VALLIAMMAI ENGINEERING COLLEGE

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF CIVIL ENGINEERING
QUESTION BANK

IV SEMESTER
CE 8301STRENGTH OF MATERIALS I
Regulation – 2017
Academic Year 2018 – 19
Prepared by

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SUBJECT : CE 8301 STRENGTH OF MATERIALS I

SEM / YEAR : III / II

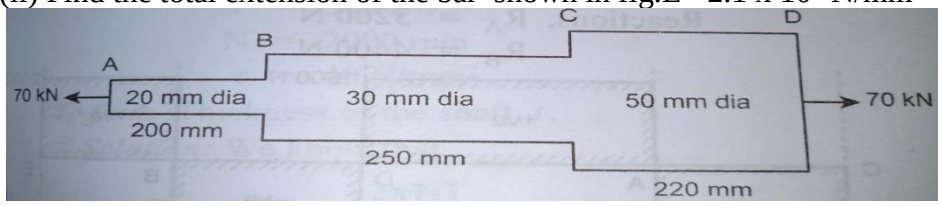
UNIT 1 STRESS, STRAIN AND DEFORMATION OF SOLIDS

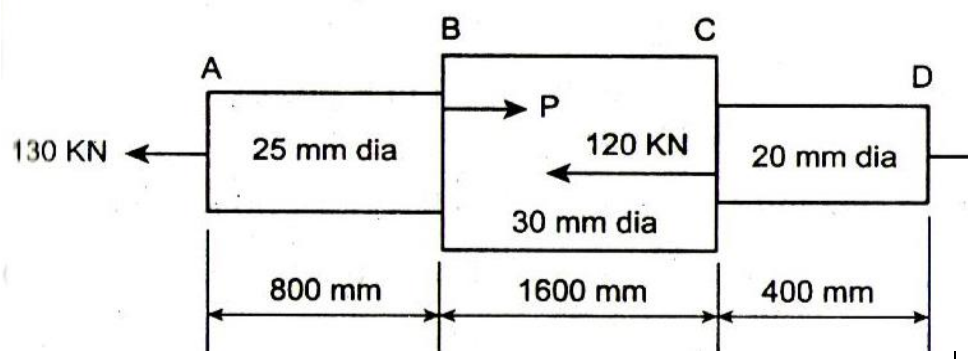
Simple Stresses and strains – Elastic constants - Relationship between elastic constants – Stress Strain Diagram – Ultimate Stress – Yield Stress – Deformation of axially loaded member - Composite Bars - Thermal Stresses – State of Stress in two dimensions – Stresses on inclined planes – Principal Stresses and Principal Planes – Maximum shear stress - Mohr's circle method.

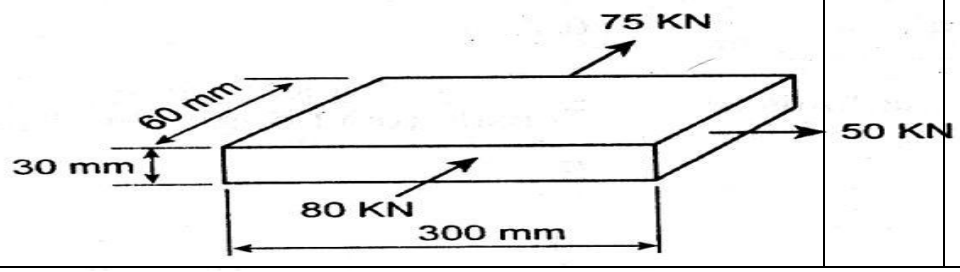
PART – A

Q.No	Questions	BT Level	Competence
1	Define Poisson's ratio.	BT-1	Remember
2	Define Hook's Law.	BT-1	Remember
3	Define stress & strain.	BT-1	Remember
4	Define (i) modulus of elasticity (ii) modulus of rigidity..	BT-4	Analyze
5	Define (i) factor of safety (ii) stability.	BT-4	Analyze
6	State bulk modulus.	BT-1	Remember
7	What is mean by strain energy density?	BT-2	Understand
8	Draw the stress strain curve for mild steel.	BT-6	Create
9	State relationship between modulus of elasticity& modulus of rigidity.	BT-3	Application
10	What do you Understand by a compound bar?	BT-1	Remember
11	What are the type of elastic constants	BT-1	Remember
12	Write two equations used to find the forces in compound bars made of two materials subjected to tension.	BT-1	Remember
13	Determine the Poisson's ratio and bulk modulus of a material for which young's modulus is1.2 x 105 N /mm2and modulus of rigidity is 4.8 x 104 N/mm2.	BT-2	Understand
14	A brass rod 2 m long is fixed at both ends. if the thermal stress is not to exceed 76.5 /mm2,calculate the temperature through which the rod should be heated. Take the values of α and E as 17 x10-6 /k and 90Gpa respectively.	BT-2	Understand
15	Define principal stress and principal plans.	BT-5	Evaluate
16	Write the concept used for finding stresses in compound bars.	BT-1	Remember
17	Explain the effect of change of temperature in a composite bar.	BT-5	Evaluate
18	Write the expressions for a normal stress on an inclined plane in aa block which is subjected to two mutually perpendicular normal stress and shear stress?	BT-3	Application

