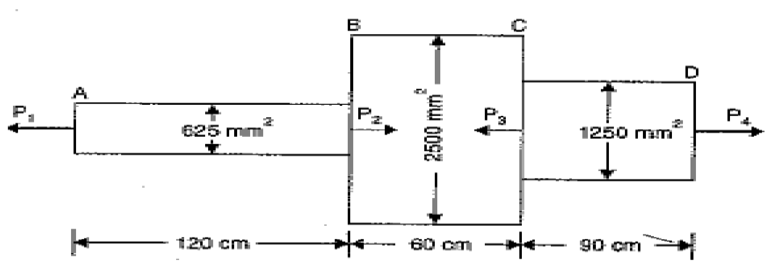
SEM / YEAR: IV/II

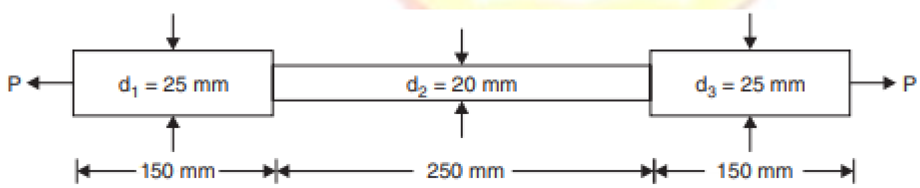
UNIT I STRESS STRAIN DEFORMATION OF SOLIDS			
Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains –Stresses on inclined planes – principal stresses and principal planes – Mohr's circle of stress.			
PART-A(2 MARKS)			
Q.No	**Questions**	**BT Level**	**Competence**
1	Describe Hooke's Law with a graph.	(BT1)	Remember
2	List various Elastic Constants.	(BT1)	Remember
3	Define Poisson's Ratio.	(BT1)	Remember
4	Differentiate between rigid and deformable bodies.	(BT2)	Understand
5	Show the relation between modulus of elasticity and modulus of rigidity.	(BT2)	Understand
6	Evaluate the load carried by a bar if the axial stress is 10 N/mm^2 and the diameter of bar is 10 mm.	(BT2)	Understand
7	A circular rod 2 m long and 15 mm diameter is subjected to an axial tensile load of 30 kN. Calculate the elongation of the rod if the modulus of elasticity of the material of the rod is 120 kN/mm^2.	(BT2)	Understand
8	Define principal planes and principal stresses.	(BT1)	Remember
9	Along which planes does greatest shear stress occur?	(BT1)	Remember
10	Express Young's modulus in terms of Bulk and Rigidity modulus.	(BT2)	Understand
11	Define factor of safety.	(BT1)	Remember
12	Discuss shortly about thermal stress.	(BT2)	Understand
13	Differentiate tensile stress from compressive stress.	(BT2)	Understand
14	State the principle of super position.	(BT2)	Understand
15	Compare longitudinal and lateral strain.	(BT2)	Understand
16	Quote the expression for stresses on an inclined plane when it is subjected to an axial pull.	(BT2)	Understand
17	Write the expressions for the stresses acting on two mutually perpendicular	(BT1)	Remember

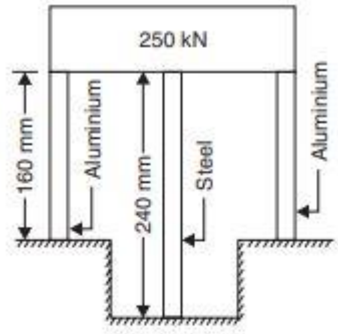
	planes to find the major and minor principal stresses.		
18	Deduce the two equations used to find the forces in compound bars made of two materials subjected to tension.	(BT1)	Remember
19	Calculate the total elongation when a bar of varying cross–section consists of two sections of lengths L_1 and L_2 with cross sections A_1 and A_2. It is subjected to an axial pull F.	(BT2)	Understand
20	Compare compound bar and simple bar.	(BT2)	Understand
21	Differentiate elasticity and elastic limit	(BT2)	Understand
22	The Young's modulus and the shear modulus of material are 120GPa and 45GPa respectively. What is it Bulk modulus	(BT2)	Understand
23	A rod of diameter 30 mm and length 400 mm was found to eligible 0.35 mm. When it was subjected to a load of 65 KN. Compute the modulus of elasticity of material of this rod	(BT2)	Understand
24	Obtain the relation between E and K	(BT2)	Understand
25	What does the radius of mohr's circle refer to?	(BT1)	Remember

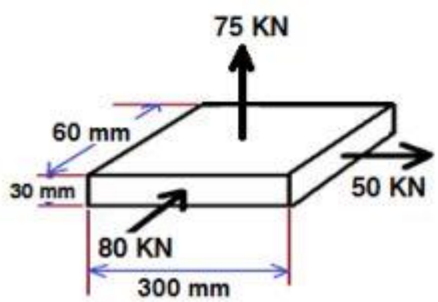
Q.No	PART B (13 MARKS)	BT Level	Competence
1	(a) Draw stress strain curve for mild steel and explain about the silent points (7)	(BT4)	Analyze
	(b) Derive a relation for change in length of a uniformly varying circular bar subjected to axial load. (6)	(BT2)	Understand
2	(a) A bar of varying cross section consists of two sections of length 700 mm and 900 mm with cross sections 400 mm^2 and 625 mm^2 respectively. it is subjected to an axial pull of 100 kN. Take E = 200 kN/ mm ^{2}. Find the total elongation. (7)	(BT3)	Apply
	(b) A rod 3 m long is initially at a temperature of 15^o C and it is raised to 90^o C. Find the expansion of the rod and if the expansion is prevented, find the stress in the material. Take E = 2*10^5 N/mm^2; α = 12*10^{-6} /^{o}C. (6)	(BT3)	Apply
3	A reinforced concrete column 500 mm × 500 mm in a section is reinforced with 4 steel bars of 25 mm diameter; one in each corner, the column is carrying a load of 1000 kN. Find the stress in the concrete and steel bars. Take E for steel	(BT4)	Analyze

