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

Question Paper Code: 42621

M.E. DEGREE EXAMINATION, MAY 2017

Second Semester

Structural Engineering

14PSE201- FINITE ELEMENT ANALYSIS FOR STRUCTURAL ENGINEERING

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions.

PART A - (5 x 1 = 5 Marks)

1. ---------- is the variational method
   (a) Least Square (b) Galerkin's method
   (c) Rayleigh Ritz method (d) Sub domain collocation method

2. In each node which of the following element of has a 2 degree of freedom
   (a) bar (b) beam (c) truss (d) none

3. Ten noded triangular element is known as ----------.
   (a) CST (b) QST (c) LST (d) NLST

4. The brick element contains
   (a) 4 nodes (b) 2 nodes (c) 7 nodes (d) 8 nodes

5. The thermal stress is given by the formula ----------.
   (a) $E\frac{du}{dx}$ (b) $E\frac{du}{dx} - E\alpha\Delta T$ (c) $E\frac{du}{dx} + E\alpha\Delta T$ (d) $E\alpha\Delta T$

PART - B (5 x 3 = 15 Marks)

6. State the principle of minimum potential energy.

7. State the properties of a stiffness matrix.

8. Define plane stress.

9. Write a short note on ill conditioned elements.

10. Differentiate between damped and undamped vibrations.

PART - C (5 x 16 = 80 Marks)

11. (a) List out the advantages, disadvantages and applications of FEM. (16)

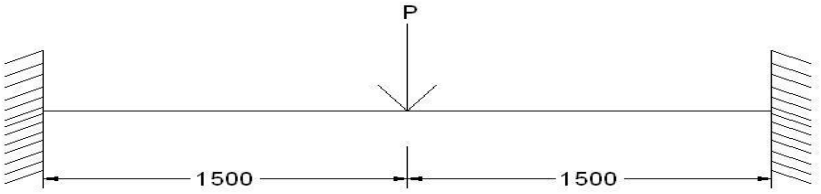
Or

(b) The differential equation for a phenomenon is given by $d^2y/dx^2+500x^2=0$, $0<x<5$, and the boundary condition are $Y(0)=0$, $Y(5)=0$. Find the approximate solution using galerkins method. Start with minimum possible approximate solution. (16)

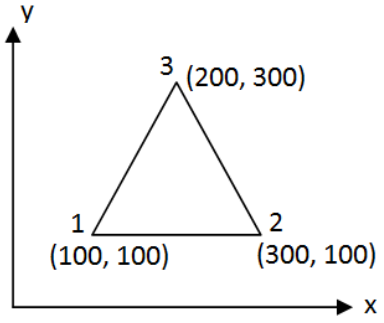
12. (a) Derive the displacement function (u), shape function (N), stiffness matrix and finite element equation for one dimensional bar element. (16)

Or

(b) A concentrated load P = 50 kN is applied at the centre of a fixed beam of length 3m, depth 200mm and width 200mm. Calculate deflection and slope at the midpoint. Take E = 2 x 10^5 N/mm^2 and figure shown below. (16)



13. (a) Determine the stiffness matrix for the CST element shown in figure. Assume plane stress condition. Take μ = 0.25, E = 2 × 10^5 N/mm^{2}and t = 20 mm. (16)



Co-ordinates in the figure are in mm

Or

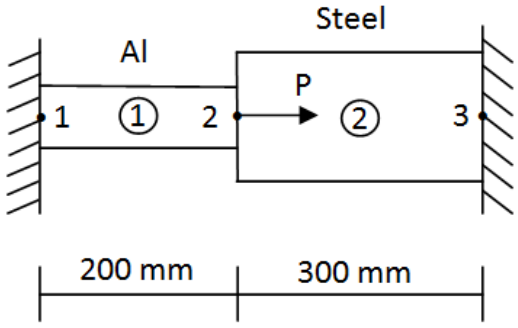
(b) Derive an expression for the two dimensional plane stresses. (16)

14. (a) Discuss p and h methods of refinement and give applications of each method. (16)

Or

(b) Briefly explain the adaptive mesh generation techniques with suitable examples. (16)

15. (a) An axial load of 4×10^5 N is applied at 30^o C to the rod as shown in figure. The temperature is then raised to 60^o C. Calculate
(i) Nodal displacements
(ii) Stresses in each material
(iii) Reactions at each nodal point.
For Aluminium $A_1 = 1000$ mm^2 ; $E_1 = 0.7 \times 10^5$ N/mm^2 ; $\alpha_1 = 23 \times 10^{-6}$ /^{o}C
For Steel $A_2 = 1500$ mm^2 ; $E_2 = 2 \times 10^5$ N/mm^2 ; $\alpha_2 = 12 \times 10^{-6}$ /^{o}C (16)



Or

(b) Discuss your views on materials and also explain the geometrical non linearity in detail. (16)