19	Write short notes on mohr's circle method and uses.	BT-3	Application
20	At a point in a strained materials is subjected to a compressive stress of 100 N/mm^2 and shear stress of 60 N/mm^2.Determine graphically or otherwise the principal stress.	BT-2	Understand

	PART –B		
1	A tensile test was conducted on a mild steel bar. The following data was obtained from the test: i. Diameter of the steel bar = 4 cm ii. Gauge length of the bar = 22 cm iii. Load at elastic limit = 250 kN iv. Extension at a load of 160 kN = 0.235 mm v. Maximum load = 390 kN vi. Total extension = 70 mm vii. Diameter of rod at failure = 2.35 cm Determine: **a)** The Young's modulus (4 marks) **b)** The stress at elastic limit (3 marks) **c)** The percentage of elongation (3 marks) **d)** The percentage decrease in area. (3 marks)	BT-4	Analyze
2	(i) Find the stresses in each section of the bar shown in fig. (ii) Find the total extension of the bar shown in fig.E= 2.1 x 10^5 N/mm^2 	BT-2	Understand
3	Estimate the values of change in length, breadth and thickness of a steel bar 4.2m long, 35mm wide and 25mm thick. When subjected to an axial pull of 130kN in the direction of its length. Take E=200Gpa and poisson's ratio = 0.3	BT-2	Understand
4	Three bars made of copper, zinc and aluminium are of equal length and have cross section 555, 705, and 1020 sq.mm respectively. They are rigidly connected at their ends. If this compound member is subjected to a longitudinal pull of 255kN, estimate the proportional of the load carried on each rod and the2induced stresses. Take the value of E for copper = 1.3×10^5 N/mm^2, for zinc = 1×10^5 $N/mm^2$and for aluminium = 0.8×10^5 N/mm^2	BT-5	Evaluate
5	A bar of 25mm diameter is subjected to a pull of 40kN. The measured extension on gauge length of 200mm is 0.085mm and the change in diameter is 0.003mm. Estimate the values of Poisson's ratio and the three	BT-2	Understand

	moduli		
6	**a)** Obtain a relation for change in length of a bar hanging freely under its own weight (7 marks) **b)**Derive the relationship between modulus of elasticity and modulus of rigidity (6 marks)	BT-5	Evaluate
7	Derive E=2G(1+(1/3)), (ii) E=3K(1-(2/3)).	BT-6	Create
8	A reinforced concrete column 500mm x 500mm in section is rein forced with 4 steel bars of 25mm diameter, one in each corner, the column is carrying a load of 1000KN. Find the stress in the concrete and steel bars. Take E for steel =210 $x10^3$N/mm^2 and E for concrete=14 $x10^3$N/mm^2.	BT-5	Evaluate
9	Find the value of P and the change in length of each component and the total change in length of the bar shown in figure. 	BT-2	Understand
10	A load of 200N falls through a height of 20mm onto a collar rigidly attached to the lower end of a vertical bar 2m long and 1.5 sq.cm c/s area. The upper end of vertical bar is fixed. Take E = $2x10^5$ N/mm^2. Find **a)** Maximum instantaneous stress (4 marks) **1.** Maximum instantaneous strain (3 marks) **2.** Maximum instantaneous elongation (3 marks) **3.** Strain energy (3 marks)	BT-2	Understand
11	A steel rod of 3.6cm diameter and 5m long is connected to two grips and the rod is maintained at a temperature of 105^oC. Determine the stress and pull exerted when the temperature falls to 40^oC if, **i.** The ends do not yield (7 marks) **ii.** The ends yield by 0.13cm (6 marks)	BT-3	Application
12	A tensile load of 55N is acting on a rod of diameter 55mm and length 4.5m. A bore of diameter 25mm is made centrally on the rod. To what length the rod should be bored so that the total extension will increase 35% under the same tensile load. Take E = $2x10^5$ N/mm^2	BT-1	Remember