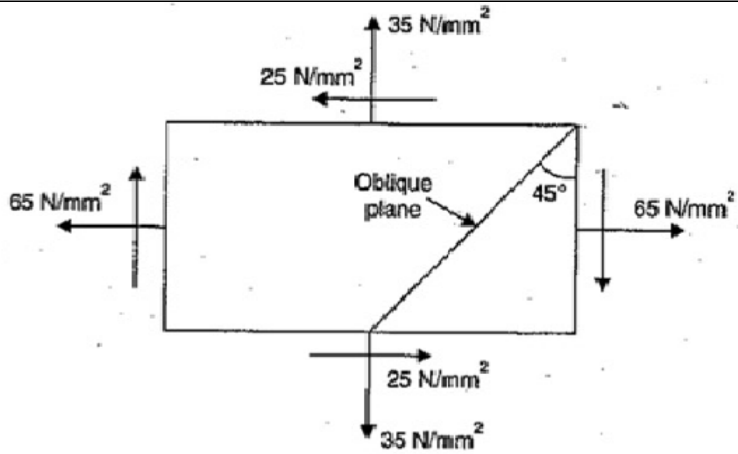
	$= 210\times10^3$ N/mm^2 and E for concrete = 14×10^3 N/mm^2.		
4	(a) A bar of 30 mm diameter is subjected to a pull of 60 kN. The measured extension of gauge length of 200 mm is 0.1 mm and change in diameter is 0.004 mm. calculate young's modulus, shear modulus and Poisson ratio. (7)	(BT4)	Analyze
	(b) Derive the relationship between modulus of elasticity and Bulk modulus.(6)	(BT3)	Apply
5	Two vertical rods one of steel and the other of copper are each rigidly fixed at the top and 50 cm apart. Diameters and lengths of each rod are 2 cm and 4 m respectively. A cross bar fixed to the rods at the lower ends carries a load of 5000 N such that the cross bar remains horizontal even after loading. Find the stress in each rod and the position of the load on the bar. Take E for steel = 2 x 10^5 N/mm^2 and E for copper = 1x 10^5 N/mm^2.	(BT4)	Analyze
6	A steel rod of 30 mm diameter passes centrally through a copper tube of 60 mm external diameter and 50 mm internal diameter. The tube is closed at each end by rigid plates of negligible thickness. The nuts are tightened lightly home on the projecting parts of the rod. If the temperature of the assembly is raised by 60˚C, calculate the stress developed in copper and steel. Take E for steel and copper as 200 GN/ m^2 and 100 GN/m^2 and α for steel and copper as 12 x 10^{-6} per ˚C and 18 x 10^{-6} per ˚C.	(BT3)	Apply
7	A mild steel rod of 25 mm internal diameter and 400 mm long is enclosed centrally inside a hollow copper tube of external diameter 35 mm and internal diameter of 30 mm. The ends of the tube and rods are brazed together and the composite bar is subjected to an axial pull of 50 kN. If E for steel and copper is 200 GN/m^2 and 100 GN/m^2 respectively, find the stresses developed in the rod and tube.	(BT4)	Analyze
8	At a certain point in a strained material, the stresses on two planes, at right angles to each other are 20 N/mm^2 and 10 N/mm^2 both tensile. They are accompanied by a shear stress of a magnitude of 10 N/mm^2. Find graphically or otherwise, the location of principal planes and evaluate the principal stresses.	(BT3)	Apply
9	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 10 N/mm^2 on these planes. Draw the Mohr's circle of stresses and hence or	(BT4)	Analyze

	otherwise determine the magnitudes and directions of principal stresses and also the greatest shear stress.		
10	(a) Find the young's modulus of a rod of diameter 30 mm and of length 300 mm which is subjected to a tensile load of 60 kN and the extension of the rod is equal to 0.4 mm. (7)	(BT3)	Apply
	(b) The ultimate stress for a hollow steel column which carries an axial load of 2 MN is 500 N/mm^2. If the external diameter of the column is 250 mm, determine the internal diameter. Take the factor of safety as 4.0 . (6)	(BT4)	Analyze
11	Two plans AB and AC which are right angles carry shear stress of intensity 17.5 N/mm^2 while these planes also carry a tensile stress of 70N/mm^2 and a compressive stress of 35 N/mm^2 respectively. Determine the following (i) Principal planes. (ii) Principal stresses. (iii) Maximum shear stress and planes on which it acts.	(BT4)	Analyze
12	The bar shown in fig. is subjected to a tensile load of 160 KN. If the stress in the middle portion is limited to 150 N/mm^2, determine the diameter of the middle portion. Find also the length of the middle portion if the total elongation of the bar is to be 0.2 mm. Young's modulus is given as equal to 2.1 x 10^5 N/mm^2. 	(BT3)	Apply
13	A member ABCD is subjected to point loads P_1, P_2, P_3, P_4 as shown in fig. calculate the force P_2 necessary for equilibrium, if P_1 = 45 kN, P_3 = 450 kN and P_4 = 139 kN. 	(BT4)	Analyze

	Determine the total elongation of the member, assuming the modulus of elasticity to be 2.1 x 10^5 N/mm^2.		
14	A cast iron flat 300 mm long and 30 mm (thickness) × 60 mm (width) uniform cross section, is acted upon by the following forces : 30 kN tensile in the direction of the length 360 kN compression in the direction of the width 240 kN tensile in the direction of the thickness. Calculate (i) The direct strain, (ii) Net strain in each direction and (iii) Change in volume of the flat. Assume the modulus of elasticity and Poisson's ratio for cast iron as 140 kN/mm^2 and 0.25 respectively.	(BT3)	Apply
15	A steel flat of thickness 10 mm tapers uniformly from 60 mm at one end to 40 mm at other end in a length of 600 mm. If the bar is subjected to a load of 80 kN, find its extension. Take E = 2 × 105 MPa. What is the percentage error if average area is used for calculating extension?	(BT4)	Analyze
16	The bar shown in Fig.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.  	(BT3)	Apply
17	Three pillars, two of aluminium and one of steel support a rigid platform of 250 kN as shown in Fig. If area of each aluminium pillar is 1200 mm2 and that of steel pillar is 1000 mm^2 , find the stresses developed in each pillar. Take Es = 2 × 105 N/mm ^{2} and Ea = 1 × 106 N/mm ^{2} .	(BT3)	Apply

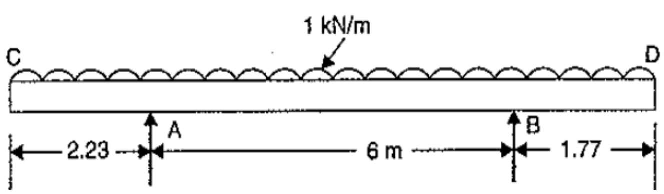
			
18	As compound tube consists of a steel of 140mm internal diameter and 5mm thickness and an outer brass tube of 150mm internal diameter and 5mm thick. The two tubes are of same length. Compound tube carries an axial load of 600Kn. Find the stresses carried by each tube and amount of shortening. Length of the tube is 120mm. Es=2X10^5N/mm^2 , Eb=1X10^5 N/mm^2 .	(BT3)	Apply

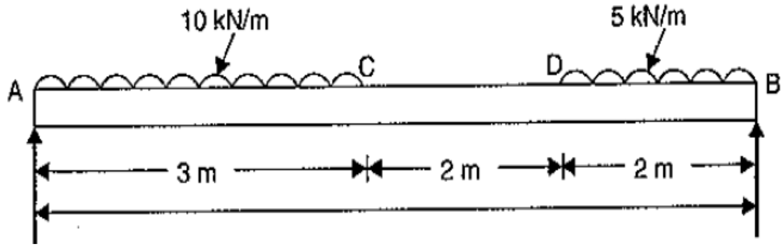
Q. No	**PART C (15 MARKS)**	**BT Level**	**Competence**
1	A steel plate 300mm long, 60mm wide and 30mm deep is acted upon by the forces shown in figure. Determine the change in volume. Take E = 200 KN/mm2 and Poisson's ratio = 0.3. 	(BT5)	Evaluate
2	A point in a strained material is subjected to stresses shown in Fig. Using Mohr's circle method, determine the normal and tangential stresses across the oblique plane. Check the answer analytically.	(BT6)	Create

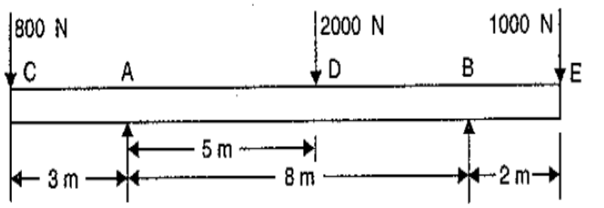
			
3	A steel rod of 20mm pases centrally through a copper tube of 50mm external diameter and 40mm internal diameter. The tube is closed at each end by rigid plates. if the temperature of the assembly is raised by 500°C, calculate the stresses developed in copper and steel. Take Es=100kN/mm^2 , Ec=100kN/mm^2 , αs=12X10^{-6} per°C, αc=18X10-6 per°C	(BT5)	Evaluate
4	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 (i) The stress at elastic limit. (ii) Young's modulus. (iii) Percentage elongation. (iv) Percentage reduction in area. (v) Ultimate tensile stress	(BT4)	Analyze
5	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 × 105 N/mm2 and 2 × 105 N/mm2 , determine the stresses developed in each material and the extension of the compound bar when axial tensile force of 60 kN acts.	(BT4)	Analyze

