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Question Paper Code:U2601

B.E./B.Tech. DEGREE EXAMINATION, APRIL / MAY 2025

Second Semester

Structural Engineering

21PSE201 - FINITE ELEMENT ANALYSIS FOR STRUCTURAL ENGINEERING

(Regulations 2021)

Duration: Three hours

Maximum: 100 Marks

Answer All Questions

PART – A (5 x 20 = 100 Marks)

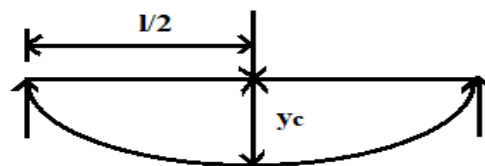
1. (a) A uniform column is fixed at the bottom and free at the top. It carries compressive load at the free end. Find out the critical load of column by assuming second degree polynomial as

$$y = a_0 + a_1x + a_2x^2 + a_3x^3$$

Or

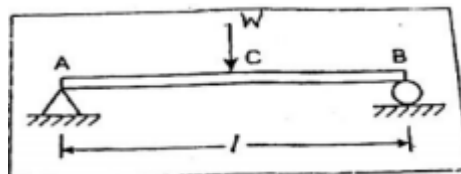
- (b) A uniform column is hinged at the both ends is subjected to compressive load P at both the ends. Find out the critical load using Rayleigh's Ritz method. Take $y = \frac{4 h_x(l-x)}{l^2}$

2. (a) Find the deflection at Centre using Rayleigh's Ritz methods,

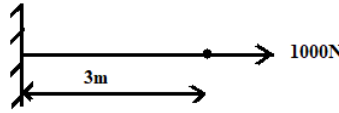


Or

- (b) Determine the deflection at midspan by using Rayleigh Ritz method and compare with exact solution.



3. (a) Calculate the nodal displacement for the following cantilever
load $A = 0.9 \text{ m}^2$, $E = 3 \times 10^{10}$ CO2-App (20)



Or

- (b) Construct a shape function for three nodal axial elements CO2-App (20)
- $$N = a_0 + a_1 r + a_2 r^2$$

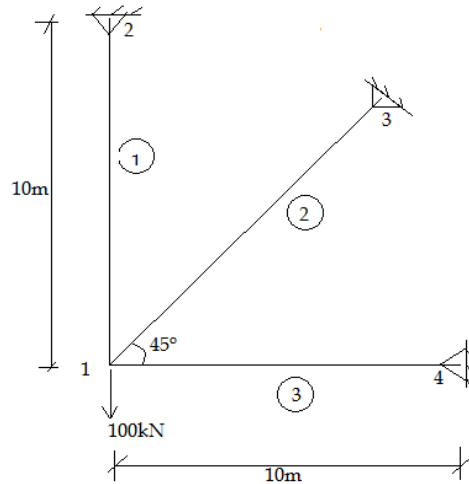
4. (a) Construct a shape function by Leclanche's polynomial methods CO2- App (20)

$$\phi_k[x_k] = \frac{(x - x_0)(x - x_1)(x - x_2)}{(x_k - x_0)(x_k - x_1)(x_k - x_2)}$$

Or

- (b) When analyzing a 3D structure, why is it important to ensure an appropriate node numbering sequence, and how does it impact solution convergence? CO2- App (20)

5. (a) The plane truss composed of 3 elements shown in figure. CO3- Ana (20)
Determine x and y displacement at node 1 and stresses in each element. Let $E = 3 \times 10^6 \text{ N/mm}^2$, $A = 200 \text{ mm}^2$.



Or

- (b) How is the one-dimensional heat conduction equation formulated and applied in thermal analysis? Explain its derivation and significance. CO3- Ana (20)