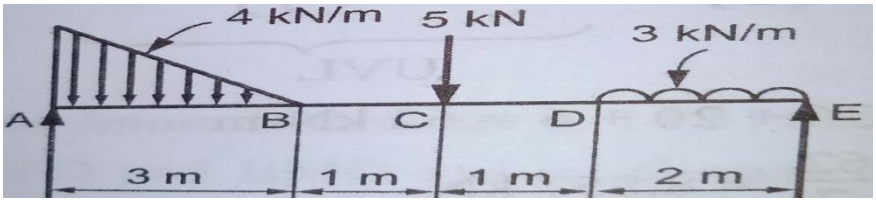
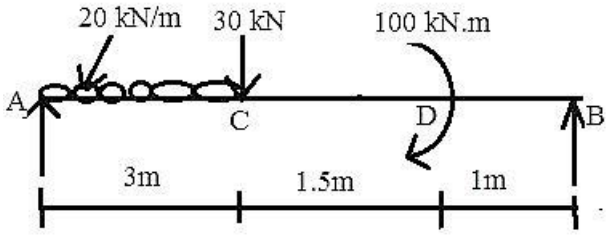
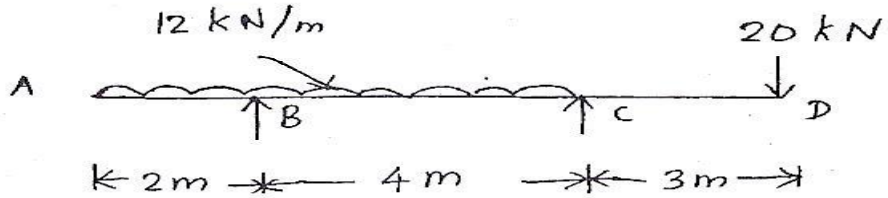
13	A steel tube of 30mm external diameter and 20mm internal diameter encloses a copper rod of 15.5mm diameter to which it is rigidly joined at each end. If, at a temperature of 10^{o}C there is no longitudinal stress, calculate the stresses in the rod and the tube when the temperature is raised to 200^{o}C. TakeEs = $2.1x10^{5}$ N/mm^{2} , Ec = $1x10^{5}$ N/mm^{2} , Co-efficient of linear expansion $11x10^{-6}$ per ^{o}C and $18x10^{-6}$ per ^{o}C	BT-4	Analyze
14	The steel plate 300mm long ,60mm wide and 30 mm deep is acted upon by the forces shown in figure. Determine the change in volume. Take E = 200KN/mm2 and Poisson's ratio=0.3. 	BT-4	Analyze
	PART –C		
1	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-2	Understand
2	A C.I plate, 300mm long and of 30mm x 50 mm uniform cross section, is acted upon by the following forces uniformly. 25kN(T), 35kN (T), and 45kN(T) in x,y and z axis respectively. Determine the change in volume of the plate. E=140GN/m^{2} and m=4	BT-4	Analyze
3	Draw stress – strain diagram for mild steel and for a brittle material and indicate salient points.	BT-6	Create
4	A compound bar is made of a central steel plate 60mm wide and 10mm thick to which copper plates 40mm wide and 5mm thick are connected rigidly on each side. The length of the bar at normal temperature is 1m. If the temperature is raised by 80^{o}c, determine the stresses in each metal and change in length. Take the value of E for steel = 2×10^{5} N/mm^{2}, for copper = 1×10^{5} N/mm^{2}. Coefficient of thermal expansion for steel and copper are 12 x 10^{-6} per ^{o}c and 17 x 10^{-6} per ^{o}c	BT-2	Application

UNIT – 2 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 - Leaf Springs.

PART – A

Q.No	Questions	BT Level	Competence
1	How to Classify the beams according to its supports?	BT-4	Analyze
2	Discuss about shear force and bending moment.	BT-2	Understand
3	Explain what do you meant by point of contra flexure?	BT-6	
4	Differentiate between hogging and sagging bending moment.	BT-2	Understand
5	Define the term (i) Point of contrafleure (ii) Maximum bending moment	BT-1	Remember
6	Draw the S.F. & B.M. diagrams for cantilever beam of length L carrying a UDL of W/unit length throughout its span.	BT-3	Application
7	Draw the SF and BM diagrams for a cantilever beam 2m long carrying a gradually varying load from zero @ free end to 2500N/m at the fixed end	BT-5	Evaluate
8	A SSB of span 4m is subjected to audl of 2 kN/m over its entire length. Sketch the bending moment diagram for the beam.	BT-5	Evaluate
9	Draw the SFD and BMD for the overhanging beam carrying UDL throughout its length and supported at 'a' distance from end A and 'b' distance from end B.	BT-3	Application
10	Summarize and sketch the types of supports used for a beam indicating the reactions in each case.	BT-2	Understand
11	Write the theory of simple bending equation.	BT-4	Analyze
12	Discuss about moment of resistance of a beam?	BT-2	Understand
13	Define (i) shear stress distribution (ii) section modulus.	BT-1	Remember
14	Write any four assumptions in the theory of simple bending?	BT-4	Analyze
15	What do you Understand by neutral axis & neutral plane? How do you locate Neutral axis?	BT-1	Remember
16	Write down the expression for shear stress distribution in a beam subjected to shear force F.	BT-4	Analyze
17	How would you find the bending stress in unsymmetrical sections?	BT-1	Remember
18	A beam subjected to a bending stress of $5N/mm^2$ and the section modulus is 3530 cm^3. Calculate the moment of resistance of the beam.	BT-3	Application
19	Discover the function of flitched beams. Why it is used?	BT-4	Analyze
20	What is meant by Laminated spring and what are the uses of leaf springs?	BT-2	Understand
	PART -B		
1	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 UDL load of 1 kN/m between the point loads.	BT-2	Understand