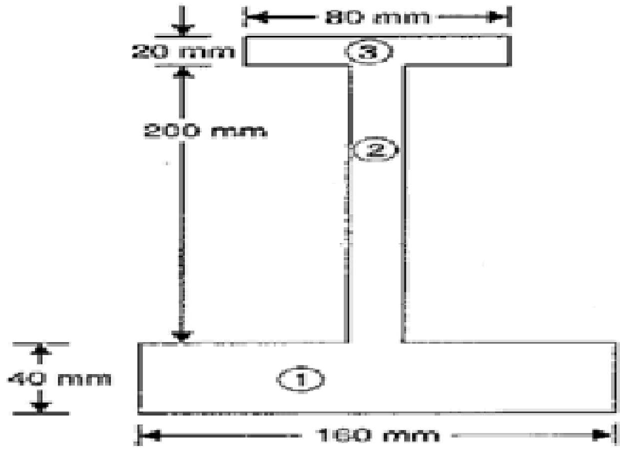
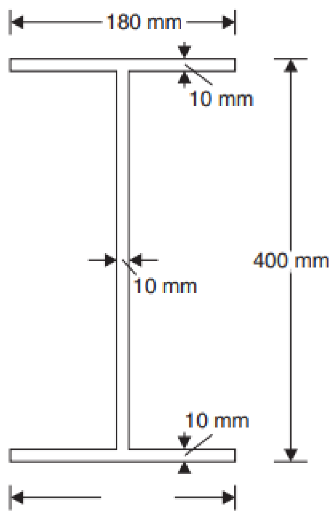
UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM			
Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending– bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.			
PART-A(2 MARKS)			
Q. No	**Questions**	**BT Level**	**Competence**
1	Classify beams based on the supports.	(BT1)	Remember
2	Name the various types of loading.	(BT1)	Remember
3	Define shear force and bending moment.	(BT1)	Remember
4	When the bending moment will be maximu?	(BT1)	Remember
5	List out the various types of supports.	(BT1)	Remember
6	Describe the term “Point of contraflexure”.	(BT1)	Remember
7	Differentiate sagging and hogging bending moment.	(BT2)	Understand
8	Estimate the shear force and bending moment at a section 2 m from the free end A of a cantilever beam of 3 m long carries a load of 20 KN at its free end.	(BT2)	Understand
9	A fixed beam 3 m long carries a load of 40 KN at its mid span. Calculate the shear force and bending moment at the midsection.	(BT2)	Understand
10	Differentiate UDL with UVL with respect to bending moment diagram.	(BT2)	Understand
11	Describe the theory of simple bending.	(BT2)	Understand
12	Define flitched beam.	(BT1)	Remember
13	Illustrate the shear stress distribution in a solid circular section.	(BT3)	Apply
14	Calculate the moment of resistance of a beam subjected to a bending stress of 5 N/mm^2 and section modulus is 3500 cm^3.	(BT3)	Apply
15	Compare overhanging beam with continuous beam.	(BT2)	Understand
16	What is the maximum bending moment in a simply supported beam of span ‘L’ meters subjected to UDL of ‘w’ KN/m over entire span.	(BT2)	Understand
17	Compare the bending stress distribution and shear stress distribution for a beam of rectangular cross section.	(BT2)	Understand
18	Formulate the mathematical form of bending moment theory.	(BT2)	Understand

19	Summarize the assumptions in the theory of simple bending.	(BT2)	Understand
20	Draw the BMD for a simply supported beam of span L carrying uniformly varying load from 0 to “W” KN / m for the entire span.	(BT2)	Understand
21	Write bending equation and explain the terms?	(BT2)	Understand
22	What is section modulus?	(BT1)	Remember
23	What do you mean by beam of uniform strength?	(BT1)	Remember
24	Draw SFD for a 6m cantilever beam carrying a clockwise moment of 6KNm at free end.	(BT2)	Understand
25	Sketch a) the bending stress distribution b) shear stress distribution for a beam of rectangular cross section.	(BT2)	Understand

Q. No	**PART B (13 MARKS)**	**BT Level**	**Competence**
1	A simply supported beam of span 6 m is carrying a uniformly distributed load of 2 kN/m over the entire span. Calculate the magnitude of shear force and bending moment at every section, 2 m from the left support. Draw the shear force and bending moment diagrams for the beam.	(BT4)	Analyze
2	A cantilever 1.5 m long is loaded with a uniformly distributed load of 2 kN/m run over a length of 1.25 m from the free end. It also carries a point load of 3 kN at a distance of 0.25 m from the free end. Draw the shear force and bending moment diagrams of the cantilever.	(BT4)	Analyze
3	(a) Draw the shear force and bending moment diagrams for the beam of span 10 m long shown in figure. 	(BT3)	Apply
	(b) Determine the maximum bending moment and locate the point of contra flexure for the given beam.	(BT3)	Apply
4	A Simply supported beam is carrying loads as shown in fig. draw the shear force and bending moment diagrams for the beam.	(BT4)	Analyze

			
5	A simply supported beam of span 8 m long is subjected to two concentrated loads of 24 kN and 48 kN at 2 m and 6 m from left support respectively. In addition it carries a UDL of 36 kN/m over the entire span. Draw shear force and bending moment diagrams. Mark the salient points.	(BT4)	Analyze
6	A beam of length 10 m is simply supported at its ends carries two concentrated loads of 5 kN each at a distance of 3 m and 7 m from the left support and also a uniformly distributed load of 1 kN/m between the point loads. i) Draw the shear force and bending moment diagrams. ii) Calculate the maximum bending moment.	(BT4)	Analyze
7	A cantilever of length 6 m carries two point loads of 2 kN and 3 kN at a distance of 1 m and 6 m from the fixed end respectively. In addition to this the beam also carries a uniformly distributed load of 1 kN/m over a length of 2 m at a distance of 3 m from the fixed end. Draw the shear force and bending moment diagrams.	(BT4)	Analyze
	A cantilever 6m long carries load of 30, 70, 40 and 60KN at a distance of 0, 0.6, 1.5 and 2.4m respectively from the free end. Draw the shear force and bending moment diagrams for the cantilever beam		
8	A simply supported beam of length 5 m carries a uniformly varying load of 800 N/m run at one end to zero at other end. Draw the shear force and bending moment diagrams for the beam. Also calculate the position and magnitude of maximum bending moment.	(BT4)	Analyze
9	Draw the shear force and bending moment diagram of the beam loaded as shown in fig. Determine the point of contraflexure if any.	(BT3)	Apply

			
10	A timber beam of rectangular section is to support a load of 20 KN uniformly distributed over a span of 3.6 m, when the beam is simply supported. If the depth of the section is to be twice the breadth and the stress in the timber is not to exceed 7 N/mm^2, find the breadth and depth of the cross section. How will you modify the cross section of the beam, if it carries a concentrated load of 30 kN placed at the mid- span with same ratio of breadth to depth?	(BT4)	Analyze
11	(a) State the assumptions made in theory of simple bending equation. (5)	(BT1)	Remember
	(b) A beam 150 mm wide and 300 mm deep is simply supported over a span of 6 m. Find the maximum UDL the beam can carry if the bending stress is not exceed 8 N/mm^2. (8)	(BT4)	Analyze
12	A simply supported beam of rectangular cross section 60 x 35 mm and 3m long carrying a load of 5KN at mid span. Determine the maximum bending stress induced in the beam		
13	A cross section of a beam in the form of a triangle with base 200 mm and depth 300 mm. If the shear stress on the beam is 60 kN study the distribution determine the maximum shear stress.	(BT4)	Analyze
14	A rectangular beam 300 mm deep is simply supported over a span of 4 meters. Determine the uniformly distributed load per meter which the beam may carry, if the bending stress should not exceed 120 N/mm^2. Take I = 8 x 10^6 mm^4.	(BT5)	Evaluate
15	A cast iron beam is of I-section as shown in Fig. The beam is supported on a span of 5 meters. If the tensile stress is not to exceed 20 N/ mm^2, find the safe uniformly load which the beam can carry. Find also the maximum compressive stress.	(BT4)	Analyze

