20 JAN 2023

Reg. No.												

Question Paper Code	11653

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2022

Fourth Semester

Civil Engineering

20CEPC402 - STRENGTH OF MATERIALS II

(Regulations 2020)

Duration: 3 Hours Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

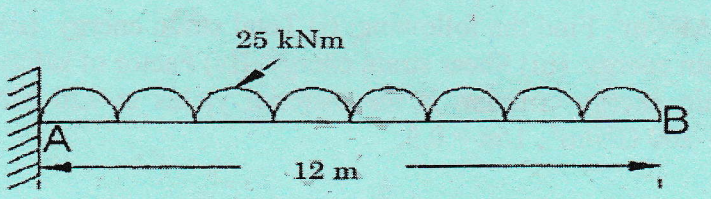
Answer ALL Questions

		Marks, K-Level, CO
1.	Define the terms: Strain Energy and Modulus of Resilience.	*2,K1,CO1*
2.	Write the formula to calculate the strain energy due to torsion.	*2,K1,CO1*
3.	State and explain the principle of virtual work.	*2,K1,CO2*
4.	State Castigliano's first theorem.	*2,K2,CO2*
5.	Write Rankines-Gordon formula.	*2,K2,CO4*
6.	Distinguish between thick and thin cylinder.	*2,K2,CO4*
7.	Define Principal Stress and Principal Planes.	*2,K1,CO5*
8.	Explain the Maximum principal strain theory.	*2,K1,CO5*
9.	Write the assumptions made in Winkler Bach Equations.	*2,K1,CO6*
10.	Define Unsymmetrical bending.	*2,K1,CO6*

PART - B (5 × 13 = 65 Marks)

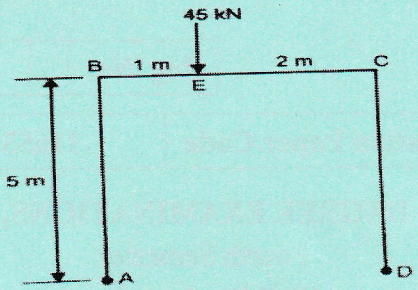
Answer ALL Questions

11.	a)	Determine the vertical displacement at free end of a cantilever beam shown in fig. using method of virtual work. Take E = 2 x 10^5 N/mm^2 and I = 825 x 10^7 mm^4.	*13,K3,CO2*



OR

	b)	The simple portal frame is shown in figure below is asymmetrically loaded. EI is constant. Analyze the frame by the strain energy method. Sketch the bending moment diagram.	*13,K3,CO2*



12. a) A steel bar 3 m long and 2500 mm^2 in area hangs vertically, which is securely fixed on a collar at its lower end. If a weight of 15 kN falls on the collar from a height of 10 mm, determine the stress developed in the bar. What will be the strain energy stored in the bar? Take E as 200 GPa. *13,K2,CO1*

OR

b) (i) Prove that the maximum stress induced in a body due to suddenly applied load is twice the stress induced when the same load is applied gradually. *8,K2,CO1*

(ii) State and prove Maxwell's reciprocal theorem. *5,K2,CO1*

13. a) A thin cylindrical shell 1m in diameter and 3m long has a metal thickness of 10mm, if it is subjected to an internal pressure of 3.5N/mm^2. Determine the changes in length, diameter and volume. Take E = 2.1 x 10^5 N/mm^2 and Poisson's ratio = 0.30. *13,K2,CO4*

OR

b) Derive Euler's formula when both ends of the columns are fixed and also one end of the column is fixed and the other end is free. *13,K2,CO4*

14. a) The rectangular stress components of a point in three dimensional stress system are defined as σx= 20 MPa, σy= -40 MPa, σz= 20 MPa, τxy = 40 MPa, τyz = -60MPa and τzx = 20 MPa. Examine the principal stresses and principal planes. Also determine associated direction of the state of stress. *13,K3,CO5*

OR

b) In a material, the principal stresses are 60 MN/m^2, 48 MN/m^2, 36 MN/m^2, Find the following: (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 , Take E = 200 GN/m^2 , 1/m = 0.3. *13,K3,CO5*

15. a) A curved bar of rectangular section, initially unstressed is subjected to bending moment of 2000 Nm 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. Judge the position of N.A and the stress at the linear and outer face. *13,K3,CO6*

OR

b) A Channel section has flanges 120mm x 20mm and web 160mm x 10mm. Total depth of the section is 200mm. Determine the shear center of the channel section. *13,K3,CO6*

PART - C (1 × 15 = 15 Marks)

16. a) A propped cantilever of span 6 m is subjected to a UDL of 3 kN/m over a length of 5m from the fixed end. Write the prop reaction and draw the SFD and BMD. *15,K3,CO3*

OR

b) A fixed beam AB of span 5m carries a point load of 90 kN at its mid span and a UDL of 15 kN/m throughout its length. Investigate (i) Fixed end moments (ii) Reactions. Also Draw the SFD and BMD. *15,K3,CO3*