	Draw the SFD and BMD. calculate the maximum bending moment.		
2	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 fixed end and 2 kN at free end. Draws shear force and bending moment diagrams for the beam.	BT-2	Understand
3	Derive an expression for shear force and bending moment of a simply supported beam carrying a UDL of w/metre length throughout its span with neat sketch.	BT-5	Evaluate
4	Alayse the beam as shown in fig and draw the the S.F and B.M diagram. 	BT-3	Application
5	Label the shear force and bending moment diagram for the beam shown in Fig 	BT-1	Remember
6	Locate and Plot the shear force and bending moment diagram for the beam given in Fig.+ 	BT-1	Remember
7	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	Application
8	Derive an expression for $\frac{M}{I}=\frac{\sigma}{Y}=\frac{E}{R}$.	BT-3	Application
9	A simply supported beam of span 4m carries a udl of 6kN/m over the entire span. If the maximum allowable stress due to bending is restricted to 150 N/mm^2, determine the cross sectional dimensions if the section is; **(i)** Rectangular with depth twice the breadth (4 marks) **(ii)** Solid circular section (5 marks)	BT-4	Analyze

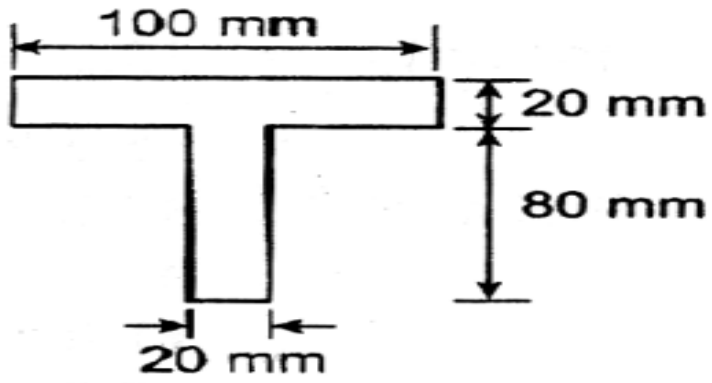
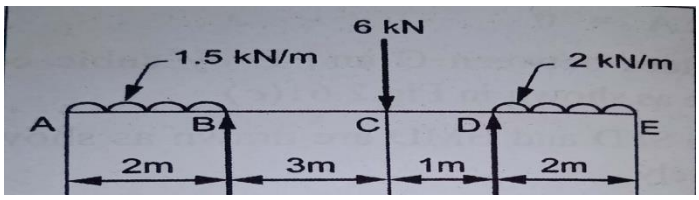
	(iii) Hollow circular section having a diameter ratio of 0.6 (4 marks)		
10	The cross section of T beam is as follows: Flange thickness = 10mm; width of the flange = 100mm; thickness of the web = 10mm; depth of the web = 120mm; If a shear force of 2kN is acting at a particular section of the beam design and draw the shear stress distribution across the section	BT-5	Evaluate
11	A 100mm X 200mm rolled steel I section has the flanges 12mm thick and web 10mm thick. Formulate **(i)** The safe udl the section can carry over a span of 6m if the permissible stress is limited to 150 N/mm^2 (7 marks) **(ii)** The maximum bending stress when the beam carries a central point load of 20kN. (6 marks)	BT-5	Evaluate
12	A simply supported beam of span 6m is subjected to a UDL of 15kn/m over its entire length. The cross section of beam is 20 cm wide and 30cm deep. Sketch the variation of bending stress and shear stress in the beam cross section	BT-4	Analyze
13	The cast iron beam is of T- section as show in the figure. The beam is simply supported on a span of 6m. thebeam carries a uniformly distributed load of 2KN/m on the entire length (span). Determine the maximum tensile and maximum compressive stress.  	BT-3	Application
14	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	BT-6	Creating
	PART-C		
1.	A cantilever beam of 3 m long carries a uniformly distributed load of 10 kN/m over a length of 2 m from the free end. Draw shear force and bending moment diagrams for the beam.	BT-2	Understand
2.	Derive an expression for shear force and bending moment of a simply supported beam carrying a UDL of w/metre length throughout its span with neat sketch of SFD and BMD	BT-4	Analyze
3.	Draw shear force and bending moment diagrams for the beam shown in	BT-1	Remember

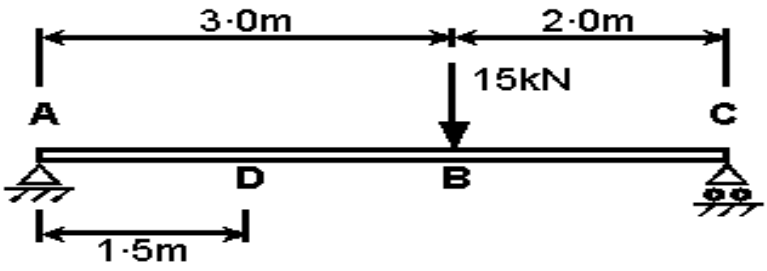
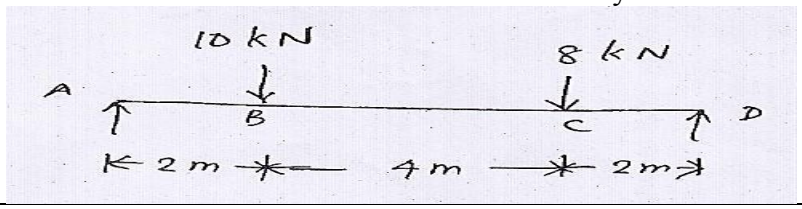
	fig.  		
4.	Find out the section modulus for the follwing a) Rectangular section(3 marks) b) Hollow rectangular section(4 marks) c) Circular section(3 marks) d) Hollow circular section(3 marks)	BT-3	Application