			
16	Draw the shear stress variation diagram for the I-section shown in Fig.if it is subjected to a shear force of 100 kN. 	(BT4)	Analyze
17	The cross-section of a cast iron beam is as shown in Fig. 14(a). The top flange is in compression and bottom flange is in tension. Permissible stress in tension is 30 N/mm2 and its value in compression is 90 N/mm2 . What is the maximum uniformly distributed load the beam can carry over a simply supported span of 5 m?	(BT4)	Analyze

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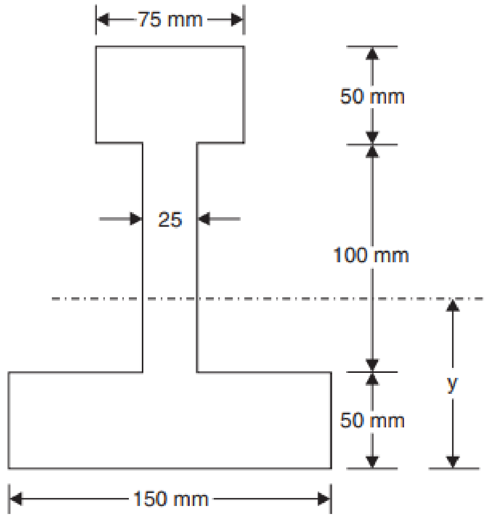
<tr><td></td><td>
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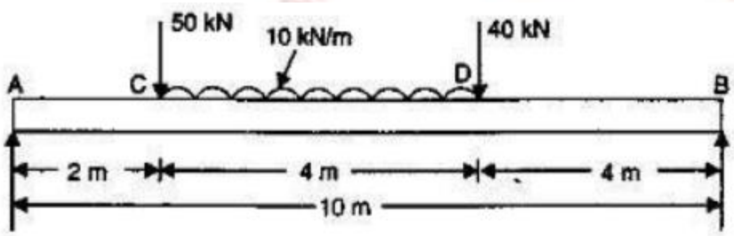
<tr><td>18</td><td>A simply supported beam of length 10m, carries the uniformly distributed load and two point loads as shown in Fig. Draw the S.F and B.M diagram for the beam and also calculate the Maximum bending moment.

</td><td>(BT3)</td><td>Apply</td></tr>
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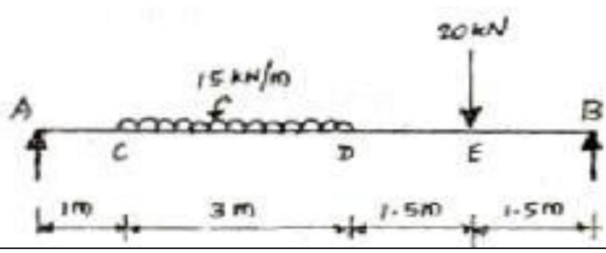
<tr><th>Q. No</th><th>PART C (15 MARKS)</th><th>BT Level</th><th>Competence</th></tr>
<tr><td>1</td><td>For the simply supported beam loaded as shown in Fig. , draw the shear force diagram and bending moment diagram. Also, obtain the maximum bending moment.

</td><td>(BT5)</td><td>Evaluate</td></tr>
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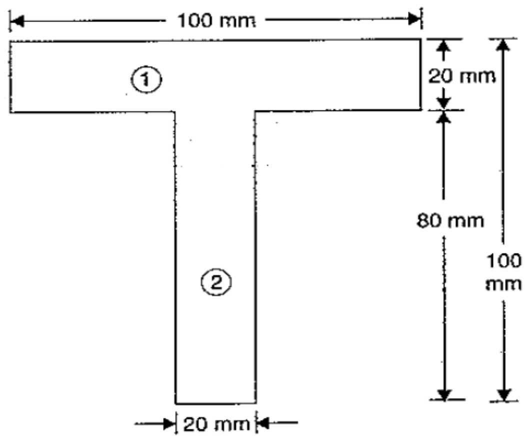
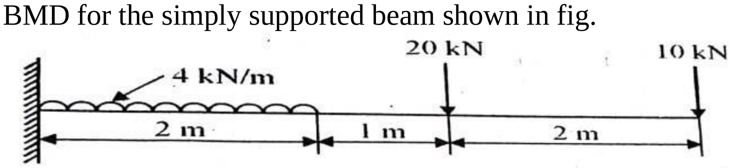
2	A T-section of a simply supported beam has the width of flange 100 mm, over all depth = 100 mm, thickness of flange and stem = 20 mm. Determine the maximum stress in beam when the bending moment of 12 kN-m is acting on the section. For the above T -section calculate the shear stress at neutral axis and at the junction of web and flange when shear force of 50 kN acting on beam. 	(BT5)	Evaluate
3	A beam AB of length 7 m is simply supported at two supports 5 m distance apart with an overhang of 2 m on right side of the beam. The beam carries a UVL of 6 kN/m at left end to zero kN/m at right end of SSB and point load of 4 kN at the right end of overhang part. Draw the SFD and BMD. Also locate the maximum bending moment.	(BT5)	Evaluate
4	A simply supported beam of span 4 m carries an UDL of 6 kN/m over the entire span. If the maximum allowable stress due to bending is restricted to 150 N/mm^2, determine 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	(BT5)	Evaluate
5	Draw SFD and BMD for the simply supported beam shown in fig. 	(BT3)	Apply

UNIT III TORSION			
Torsion formulation 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 (2 MARKS)			
Q. No	**Questions**	**BT Level**	**Competence**
1	Define torsional rigidity of the solid circular shaft.	(BT1)	Remember
2	Differentiate between closed coil helical spring and open coil helical spring.	(BT2)	Understand
3	List out of the applications of helical springs.	(BT1)	Remember
4	When are hollow circular shafts more suitable than solid circular shafts?	(BT1)	Remember
5	Describe the term polar modulus.	(BT1)	Remember
6	Define torsion.	(BT1)	Remember
7	Evaluate the torque which a shaft of 50 mm diameter can transmit safely, if the allowable shear stress is 75 N/mm^2.	(BT5)	Evaluate
8	Quote the expressions for polar modulus of solid and hollow circular shaft.	(BT1)	Remember
9	Express the stiffness of a close coiled helical spring mathematically.	(BT2)	Understand
10	Summarize the assumptions made in torsional equation.	(BT2)	Understand
11	Give the expression for the angle of twist for a hollow circular shaft with external diameter D, internal diameter, length l and rigidity modulus G.	(BT2)	Understand
12	Calculate the minimum diameter of shaft required to transmit a torque of 29820 Nm if the maximum shear stress is not to exceed 45 N/mm^2.	(BT3)	Apply
13	Classify springs with example.	(BT1)	Remember
14	Show the difference in stiffness of two springs when they are connected in series and in parallel.	(BT2)	Understand
15	Define the term spring index.	(BT1)	Remember
16	List out the applications of leaf spring.	(BT1)	Remember
17	Compare helical spring and carriage spring.	(BT1)	Remember
18	Evaluate the axial deformation, when a load of 50 N is acting in the spring of	(BT2)	Understand

	stiffness 10 N/mm.		
19	Deduce the expressions for deflection and shear stress of close coiled spring.	(BT2)	Understand
20	Formulate the mathematical expression for deflection of an open coiled helical spring.	(BT2)	Understand
21	Give any two functions of spring	(BT2)	Understand
22	Write the expression for polar modulus for a solid shaft and for a hollow shaft	(BT2)	Understand
23	Define torsional stiffness.	(BT1)	Remember
24	List out the stresses induced in the helical and carriage springs.	(BT1)	Remember
25	The shearing stress in a solid shaft is not to exceed 40N/mm$^{2.}$ When the torque transmitted is 2000N.m. Determine the minimum diameter of the shaft	(BT5)	Evaluate

