Q. Code: 980572

Reg. No. | | | | | | | | | | | | | |

B.E. / B.TECH. DEGREE EXAMINATIONS, MAY 2024

Fourth Semester

CE18401 – STRENGTH OF MATERIALS II

(Civil Engineering)

(Regulation 2018/2018A)

TIME: 3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
	Upon successful completion of the course, the students should be able to:	
CO 1	Estimate strain energy and deflections of beams, trusses and frames using strain energy principles.	**3**
CO 2	Analyse indeterminate beams and draw Shear Force Diagram and Bending Moment Diagram.	**3**
CO 3	Estimate the critical load of columns and stresses induced in thick and compound cylinders.	**3**
CO 4	Estimate the principal stresses and principal planes due to three dimensional states of stresses and also study the theories of failure in materials.	**3**
CO 5	Estimate the stresses due to unsymmetrical bending and stresses in curved beams.	**3**

PART- A (10 x 2 = 20 Marks)

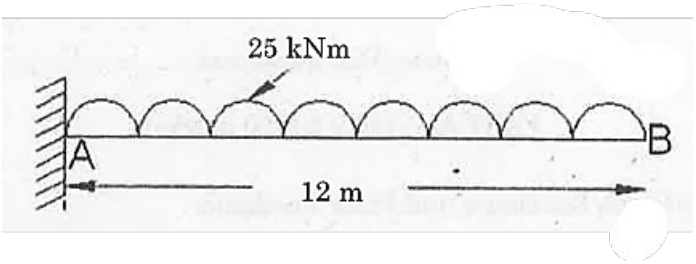
(Answer all Questions)

		CO	RBT LEVEL
1.	What is meant by resilience and proof resilience?	**1**	**1**
2.	State Maxwell's reciprocal theorem.	**1**	**1**
3.	Write Clayperon's three moment equation for continuous beams when flexural rigidity is same and supports are at same level.	**2**	**1**
4.	Find the reaction at prop for a propped cantilever subjected to a concentrated load at centre.	**2**	**3**
5.	List out the limitations of Euler's theory of columns.	**3**	**1**
6.	Calculate the bursting pressure for cold-drawn seamless steel tubing of 50 mm inside diameter with 2 mm wall thickness. The ultimate strength of steel is 400 MN/m^2.	**3**	**3**
7.	What is the significance of principal planes in the strength of materials?	**4**	**2**
8.	List the different theories of failure.	**4**	**1**

9.	Outline two reasons for the unsymmetrical bending of beams.	**5**	**2**	
10.	What are the assumptions made in the analysis of curved beams using Winkler-Bach Theory.	**5**	**1**	

PART- B (5 x 14 = 70 Marks)

		Marks	CO	RBT LEVEL
11. (a)	Determine vertical displacement at free end of a cantilever beam shown in figure using method of virtual work. Take E = 2 x 10^5 MPa and I = 825 x 10^7 mm^4.	**(14)**	**1**	**3**

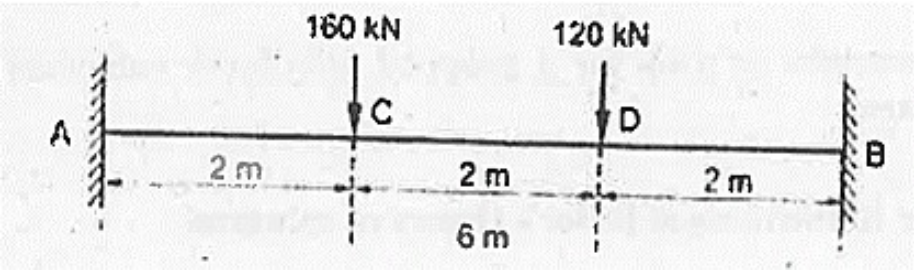


(OR)