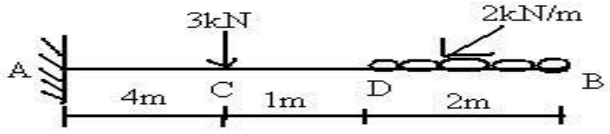
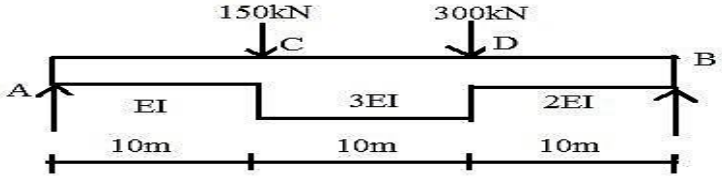
UNIT – 3 DEFLECTION OF BEAMS

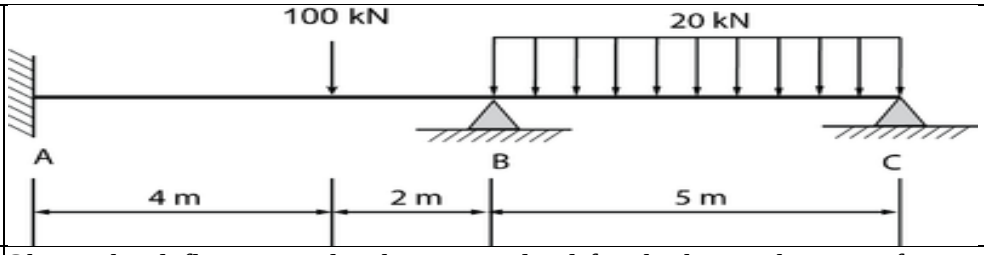
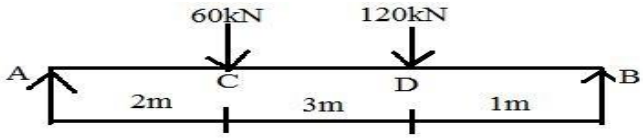
Elastic curve – Governing differential equation - Double integration method - Macaulay's method - Area moment method - conjugate beam method for computation of slope and deflection of determinant beams.

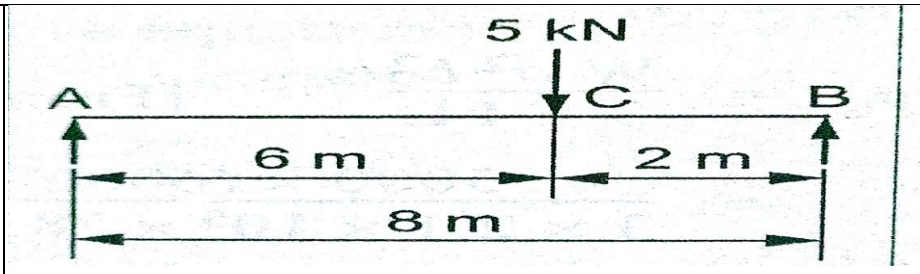
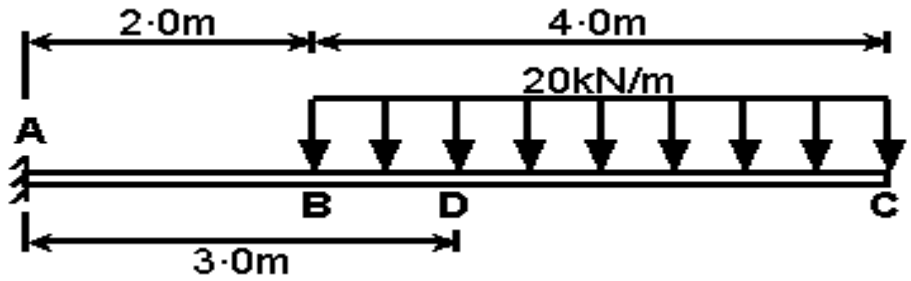
Part A

Q.No	Questions	BT Level	Competence
1	Illustrate what is meant by deflection of beam with neat sketch.	BT-2	Understand
2	Recall the methods for finding out the slope and deflection at a section?	BT-1	Remember
3	Analyze double integration method.	BT-4	Analyze
4	Distinguish between actual beam and conjugate beam.	BT-6	Create
5	State the two theorems in moment area method.	BT-1	Remember
6	Give the differential relation between bending moment, slope and the deflection?	BT-3	Application
7	Give the maximum slope and maximum deflection of a cantilever beam subjected to UDL?	BT-1	Remember
8	Illustrate when Macaulay's method is preferred?	BT-2	Understand
9	When do you prefer Moment area method?	BT-1	Remember
10	Identify the values of slope and deflection for a cantilever beam of length 'L' subjected to Moment 'M' at the free end?	BT-3	Application
11	Distinguish between statically determinate and indeterminate beams.	BT-2	Understand
12	State the theorems of conjugate beam method.	BT-1	Remember
13	Formulate the slope at the support for a simply supported beam of length L, constant EI and carrying central concentrated load?	BT-5	Evaluate
14	Justify why moment method is more useful when compared with double integration?	BT-6	Create
15	Write down the formula used to find the deflection of beam by Moment-Area method.	BT-4	Analyze
16	Compare and contrast working stress & allowable stress	BT-2	Understand
17	Write the maximum value of deflection for a cantilever beam of length L, constant EI and carrying concentrated load W at the end.	BT-4	Analyze
18	Write the relation between deflection of bending moment and flexural rigidity for a beam.	BT-4	Analyze
19	Recall method of Singularity functions.	BT-1	Remember
20	Among 4 methods of analyzing the beams for deflection and slope, relate the situations when each methods are used.	BT-2	Understand
	PART –B		
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 (4 marks) **(ii)** Maximum deflection (4 marks) **(iii)** The point at which the maximum deflection occurs. (5 marks) Take $I=85\times10^6$ mm^4 $E = 2\times10^5$ N/mm^2	BT-5	Evaluate