Q. No	**PART-B(13 MARKS)**	**BT Level**	**Competence**
1	The internal and external diameter of a hollow shaft is in the ratio of 2:3. The hollow shaft is to transmit a 400 kW power at 120 rpm. The maximum expected torque is 15% greater than the mean value. If the shear stresses not to exceed 50 MPa, find section of the shaft which would satisfy the shear stress and twist condition. Take G = 0.85×10^{5}MPa.	(BT4)	Analyze
2	(a) What are the assumptions made in the torque equations? (5)	(BT1)	Remember
	(b) Derive the expression for power transmitted by a shaft. (8)	(BT4)	Analyze
3	(a) A steel shaft is to require transmitting 75 kW power at 100 rpm and the maximum twisting moment is 13% greater than the mean. Find the diameter of the steel shaft if the maximum stress is 70 N/mm^2. Also determine the angle of twist in a length of 3 m of the shaft. Assume the modules of rigidity for steel as 90 KN/mm^2. (7)	(BT3)	Apply
	(b) Obtain a relation for the torque and power, a solid shaft can transmit. (6)	(BT4)	Analyze
4	(a) Find the diameter of the solid shaft to transmit 90 KW at 160 rpm such that the shear stress is limited to 60 N/mm^2. The maximum torque is likely to exceed the mean torque by 20%. Also find the permissible length of the shaft, if the twist is not to exceed 1° over the entire length. Take rigidity modulus as	(BT4)	Analyze

	0.8×10^5 N/mm^2. (7)		
	(b) What do you mean by the strength of the shaft? Compare the strength of solid and hollow circular shafts. (6)	(BT2)	Understand
5	(a) Determine the dimensions of a hollow circular shaft with a diameter ratio of 3:4 which is to transmit 60 KW at 200 rpm. The maximum shear stress in the shaft is limited to 70 GPa and the angle of twist to 3.8° in a length of 4 m. For the shaft material, the modulus of rigidity is 80 GPa. (7)	(BT4)	Analyze
	(b) Derive the expression for the shear stress produced in a circular solid shaft subjected to torsion. (6)	(BT4)	Analyze
6	(a) Calculate the power that can be transmitted at 300 rpm by a hollow steel shaft of 75 mm external diameter and 50 mm internal diameter when the permissible shear stress for the steel is 70 N/mm^2 and the maximum torque is 1.3 times the mean. Compare the strength of this hollow shaft with that of a solid shaft. The material, weight and length of both the shafts are same. (7)	(BT4)	Analyze
	(b) Derive the expression for angle of twist of two shafts when they are connected in series. (6)	(BT4)	Analyze
7	A steel shaft ABCD having a total length of 2400 mm is contributed by three different sections as follows. The portion AB is hollow having outside and inside diameters 80 mm and 50 mm respectively, BC is solid and 80 mm diameter. CD is also solid and 70 mm diameter. If the angle of twist is same for each section, determine the length of each portion and the total angle of twist. Maximum permissible shear stress is 50 Mpa and shear modulus as 0.82 x 10^5 MPa	(BT3)	Apply
8	(a) The stiffness of the closed coil helical spring at mean diameter 20 cm is made of 3 cm diameter rod and has 16 turns. A weight of 3 KN is dropped on this spring. Find the height by which the weight should be dropped before striking the spring so that the spring may be compressed by 18 cm. Take C= 8x10^4 N/mm^2. (7)	(BT4)	Analyze
	(b) Derive the expression for stiffness of two closed coil helical springs when connected in series. (6)	(BT3)	Apply
9	(a) It is required to design a closed coiled helical spring which shall deflect 1mm under an axial load of 100 N at a shear stress of 90 Mpa. The spring is to be made of round wire having shear modulus of 0.8 x 10^5 MPa. The mean	(BT4)	Analyze

	diameter of the coil is 10 times that of the coil wire. Find the diameter and length of the wire. (8)		
	(b) Deduce the expression for strain energy stored in a closed coil helical spring when subjected to axial loading. (5)	(BT3)	Apply
10	(a) A helical spring of circular cross-section wire 18 mm in diameter is loaded by a force of 500 N. The mean coil diameter of the spring is 125 mm. The modulus of rigidity is 80 KN/mm^2. Determine the maximum shear stress in the material of the spring. What number of coils must the spring have for its deflection to be 6 mm? (8)	(BT3)	Apply
	(b) Derive the expression for stiffness of two closed coil helical springs when connected in parallel. (5)	(BT3)	Apply
11	A close coiled helical spring is to have a stiffness of 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 is 50 mm. Find the diameter of coil, diameter of wire and number of coils .C = 4.5 $xl0^4$ N/mm^2.	(BT3)	Apply
12	A closely coiled helical spring of round steel wire 10 mm in diameter having 10 complete turns with a mean diameter of 12 cm is subjected to an axial load of 250 N. Determine a) The deflection of the spring b) Maximum shear stress in the wire c) Stiffness of the spring and d) Frequency of vibration. Take C = 0.8 x 10^5 N/mm^2	(BT4)	Analyze
13	A leaf spring of semi elliptical type has 10 plates, each 60 mm wide and 5 mm thick. The longes t plate is 700 mm long. Find the greatest central load on the spring so that the bending stress shall not exceed 150 N/mm^2 and the central deflection shall not exceed 10 mm. take E=2×10^5 N/mm^2.	(BT4)	Analyze
14	A hollow shaft is required to transmit 300KN at 90rpm the permissible shear stress in the shaft is 60Kn/mm^2. The maximum torque transmitted exceeds the mean torque by 25% more than the mean torque .the internal diameter is half of the external diameter. Find the internal diameter and external diameter of the shaft	(BT3)	Apply

15	A leaf spring is made of 12 steel plates of 50 mm wide and 5 mm thick. It carries a load of 4 kN at the centre. If the bending stress is limited to 140 N/mm^2, determine the following: i) Length of the spring and ii) Deflection at the centre of the spring. Take E = 2 x 10^5 N/mm^2.	(BT4)	Analyze
16	A closely coiled helical spring of mean diameter 20cm is made of 3cm diameter rod and has 16 turns. A weight of 3kN is dropped on this spring. Find the height by which the should be dropped before striking the spring so that the spring may be compressed by 18cm. Take C=8 x 10^4 N/mm^2	(BT4)	Analyze
17	A solid circular shaft is required to transmit 100KW at 180r.p.m. The permissible shear stress in the shaft is 60N/mm^2.Find the suitable diameter of the shaft. The angle of twist is not to exceed 1degree in a length of 3m. The value of rigidity modulus is 0.8x10^5 N/mm^2.	(BT4)	Analyze
18	A shaft is to be transmitted 100KW at 240 rpm. If the allowable shear stresses of the material is 60MPa. The shaft is not to twist more than 10 in a length of 3.5 mts. Find the diameter of the shaft based on strength and stiffness criteria. The modulus of rigidity of the material (N) is 80 X 10^{3}N/mm^2	(BT4)	Analyze