(b)	A uniform metal bar has a cross-sectional area of 700 mm^2 and a length of 1.5 m. With an elastic limit of 160 MN/m^2, what will be its proof resilience? Determine also the maximum value of an applied load that may be suddenly applied without exceeding the elastic limit. Calculate the value of gradually applied load which will produce the same extension as that produced by the suddenly applied load above. Take E = 200 GN/m^2.	**(14)**	**1**	**3**
12. (a)	A beam ABCD with simply supported ends, 16 m long is continuous over three spans; AB = 6 m, BC = 5 m and CD = 5 m, the support is at the same level. There is a uniformly distributed load of 20 kN/m over BC. On AB, there is a point load of 80 kN at 2m span from A. On CD, there is a point load of 60 kN at 3 m from D. Using the theorem of three moments, calculate the moments and reactions at the supports and draw bending moment and shear force diagrams.	**(14)**	**2**	**3**

(OR)

(b)	A fixed beam AB of length 6 m carries a point load of 160 kN and 120 kN at a distance of 2 m and 4 m from the left end A. Find the fixed end moments and the reactions at the supports. Draw bending moment and shear force diagrams.	**(14)**	**2**	**3**



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13. (a)	Determine the shortest length for a pin jointed column of cross-section 75 mm x 48 mm using Euler's formula. Take the critical stress value as 220 MPa and E = 205 GPa.	**(14)**	**3**	**3**
	(OR)			
(b)	A cast iron pipe has 20 mm internal diameter and 50 mm metal thickness and carries water under a pressure of 5 N/mm^2. Calculate the maximum and minimum intensities of circumferential stress and sketch distribution of circumferential stress intensity and the intensity of radial pressure across the section.	**(14)**	**3**	**3**
14. (a)	A steel shaft is subjected to an end thrust producing a stress of 90 MPa and the maximum shearing stress on the surface arising from the torsion is 60 MPa. The yield point of the material in simple tension was found to be 300 GPa. Calculate the factor of safety of the shaft according to Maximum shear stress theory and maximum distortion energy theory.	**(14)**	**4**	**3**
	(OR)			
(b)	In a material, the principal stresses are 60 MN/m^2, 48 MN/m^2 and 36 MN/m^2. Take E = 200 GN/m^2 and 1/m = 0.3. Calculate i) total strain energy ii) volumetric strain energy iii) shear strain energy iv) factor of safety on the total strain energy criterion if the material yields at 120 MN/m^2.	**(14)**	**4**	**3**
15. (a)	A simply supported beam of T-section (flange: 100 mm x 20 mm & web: 150 mm x 10 mm) is 2.5 m in length. It carries a load of 3.2 kN inclined at 20^o to the vertical line passing through the centroid of the section. If E = 200 GN/m^2, calculate	**(14)**	**5**	**3**

i) maximum tensile stress

ii) maximum compressive stress

iii) deflection due to the load

iv) position of the neutral axis.

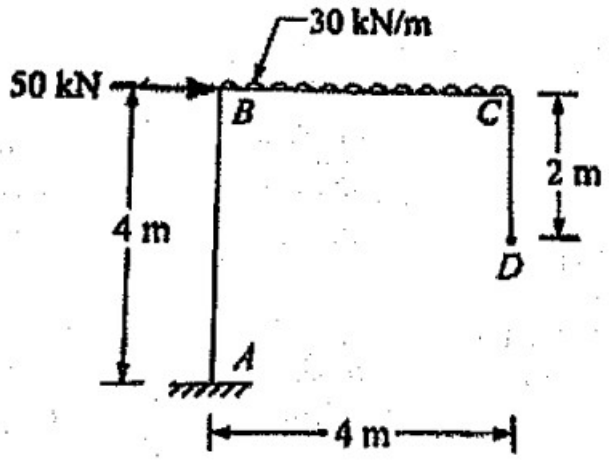
(OR)

		Marks	CO	RBT LEVEL
(b)	A curved bar of rectangular section, initially unstressed is subjected to a bending moment of 2000 N.m tends to straighten the bar. The section is 5 cm wide and 6 cm deep in the plane of bending and the mean radius of curvature is 10 cm. Find the position of the neutral axis and the stress at the inner and outer face.	**(14)**	**5**	**3**

PART- C (1 x 10 = 10 Marks)

(Q.No.16 is compulsory)

		Marks	CO	RBT LEVEL
16.	Determine horizontal and vertical displacements at the free end D using Castigliano's theorem. Take EI = 12 x 10^{13} Nmm^2.	**(10)**	1	**3**



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