2	A beam is simply supported as its ends over a span of 10 m and 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) slop and deflection under the 100 kN load. Assume EI = 36 x 10^4 kN-M^2	BT-1	Remember
3	For the beam shown in fig find the deflection at the B. Use Macaulay's method. 	BT-4	Analyze
4	Analyze the slope at the supports and deflection of the beam shown in figure. Take E=2x10^5N/mm^2 and I= 20x10^6 mm^4. Use Macaulay's method 	BT-4	Analyze
5	A cantilever of length 2.5m is loaded with an udlof10 kN/m over a length 1.5m from the fixed end and point load 2kN at 2m from free end. Use Moment area method. **a)** Design the beam for slope (6 marks) **b)** Design the beam for deflection at the free end. (7 marks)	BT-6	Create

6	Indicate and solve the slope and deflection at the free end of the cantilever shows in fig. Take EI = 1x10 ^{10}kN/mm^2 	BT-2	Understand
7	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-5	Evaluate
8	For the beam shown in fig Predict the deflection at the B. Use Macaulay's method	BT-6	Create

			
9	Obtain the deflection under the greater load for the beam shown in fig using the Moment Area method. 	BT-6	Create
10	A beam AB of span 6m is simply supported at its ends is subjected to a point load of 20kN at C at a distance of 2m from left end. Using moment area method, Predict the deflection at the point C, slope at the points A, B and C. Take I = 6 x10^8 mm^4 and E = 200GPa	BT-2	Understand
11	A beam of leangth 6m is simply supported at its ends and carries two point loads bof 48 kN and 40 kN at a distance of 1m & 3m respectively. (i) Deflection under each load (ii) Maximum deflection (iii) take point at which the max deflection occues. Take I=85×10^6 mm^4 E = 2×10^5 N/mm^2.	BT-3	Application
12	A simply supported beam carrying a triangular distributed load. Label **a)** the slope at left end (7 marks) **b)** deflection at Centre (6 marks)	BT-1	Remember
13	Derive an expression for deflection of a simply supported beam carrying an eccentric point load.	BT-4	Analyze
14	A beam of 4m span is carrying a point load of 40kN at a distance of 3m from the left end. Calculate the slope at the supports and deflection under the load. Also calculate the maximum deflection. EI= 2.6x10^7N-m^2	BT-4	Analyze
	PART-C		
1	Derive an expression for slope and deflection of a cantilever beam carrying point load at free end	BT-2	Understand
2	Derive an expression for deflection of a simply supported beam carrying UDL throughout its span	BT-4	Analyze
3	A simply supported beam of length 8 m is loaded as shown in fig. calculate the slope and deflection at each point by the following methods. using any one method. (i) Double integration (ii) Macaulay's method (iii) Moment area method (iv) Conjugate beam method. Assume E= 2.1 x 10^5 N/mm^2 and I= 78 x 10^6 mm^4	BT-3	Application

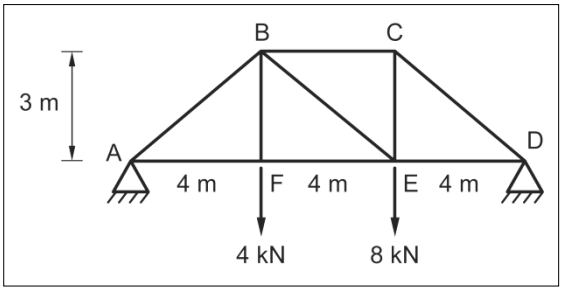
			
4	Indicate and solve the slope and deflection at the free end of the cantilever shows in fig. Take EI = $1x10^{10}$ kN/mm^2 	BT-1	Remember