Q. No	**PART-(15 MARKS)**	**BT Level**	**Competence**
1	A hollow shaft with diameter ratio 3/5 is required to transmit 450 KW at 120 rpm. The shearing stress in the shaft must not exceed 60 N/mm^2 and the twist in a length of 2.5 m is not to exceed 1°. Calculate the maximum external diameter of the shaft. C= 80 kN/mm^2.	(BT5)	Evaluate
2	A close coiled helical spring is required to absorb 2250J of energy. Determine the diameter of the wire, the mean coil diameter of the wire, the mean coil diameter of the spring and the number of coils necessary if i) the maximum stress is not to exceed 400 MPa, ii) the maximum compression of the spring is limited to 250 mm and iii) the mean diameter of the spring is eight times the wire diameter. For the spring material, rigidity modulus is 70 GPa.	(BT5)	Evaluate
3	A solid shaft is to transmit 300 kW at 100 rpm if the shear stress is not to exceed 80 N/mm^2. Find diameter of the shaft. If this shaft was to be replaced by hollow shaft of same material and length with an internal diameter of	(BT5)	Evaluate

	0.6 times the external diameter. What percentage saving in weight is possible?		
4	A close coiled helical spring has stiffness of 10 N/mm. Its length when fully compressed with adjacent coils touching each other is 400 mm. The modulus of rigidity of the material of the spring is 80 GPa. i) Determine the wire diameter and mean coil diameter if their ratio is 1/10. ii) If the gap between any two adjacent coils is 2 mm, what maximum load can be applied before the spring becomes solid. iii) What is the corresponding maximum shear stress in the spring?	(BT5)	Evaluate
5	A closely coiled helical spring made of 10mm diameter steel wire has 15 coils of 100mm mean diameter. The spring is subjected to an axial load of 100N. Calculate (i) The maximum shear stress induced (ii)The deflection and (iii) Stiffness of the spring Take C=8.16 x 104 N/mm^2.	(BT3)	Apply

UNIT IV DEFLECTION OF BEAMS			
Double Integration method – Macaulay's method – Area moment method for computation of slopes and deflections in beams - Conjugate beam and strain energy – Maxwell's reciprocal theorems.			
PART-A(2MARKS)			
Q. No	**Questions**	**BT Level**	**Competence**
1	List the important methods used to find slope and deflection.	(BT1)	Remember
2	Where does the maximum deflection occur in cantilever beam?	(BT1)	Remember
3	Where does the maximum deflection occur for simply supported beam loaded symmetrically about mid-point and having same cross- section through their length?	(BT1)	Remember
4	Calculate the stored stain energy if tensile load = 30 kN; length = 1 m; width = 25 mm; thickness = 20 mm.. Take E = 200 GPa.	(BT2)	Understand
5	Classify the types of loading on a body.	(BT3)	Apply
6	Define modulus of resilience.	(BT1)	Remember
7	List the advantages of Macaulay's method.	(BT2)	Understand
8	Define proof resilience.	(BT1)	Remember
9	Give the disadvantage of double integration method.	(BT2)	Understand
10	Define conjugate beam method.	(BT1)	Remember
11	Define strain energy.	(BT1)	Remember

12	Express the units of slope and deflection.	(BT2)	Understand
13	Express the value of slope at the free end of a cantilever beam of constant EI.	(BT2)	Understand
14	Write the expression for stress induced in a body when impact load is applied.	(BT1)	Remember
15	Calculate the maximum deflection of a simply supported beam carrying a point load of 100 kN at mid span. Span = 6 m, E= 20000 kN/m^2.	(BT2)	Understand
16	Modify the cantilever beam with a point load at free end into conjugate beam.	(BT2)	Understand
17	Compare the moment area method with conjugate beam method for finding the deflection of a simply supported beam with UDL over the entire span.	(BT2)	Understand
18	Define Mohr's first theorem.	(BT1)	Remember
19	Describe the theorem for conjugate beam method?	(BT2)	Understand
20	Analyze the strain energy method.	(BT1)	Remember
21	A cantilever beam of spring 2 m is carrying a point load of 20 kN at its free end. Measure the slope at the free end. Assume EI = 12 x 103 kN-m2.	(BT2)	Understand
22	State the two theorems in the moment area method.	(BT2)	Understand
23	What is the relation between slope, deflection and radius of curvature of a beam?	(BT1)	Remember
24	Calculate the maximum deflection of a simply support beam carrying a point load of 100 KN at mid span. Span = 6m; EI = 20,000 KN/m2	(BT2)	Understand
25	Why moment area method is more useful when compared with double integration?	(BT1)	Remember

Q. No	**PART-B (13 MARKS)**	**BT Level**	**Competence**
1	A beam AB of length 8 m is simply supported at its ends and carries two point loads of 50 kN and 40 kN at a distance of 2 m and 5 m respectively from left support A. Determine, deflection under each load, maximum deflection and the position at which maximum deflection occurs. Take E = 2 x 10^5 N/mm^2 and I = 8.5 X10^6 mm^4.	(BT4)	Analyze
2	Explain the Macaulay's method for finding the slope and deflection of beams with example.	(BT4)	Analyze
3	(a) A beam is simply supported at its ends over a span of 10 m and	(BT4)	Analyze

	carries two concentrated loads of 100 kN and 60 kN at a distance of 2 m and 5 m respectively from the left support. Calculate (i) slope at the left support (ii) slope and deflection under the 100 kN loads. Assume EI = 36 x 10^4 kN-m^2.		
	(b) Explain the moment area method for finding the deflection and slope of beams with example. (6)	(BT3)	Apply
4	(a) Explain the conjugate beam method for finding the deflection of beams with example. (6)	(BT3)	Apply
	(b) A horizontal beam is freely supported at its ends 8 m apart and carries a UDL of 15 kN/m over the entire span. Find the maximum deflection. Take E = 2 x 10^5 N/mm^2 and I = 2 x 10^9 mm^4. (7)	(BT4)	Analyze
5	Explain double integration method for finding deflection of beams with example.	(BT3)	Apply
6	A cantilever beam with a span of 3 m carries a point load of 30 kN at a distance of 2 m from the fixed end. Determine the slope and deflection at the free end and at the point where load is applied. Take M.O.I of the section = 11924 cm^4 and E = 200 GN/m^2.	(BT4)	Analyze
7	(a) A simply supported beam of uniform flexural rigidity EI and span l, carries two symmetrically placed loads P at one–third of the span from each end. Find the slope at the supports and the deflection at mid–span. Use moment area theorems. (7)	(BT4)	Analyze
	(b) Derive the expression for strain energy stored in a body when load is applied with impact. (6)	(BT2)	Understand
8	A circular bar of 60 mm diameter and 7 m long subjected to gradually applied load of 80 kN. Calculate i) Stretch in the rod, ii) Stress in the rod and iii) Strain energy absorbed by the rod. E = 2×10^5 N/mm^2.	(BT3)	Apply
9	An unknown weight falls through a height of 1cm on a collar rigidly attached to lower end of a vertical bar 5000 mm long and 600 mm^2 in	(BT4)	Analyze

	section. If the maximum extension of the rod is to be 0.002 m, what is the corresponding stress and magnitude of the unknown weight? Take $E = 2\times10^5$ N/mm^2.		
10	A cantilever AB, 2 m long, is carrying a load of 20 kN at free end and 30 kN at a distance 1 m from the free end. Find the slope and deflection at free end. Take E = 200 GPa and I = 150 x 10^6 mm^4.	(BT4)	Analyze
11	Derive the expression for strain energy stored in a body when load is applied suddenly. (6)	(BT2)	Understand
12	A simply supported beam AB of span 4 m, carrying a load of 100 kN at the mid span C has cross sectional moment of inertia 24 x 10^6 mm^4 over the left half of the span and 48 x 10^6 mm^4 over the right half. Find the slope at two supports and the deflection under the load. Take E = 200 GPa.	(BT3)	Apply
13	(a) A simply supported beam of length 4 m is loaded with a point load of 10 kN and 20 kN at a distance of 1 m and 2 m respectively from the left support. The beam is 200 mm wide and 400 mm deep. Find the slopes at the supports, deflections under the loads and location and magnitude of the maximum deflections using Macaulay's method. Take $E=2\times10^4$ N/mm^2. (8)	(BT4)	Analyze
	(b) State and explain Maxwell's reciprocal theorem. (5)	(BT1)	Remember
14	(a) A simply supported beam subjected to uniformly distributed load of 'w' kN/m for the entire span. Calculate the maximum deflection by double integration method. (8)	(BT4)	Analyze
	(b) Derive the expression for strain energy stored in a body due to shear stress. (5)	(BT2)	Understand
15	A simply supported beam AB of span 5m carries a point load of 40 kN at its centre. The value of moment of inertia for the left half is 2 x 10^8 mm^4 and for the right half portion is 4 x 10^8 mm^4. Find the slopes at the two supports and deflection under the load.	(BT3)	Apply

