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ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B.Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, DECEMBER 2024

CIVIL ENGINEERING

Third Semester

CE 23301 STRENGTH OF MATERIALS I

(Regulation2023)

Time:3hrs

Max.Marks: 100

CO1	Understand the concepts of stress, strain, principal stresses and principal planes and the mechanical properties of materials such as tension, compression and hardness
CO2	Determine shearing forces, bending moments and their stress distributions in the determinate beams, along with the double shear and impact properties of metals
CO3	Calculate the slope and deflection of beams by different methods and verify the deflection of beams and carriage springs experimentally
CO4	Gain knowledge on theory of torsion, power transmitted by circular shafts, stresses and deformation of helical springs, with experimental insight
CO5	Analyze determinate plane and space trusses

BL – Bloom's Taxonomy Levels

(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

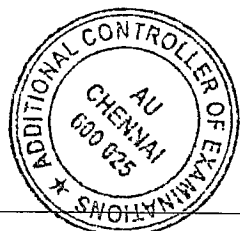
PART- A(10x2=20Marks)
(Answer all Questions)

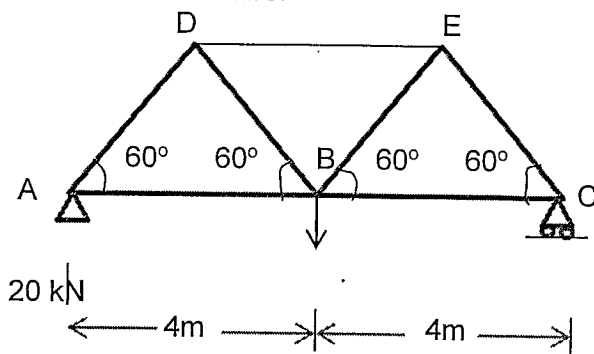
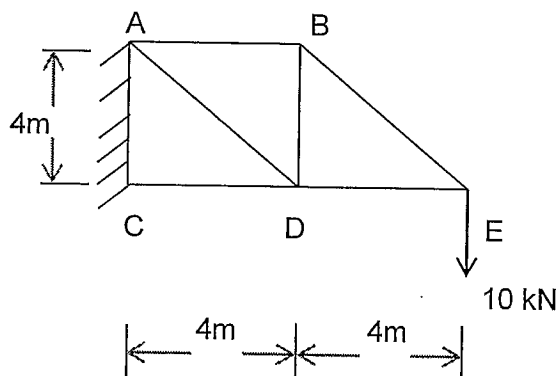
Q.No.	Questions	Marks	CO	BL
1	What are thermal stresses and how are they produced ?	2	1	L1
2	List the types of stresses developed in thin cylinders subjected to internal pressure?	2	1	L1
3	Define Shear Force and Bending Moment.	2	2	L1
4	Why a square section is more efficient than a circular section of same area in resisting bending moment ?	2	2	L2
5	State the Area Moment second theorems.	2	3	L1
6	Draw a conjugate beam for a double side over hanging beam .	2	3	L3
7	Why hollow circular shafts are preferred over solid circular shafts ?	2	4	L2
8	In a helical spring, 1.25 mm of compression is observed on applying a load of 1200 N. Find the stiffness of the spring.	2	4	L3
9	What is meant by a perfect frame(truss) ?	2	5	L1
10	What are the different methods of analyzing a truss ?	2	5	L1

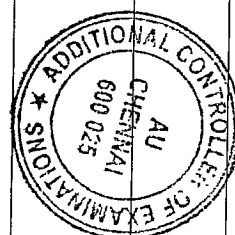
PART- B(5x 13=65Marks)

Q.No.	Questions	Marks	CO	BL
11 (a)	A circular bar of length 300mm and diameter 12mm, on the application of 100 kN axial force, elongates by 1.33 mm and its diameter reduces by 0.016mm. Calculate the three elastic constants.	13	1	L3
OR				