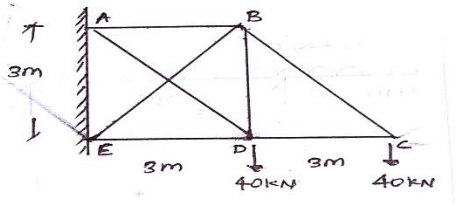
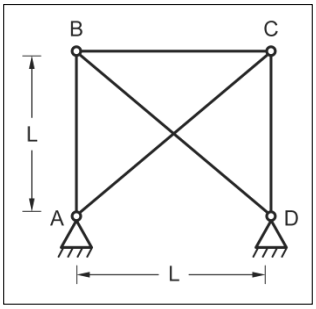
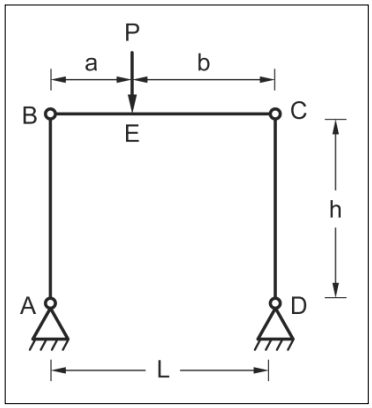
UNIT-IV TORSION			
Theory of Torsion – Stresses and Deformations in Solid and Hollow Circular Shafts – combined bending moment and torsion of shafts - Power transmitted to shaft – Shaft in series and parallel – Closed and Open Coiled helical springs – springs in series and parallel – Design of buffer springs			
PART - A			
Q.No	**Questions**	**BT**	**Competence**
1.	Compare and contrast between torsion, bending and torque	BT-1	Remember
2.	List the assumptions made in the theory of torsion?	BT-1	Remember
3.	Write about Torsional equation and torsional rigidity	BT-2	Remember
4.	Write about modulus of rupture	BT-2	Remember
5.	Write the expression for power transmitted by a shaft.	BT-5	Application
6.	Explain the term spring index	BT-4	Analyze
7.	Differentiate between closed coil helical spring and open coil helical spring.	BT-4	Understand
8.	Summarize the assumptions made in torsional equation.	BT-4	Understand
9.	Quote the expressions for polar modulus of solid and hollow circular shaft.	BT-3	Remember
10.	Formulate the mathematical expression for deflection of an open coiled helical spring.	BT-6	Creating

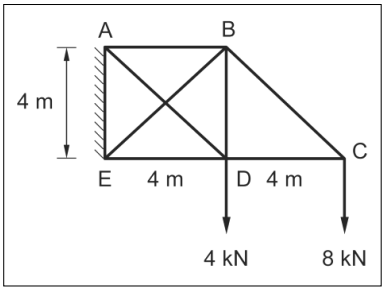
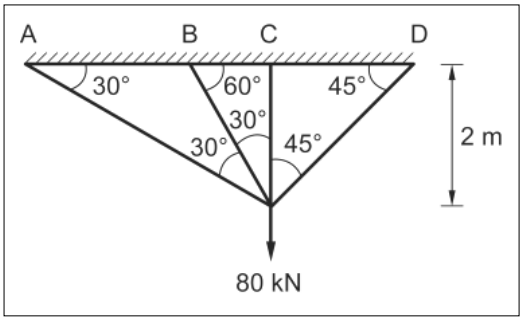
11.	Classify springs with example.	BT-3	Application
12.	Summarize the assumptions made in torsional equation.	BT-1	Understand
13.	Express the stiffness of a close coiled helical spring mathematically.	BT-1	Understand
14.	Combine the expressions for deflection and shear stress of close coiled spring.	BT-6	Creating
15.	What is meant by stiffness? Write the formula for stiffness of a close coiled helical spring subjected to axial load.	BT-2	Evaluate
16.	A circular shaft is subjected to a torque of 10kNm. The power transmitted by the shaft is 209.33kW. Find the speed of shaft in revolution per minute	BT-1	Remember
17.	What is meant by stiffness? Write the formula for stiffness of a close coiled helical spring subjected to axial load	BT-2	Evaluate
18.	What is leaf spring? State the uses of leaf spring.	BT-1	Analyze
19.	Design the equivalent bending moment for a shaft subjected to moment M and torsion T?	BT-3	Analyze
20.	Write short notes on buffer springs	BT-5	Application
	PART – B (13 MARKS)		
1.	What do you mean by the strength of the shaft? Compare the strength of solid and hollow circular shafts	BT-1	Understand
2.	What are the assumptions made in the torque equations?	BT-4	Remember
3.	In a tensile test, a test piece of 25mm diameter, 200mm gauge length stretched 0.0950mm under a pull of 50kN. In a 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) Poisson's ratio (3 marks) b) Young's modulus (3 marks) c) Bulk modulus and (3 marks) d) Rigidity modulus for a material (4 marks)	BT-1	Understand
4.	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-4	Application

5.	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 (6 marks) b) Shear stress developed in steel (7 marks)	BT-4	Creating
6.	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-2	Understand
7.	A solid shaft is to transmit 300kW at 100 rpm if the shear stress is not to exceed 80N/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 0.6 times the external diameter. What percentage saving in weight is possible?	BT-3	Creating
8.	A leaf spring is made of 12 steel plates of 50mm wide and 5mm 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 105 N/mm^2	BT-2	Application
9.	A leaf spring of semi elliptical type has 10 plates, each 60mm wide and 5 mm thick. The longest 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=2×105 N/mm^2 .	BT-3	Creating
10.	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 125N/mm^2 .The solid length of the spring is 50mm. Find the diameter of coil, diameter of wire and number of coils .C = 4.5 xl04N/mm^2	BT-1	Application
11.	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 105 MPa. The mean diameter of the coil is 10 times that of the coil wire. Find the diameter and length of the wire.	BT-2	Understand
12.	Derive the expression for the shear stress produced in a circular solid shaft subjected to torsion.	BT-6	Analyze