	Take E = 200 GN/m^2.		
16	A simply supplied beam of span 5.80 m carries a central point load of 37.5 KN, Find the max. slope and deflection, Let EI = 40000 KNm	(BT2)	Understand
17	A beam 6m long, simply supported at its end, is carrying a point load of 50 KN at its centre. The moments of inertia of the beam is given as equal to 78 ×106mm4. If E for the material of the beam = 2.1 ×10 5 N/mm2, calculate i) deflection at the centre of the beam & ii) slope at the supports	(BT2)	Understand
18	A simply supported beam is loaded as shown in fig is 200mm wide and 400 mm deep . find the slope at the supports, deflection under load and location and magnitude of the maximum deflection . Take E=2x105N/mm2	(BT3)	Apply

Q. No	PART-C (15 MARKS)	BT Level	Competence
1	(a) A 3 m long cantilever of uniform rectangular cross–section 150 mm wide and 300 mm deep is loaded with a point load of 3 kN at the free end and a UDL of 2 kN/m over the entire length. Find the maximum deflection. E = 210 kN/mm^2. Use Macaulay's method. (9)	(BT5)	Evaluate
	(b) Describe the terms Resilience, Proof resilience and modulus of resilience. (6)	(BT1)	Remember
2	(a) A simply supported beam of span 6 m is subjected to an UDL of 2 kN/m over the entire span and a point load of 3 kN at 4 m from the left support. Find the deflection under the point load in terms of EI. Use strain energy method. (10)	(BT5)	Evaluate
	(b) Explain any one theorem in the moment area method. (5)	(BT1)	Remember
3	A tension bar is made of two parts. The length of first part is 3000 mm and area is 2000 mm^2, while the second part is of length 2000 mm and area 3000 mm^2. An axial load of 90 kN is gradually applied. Find the total strain energy produced in the bar and compare this value with that obtained in a uniform bar of same length and having same volume under	(BT5)	Evaluate

	same load. Take E = 2 x 10^5 N/mm^2.		
4	A simply supported beam of length 5 m carries a point load of 5 kN at a distance of 3 m from the left end. If E = 2 x 10^5 N/mm^2 and I = 10^8 mm^4, determine the slope at the left support and deflection under the point load using conjugate beam method.	(BT6)	Create
5.	A cantilever AB, 2m long is carrying a load of 20kn at free and 30KN at a distance 1m from the free end . find the slope and deflection at free end . take E=200GPa and I =150x106mm^4	(BT5)	Evaluate

UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS			
Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders – spherical shells subjected to internal pressure –Deformation in spherical shells – Lame's theorem.			
PART-A(2 MARKS)			
Q. No	**Questions**	**BT Level**	**Competence**
1	A cylindrical pipe of diameter 1.5 m and thickness 1.5 cm is subjected to an internal fluid pressure of 1.2 N/mm^2. Calculate the longitudinal stress developed in the pipe.	(BT2)	Understand
2	Estimate the thickness of the pipe due to an internal pressure of 10 N/mm^2 if the permissible stress is 120 N/mm^2. The diameter of pipe is 750 mm.	(BT2)	Understand
3	Define circumferential stress.	(BT1)	Remember
4	A spherical shell of 1 m diameter is subjected to an internal pressure 0.5 N/mm^2. Discover the thickness of the shell, if the allowable stress in the material of the shell is 75 N/mm^2.	(BT2)	Understand
5	Define longitudinal stress.	(BT1)	Remember
6	Write the expression for longitudinal stress in a thin cylinder subjected to a uniform internal fluid pressure.	(BT1)	Remember
7	A cylinder of diameter 1.3 m and thickness 12 mm is subjected to an internal pressure of 1 N/mm^2. Identify the type of cylinder.	(BT1)	Remember
8	Where the hoop stresses and longitudinal stresses are acting in a thin cylindrical shell?	(BT1)	Remember
9	Name the various methods of reducing the hoop stresses.	(BT1)	Remember
10	Formulate the mathematical expressions of Lame's theorem.	(BT1)	Remember
11	Formulate an expression for the longitudinal stress in a thin cylinder subjected to a uniform internal fluid pressure.	(BT1)	Remember
12	When will the longitudinal stress in a thin cylinder be zero?	(BT1)	Remember
13	Mention the relationship between longitudinal stress and circumferential stress.	(BT2)	Understand
14	Compare the cylindrical shell and spherical shell.	(BT2)	Understand
15	Differentiate the thick cylinder from thin cylinder.	(BT2)	Understand
16	List out the formulae for finding change in diameter, change in length and change in volume of a thin cylindrical shell subjected to internal fluid pressure?	(BT1)	Remember

17	Distinguish between Circumferential stress and longitudinal stress.	(BT2)	Understand
18	Assess the thickness of the pipe due to an internal pressure of 10 N/mm^2 if the permissible stress is 120 N/mm^2. The diameter of pipe is 750 mm.	(BT2)	Understand
19	Define thick cylinders.	(BT1)	Remember
20	Give the expression for hoop stress for thin spherical shells.	(BT2)	Understand
21	When will you call a cylinder as thin cylinder?	(BT1)	Remember
22	Write the circumferential strain in thin spherical shell.	(BT2)	Understand
23	What is the effect of riveting a thin cylindrical shell	(BT1)	Remember
24	Write the equation for the change in diameter and length of athin cylinder shell , when subjected to an internal pressure.	(BT2)	Understand
25	A cylindrical shell 3m long , 1m in dia and 10mm thick is subjected to an internal pressure of 2mp .calculate the change in dimensions of the shell. E =$2X10^5 N/mm^2$	(BT2)	Understand