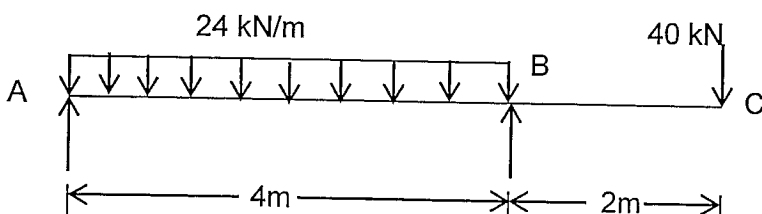
11 (b)	At a point in a stressed material, a tensile stress of 100 MPa accompanied by a positive shear stress of 25 MPa is observed in a plane. In another plane at the same point which is normal to the first plane, a compressive stress of 60 MPa and a negative shear stress of 25 MPa are seen. Find the principal stresses and locate their planes at this point. Find also the maximum shear stress and its plane,	13	<u>1</u>	<u>L3</u>
12 (a)	A simply supported beam of span 6 metres carries a concentrated load of 40 kN at its mid span. The cross section of the beam is a rectangle with a depth of 150mm and a width of 90mm. Find the maximum tensile and compressive bending stresses in the beam. Sketch the bending stress variation across the section neatly.	13	<u>2</u>	<u>L4</u>
OR				
12 (b)	A symmetric I section with top and bottom flanges 120mmx20mm and the web 150mmx20mm is subjected to a shear force of 200 kN. Find the shear stress at the junction of the flange and the web and also at the neutral axis. Sketch the shear stress variation across the section neatly.	13	<u>2</u>	<u>L3</u>
13 (a)	A simply supported beam of span 6 metres carries two point loads 40 kN and 60 kN at 2m and 4m from the left end respectively. If the flexural rigidity of the beam is $15 \times 10^4 \text{ kNm}^2$ find the slopes at the supports and the deflections under the loads.	13	<u>3</u>	<u>L4</u>
OR				
13 (b)	A simply supported beam of length 6 metres carries two point loads of 60 kN each at 2m and 4m from the left end. If the flexural rigidity of the beam is 15000 kNm^2 find the slopes at the supports and the maximum deflection using area moment method.	13	<u>3</u>	<u>L4</u>
14 (a)	A solid cylindrical shaft is to transmit 320 kW at 120 RPM. If the shear stress is not to exceed 80 MPa, design the shaft and find the angle of twist for the designed shaft. Take $G=80 \text{ GPa}$ and length of the shaft as 2m.	13	<u>4</u>	<u>L3</u>
OR				
14 (b)	A close coiled helical spring of mean diameter 120mm is made of 10mm diameter steel wire with 10 complete turns. The spring is axially compressed with a load of 180 N. If the shear modulus is 80 GPa, find the compression in the spring and its stiffness. Find also the maximum shear stress induced in the spring.	13	<u>4</u>	<u>L3</u> <u>L5</u>



15 (a)	<p>Analyse the pin jointed plane determinate truss shown in Fig.Q15(a) using method of joints. Tabulate the values of the member forces with their nature.</p>  <p style="text-align: center;">Fig. Q 15(a)</p>	13	5	L4
OR				
15 (b)	<p>Analyse the pin jointed plane determinate truss shown in Fig.Q15(b) using any method. Tabulate the values of the member forces with their nature.</p>  <p style="text-align: center;">Fig. Q 15(b)</p>	13	5	L4



PART- C(1x 15=15Marks)
(Q.No.16 is compulsory)

Q.No.	Questions	Marks	CO	BL
16.	<p>Draw the shear force and bending moment diagrams for the overhanging beam ABC shown in Figure Q16 . It is simply supported at A and B and free at C. AB=4m and BC=2m. It carries a uniformly distributed load of 24 kN/m over AB and a concentrated load of 40 kN at C. Mark all the salient values including maximum bending moment and point of contraflexure.</p> 	15	2	L4