Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. (Full Time) - END SEMESTER EXAMINATIONS, APR / MAY 2024

CIVIL ENGINEERING
III Semester
CE5301 Strength of Materials
(Regulation 2019)

Time:3 hrs

Max. Marks: 100

CO1	Understand the concepts of stress and strain, principal stresses and principal planes.
CO2	Determine Shear force and bending moment in beams and understand concept of theory of simple bending.
CO3	Calculate the deflection of beams by different methods and selection of method for determining slope or deflection.
CO4	Analyze propped cantilever, fixed beams and continuous beams for external loadings and support settlements.
CO5	Determine the stresses due to Unsymmetrical bending of beams, locate the shear center, and study the various theories of failure

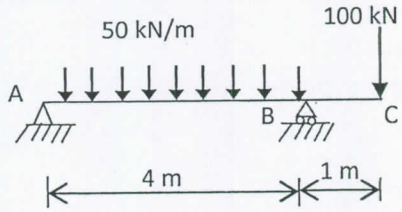
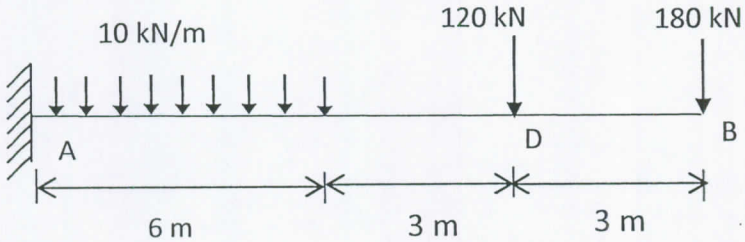
BL – Bloom's Taxonomy Levels
(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

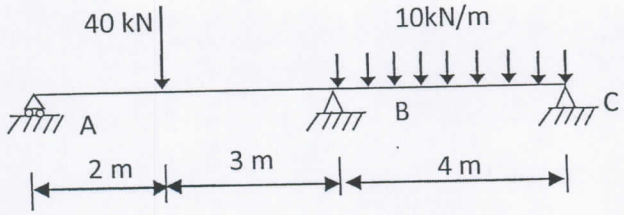
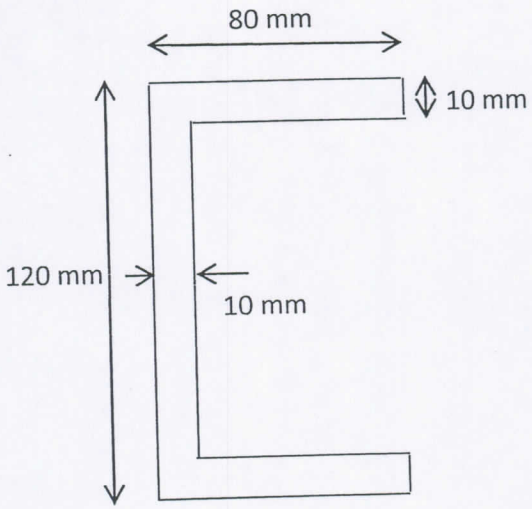
PART- A (10x2=20Marks)
(Answer all Questions)

Q. No.	Questions	Marks	CO	BL
1	Write the relationship between the elastic constants – Youngs modulus, Shear modulus and Bulk modulus.	2	1	L1
2	Determine the maximum torque transmitted by a solid shaft of diameter 100 mm, if the maximum stress induced in the shaft is 100 N/mm^2.	2	1	L2
3	List any four assumptions of theory of simple bending	2	2	L1
4	The maximum moment at a section of a rectangular beam is 200 kNm. The section modulus of the beam is 500 x 10^4 mm^3. Determine the maximum bending stress induced at the extreme fibers.	2	2	L2
5	Draw the conjugate beam for a cantilever beam AB of length L subjected to an uniformly distributed load (w) over the whole span. In the beam AB, A is the fixed support and B is the free end.	2	3	L2
6	Write the expression for strain energy of a beam due to bending.	2	3	L1
7	State the applicability of theorem of three moments	2	4	L2
8	Draw the typical bending moment diagram for a propped cantilever beam subjected to uniformly distributed load (w) over the whole span.	2	4	L2
9	State the failure theory based on maximum strain energy.	2	5	L1
10	Bring out the difference between centre of gravity and shear centre of a cross-section.	2	5	L2

PART- B (5x 13=65Marks)
(Restrict to a maximum of 2 subdivisions)

Q. No.	Questions	Marks	CO	BL
		13	1	L4

	30^0 to the axis of the major principal stress. Also, determine the maximum intensity of shear stress in the material at the point.			
	OR			
11 (b)	A boiler is subjected to an internal pressure of 2 N/mm^2. The thickness of the boiler plate is 20 mm and the permissible stress is 120 N/mm^2. Determine the maximum diameter if the efficiency of the longitudinal joint is 90% and that of circumferential joint is 40%.	**13**	1	L4
12 (a)	A simply supported beam with an overhang is loaded as shown in Fig. Q12a. Determine the support reactions and draw the bending moment diagram and shear force diagram for the beam.  Fig. Q12a	**13**	2	L4
	OR			
12 (b)	A cantilever beam AB of length 12 m is loaded as shown in Fig. Q12b. Determine the support reactions and draw the bending moment diagram and shear force diagram for the beam.  Fig. Q12b	**13**	2	L4
13 (a)	A simply supported beam of span 10 m is subjected to a uniformly distributed load (udl) of magnitude 10 kN/m over the whole span. Also, a concentrated load of 100 kN acts at the mid span. Determine the deflection at the midspan and the slope at the supports. Use Macaulays method. Take E= 2 x 10^5 N/mm^2 and I = 10^8 mm^4	**13**	3	L4
	OR			
13 (b)	A cantilever beam of span 8 m is subjected to a concentrated load of 100 kN at the free end and 50kN at a distance of 4 m from the support. Determine the deflection and slope of the cantilever beam at the free end. Use moment area method. Take E= 2 x 10^5 N/mm^2 and I = 10^8 mm^4	**13**	3	L4
14 (a)	A fixed beam AB of span 8 m is subjected to a concentrated load of 150 kN at the midspan. Analyze the beam, determine the support moments and draw the bending moment and shear force diagram for the beam.	**13**	4	L4
	OR			
14 (b)	A continuous beam ABC is shown in Fig. Q14b. Analyze the beam and draw the bending moment and shear force diagram.	**13**	4	L4

	 Fig. Q14b			
15 (a)	Determine the position of shear centre for the channel section shown in fig. Q15a.  Fig. Q15a	**13**	5	L4
	OR			
15 (b)	Determine the thickness required for a cylindrical shell of internal diameter 180 mm to withstand an internal pressure of 10 N/mm^2. The maximum hoop stress in the section is not to exceed 30 N/mm^2	**13**	5	L4

PART- C (1x 15=15Marks)

(Q.No.16 is compulsory)

Q. No.	Questions	Marks	CO	BL
16.	At a section of a mild steel shaft, the maximum torque is 13 kNm and the maximum bending moment is 8 kNm. The diameter of the shaft is 75 mm and the tensile strength of the material of the shaft is 250 N/mm^2. Determine whether the section is safe as per (i) maximum principal stress theory (ii) maximum principal strain theory and (iii) maximum shear stress theory. If not safe, suggest suitable measures. Comment on the results. Take E = 2 x 10^5 N/mm^2.	**15**	5	L6