13.	Derive an expression for strain energy stored in a body due to torsion	BT-3	Applying
14.	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=8x104 N/mm^2 (6 marks) 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 (7 marks)	BT-5	Evaluating
	PART - C		
1.	Derive the expression for the shear stress produced in a circular solid shaft subjected to torsion	BT-2	Understand
2.	Deduce the expression for strain energy stored in a closed coil helical spring when subjected to axial loading.	BT-6	Evaluate
3.	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 10 per metre length, find a suitable diameter. If a) The shaft is solid (7 marks) b) The shaft is hollow with external diameter twice the internal diameter Take C = 8x104 N/mm^4 (8 marks)	BT-3	Understand
4.	Derive the expression for stiffness of two closed coil helical springs when connected in series.	BT-5	Evaluate
	UNIT V ANALYSIS OF TRUSSES		
	Determinate and indeterminate trusses - Analysis of pin jointed plane determinate trusses by method of joints, method of sections and tension coefficient – Analysis of Space trusses by tension coefficient method.		
	PART - A		
Q.No	**Questions**	**BT**	**Competence**
1.	Differentiate between plane truss and space truss.	BT-2	Remember
2.	Define tension coefficient of a truss member.	BT-4	Evaluate
3.	What is meant by indeterminate structures?	BT-1	Remember
4.	What are the conditions of equilibrium?	BT-2	Understand
5.	Differentiate between determinate and indeterminate structures.	BT-2	Remember

6.	Define degree of indeterminacy.	BT-5	Remember
7.	Write the equation for degree of indeterminacy for truss member.	BT-3	Remember
8.	Explain in internal and external indeterminacies.	BT-6	Remember
9.	Explain the different methods of analysis of indeterminate structures?	BT-1	Understand
10.	analysis a space frame and what is the nature of joints provided in the shape trusses	BT-3	Analyze
11.	Explain the methods available for the analysis of space trusses?	BT-1	Evaluate
12.	Examine condition of equilibrium.	BT-4	Understand
13.	Define compatibility conditions?	BT-2	Application
14.	Write the comparative statement in linear and non-linear systems?	BT-6	Analyze
15.	What are all type of frames	BT-1	Creating
16.	What are the assumptions made in the unit load method?	BT-4	Understand
17.	Write down the two methods of determining displacements in pin jointed plane frames by the unit load concept.	BT-5	Application
18.	What is meant by perfect frame?	BT-1	Analyze
19.	Differentiate external and internal indeterminacy of structures	BT-1	Creating
20.	Define redundant force	BT-3	Application
	PART-B		
1.	Using the method of tension coefficients, Analyse the space truss shown in the figure and find the forces in the members of the truss.	BT-1	Understand
2.	Analyse the space truss shown in the figure by the method of tension coefficients and determine the member forces	BT-2	Remember
3.	Determine the force in the members of the truss shown in figure. The cross sectional area of vertical and horizontal members is 4000mm2 and that of the diagonal is 6000 mm^2 	BT-4	Understand

4.	Tabulate the forces in the members of the truss shown in figure. The cross sectional area and young's modulus of all the members are the same. 	BT-3	Remember
5.	Determine the force in various members of the pin-jointed frame as shown in Fig. If the member BC is short by an amount of δ. All members of the frame have same axial rigidity as AE. 	BT-2	Application
6.	Determine the horizontal reaction of the portal frame shown in Fig, by the energy method. Also, calculate the horizontal reaction when the member BC is subjected to the uniformly distributed load, w over entire length 	BT-5	Analyze

7.	Find the forces in the members of the truss shown in Fig. The axial rigidities are same for all the members. 	BT-6	Creating
8.	Analyse the pin-connected plane frame shown in Fig. The cross- sectional area of each member is 3000 mm^2. Take E equal to 210 kN/ mm^2 	BT-4	Creating
9.	List the force methods and explain in detail about any methods with an example.	BT-2	Evaluate
10.	Write in detail about the Equilibrium, Compatibility and Force displacement Relationships	BT-3	Remember
11.	Explain in detail about the (i) Plane frame(ii) Pin jointed Frame (iii) Rigid jointed Frame	BT-1	Understand
12.	What are the conditions to be satisfied for determinate structures and how are indeterminate structures identified?	BT-1	Understand
13.	Define degree of freedom of the structure with an example.	BT-3	Applying
14.	Derive the stiffness matrix of a typical pin-jointed two-dimensional frame element.	BT2	Understand
	PART - C		
1.	Explain in details about External and Internal indeterminacy.	BT-6	**Remember**
2.	Elaborate in List the classical methods of structural analysis.	BT-2	**Understand**

3.	Give the mathematical expression for the degree of static indeterminacy of rigid jointed plane frames.	BT-1	**Evaluate**
4.	Write down the equation for the degree of static indeterminacy of the pin jointed Plane frames, explain the notations used.	BT-4	**Creating**