Q.No	PART-B (13 MARKS)	BT Level	Competence
1	Derive the expressions for change in dimensions of a thin cylinder due to internal pressure.	(BT2)	Understand
2	A cylindrical thin drum 80 cm in diameter and 3 m long has a shell thickness of 1 cm. If the drum is subjected to an internal pressure of 2.5 N/mm^2, determine: 1. Change in diameter, 2. Change in length and 3. Change in volume. Take E = 2 x 10^5 N/mm^2 and Poisson's ratio = 0.25.	(BT4)	Analyze
3	A thin cylindrical shell 3 m long has 1m internal diameter and 15 mm metal thickness. Calculate the circumferential and longitudinal stresses induced and also the change in the dimensions of the shell, if it is subjected to an internal pressure of 1.5 N/mm^2 Take E = $2x10^5$ N/mm^2 and poison's ratio =0.3. Also calculate change in volume.	(BT4)	Analyze
4	(a) A closed cylindrical vessel made of steel plates 4 mm thick with plane ends, carries fluid under pressure of 3 N/mm^2 The diameter of the cylinder is 25 cm and length is 75 cm. Calculate the longitudinal and hoop stresses in the cylinder wall and determine the change in diameter, length and Volume of the cylinder. Take E = $2.1x10^5$ N/mm^2 and 1/m = 0.286. (7)	(BT4)	Analyze
	(b) Explain briefly about thin spherical shell and derive the expression for hoop stress in thin spherical shell. (6)	(BT3)	Apply
5	(a) A cylindrical shell 3 m long, 1 m internal diameter and 10 mm thick is	(BT3)	Apply

	subjected to an internal pressure of 1.5 N/mm^2. Calculate the changes in length, diameter and volume of the cylinder. E = 200 KN/mm^2,1/m = 0.3. (7)		
	(b) Derive the expressions for change in dimensions of spherical shell due to internal pressure. (6)	(BT2)	Understand
6	(a) A steel cylindrical shell 3 m long which is closed at its ends, had an internal diameter of 1.5 m and a wall thickness of 20 mm. Calculate the circumferential and longitudinal stress induced. (7)	(BT3)	Apply
	(b) For the given cylindrical shell determine the change in dimensions of the shell if it is subjected to an internal pressure of 1.0 N/mm^2. Assume the modulus of elasticity and Poisson's ratio for steel as 200 kN/mm^2 and 0.3 respectively. (6)	(BT4)	Analyze
7	A thin cylindrical shell 3m long, 1.2 m diameter is subjected to an internal pressure of 1.67 N/mm^2. If the thickness of the shell is 13 mm, E = 2×10^5 N/mm^2 and 1/m = 0.28. (a) Find the circumferential and longitudinal stresses. (b) Find the maximum shear stress and change in dimensions of the shaft.	(BT3)	Apply
8	(a) A cylindrical shell 3 m long which is closed at the ends has an internal diameter 1 m and wall thickness of 15 mm. Calculate the change in dimensions and change in volume if the internal pressure is 1.5 N/mm^2,E = 2×10^5 N/mm^2, μ= 0.3. (7)	(BT4)	Analyze
	(b) List out the assumptions made on Lame's theory. (6)	(BT3)	Apply
9	A cylindrical vessel 2 m long and 500 mm in diameter with 10 mm thick plates is subjected to an internal pressure of 3 MPa. Calculate the change in volume of the vessel. Take E = 200 GPa and Poisson's ratio = 0.3 for the vessel material.	(BT3)	Apply
10	A spherical shell of 2 m diameter is made up of 10 mm thick plates. Calculate the change in diameter and volume of the shell, when it is subjected to an internal pressure of 1.6 MPa. Take E = 200 GPa and 1/m = 0.3.	(BT3)	Apply
11	(a) Determine the maximum hoop stress across the section of a pipe of external diameter 600 mm and internal diameter 440 mm. when the pipe is subjected to an internal fluid pressure of 50 N/mm^2. (7)	(BT4)	Analyze
	(b) Explain the concept of thick cylinder and deduce the expressions for various stresses induced in thick cylinders. (6)	(BT3)	Apply
12	A steel cylinder of 300 mm external diameter is to be shrunk to another steel	(BT4)	Analyze

	cylinder of 150 mm internal diameter. After shrinking the diameter at the junction is 250 mm and radial pressure at the common junction is 40 N/mm^2. Find the original difference in the radii at the junction. Take E = $2x10^5$ N/mm^2. (7)		
	(b) A spherical shell of 1.5m internal diameter and 12 mm shell thickness is subjected to pressure of 2 N/mm^2. Determine the stress induced in the material of the shell. (6)	(BT3)	Apply
13	(a) Find the thickness of metal necessary for a cylindrical shell of internal diameter 150 mm to withstand an internal pressure of 25 N/mm^2. The maximum hoop stress in the section is not to exceed 125 N/mm^2. (7)	(BT4)	Analyze
	(b) Describe the stresses in compound thick cylinder. (6)	(BT1)	Remember
14	(a) Determine the maximum and minimum hoop stress across the section of a pipe of 400 mm internal diameter and 100 mm thick, when the pipe contains a fluid at a pressure of 8 N/mm^2. (7)	(BT3)	Apply
	(b) Sketch the radial pressure distribution and hoop stress distribution across the section of the given pipe. (6)	(BT4)	Analyze
15	A boiler shell is to be made of 15mm thick plate having tensile stress of 120 N/mm2 If the efficiencies of the longitudinal and circumferential joints are 70% and 30%. Determine the maximum permissible diameter of the shell for an internal pressure of 2 N/mm2	(BT3)	Apply
16	A cylindrical shell 3m long which is closed at the ends has an internal diameter of 1.5m and a wall thickness of 20mm. Calculate the circumferential and longitudinal stresses induced and also change in the dimensions of the steel. If it is subjected to an internal pressure of 1.5 N/mm2 Take E=2×105N/mm2 and poisons ratio=0.3	(BT4)	Analyze
17	A thin cylindrical shell with following dimensions is filled with a liquid at atmospheric pressure. Length=1.2m, external diameter=20cm, thickness of metal=8mm, Find the value of the pressure exerted by the liquid on the walls of the cylinder and the hoop stress induced if an additional volume of 25cm3 of liquid is pumped into the cylinder. Take E=2.1×105N/mm2 and poisons ratio=0.33.	(BT3)	Apply
18	Calculate (i) the change in diameter (ii) Change in length and (iii) Change in	(BT4)	Analyze

	volume of a thin cylindrical shell 100cm diameter, 1cm thick and 5m long, when subjected to internal pressure of 3N/mm2.Take the value of E=2×105N/mm2 and poison' s ratio, **μ**=0.3		

Q. No	PART-C(15MARKS)	BT Level	Competence
1	(a) A thin cylinder 1.5 m internal diameter and 5 m long is subjected to an internal pressure of 2 N/mm^2. If the maximum stress is limited to 160 N/mm^2 find the thickness of the cylinder. E= 200 KN/mm^2 and Poisson's ratio = 0.3. Also find the changes in diameter, length and volume of the cylinder. (8)	(BT5)	Evaluate
	(b) Explain and derive the hoop stress and longitudinal stress in thin cylinders. (7)	(BT2)	Understand
2	(a) A cylinder has an internal diameter of 230 mm, wall thickness 5 mm and is 1 m long. It is found to change in internal volume by 12×10^{-6} m^3 when filled with a liquid at a pressure 'p'. Taking E = 200 GPa and 1/m = 0.25, determine the stresses in the cylinder, the changes in its length and internal diameter. (8)	(BT5)	Evaluate
	(b) A spherical shell of internal diameter 1.2 m and of thickness 12 mm is subjected to an internal pressure of 4 N/mm^2. Determine the increase in diameter and increase in volume. Take E = 2 x 10^5 N/mm^2 and μ = 0.33 (7)	(BT4)	Analyze
3	A boiler is subjected to an internal steam pressure of 2 N/mm^2. The thickness of boiler plate is 2.6 cm and permissible tensile stress is 120 N/mm^2. Find the maximum diameter, when efficiency of longitudinal joint is 90% and that of circumferential joint is 40%. (15)	(BT5)	Evaluate
4	A thin spherical shell 1 m in diameter with its wall of 1.2 cm thickness is filled with a fluid at atmospheric pressure. What intensity of pressure will be developed in it if 175 cm^3 more of fluid is pumped into it? Also calculate the circumferential stress at the pressure and the increase in diameter. Take E = 200 GN/mm^2 and 1/m = 0.3.	(BT5)	Evaluate
5	A thin seamless spherical shell of diameter 1.5 m and thickness 8 mm. It is filled with a liquid so that the internal pressure is 1.5 N/mm^2. Determine the increase in diameter and capacity of the shell.Take E = 2 x 10^5 N/mm^2 and μ = 0.3.	(BT5)	Evaluate