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

Question Paper Code: 42621

M.E. DEGREE EXAMINATION, NOV 2016

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 of these

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. In a thermally isotropic medium, Fourier's law for two dimensional heat flows is given by
   (a) $Q_x = -k\ [\partial T/\partial x]$ (b) $Q_x = -k\ [\partial T/\partial y]$
   (c) $Q_x = \ [\partial T/\partial x]$ (d) $Q_x = -k\ [\partial T^2/\partial x^2]$

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) 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)

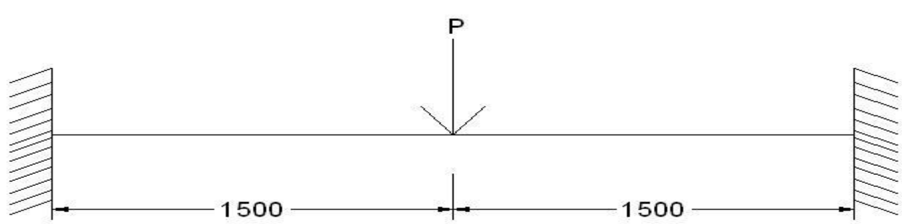
Or

(b) A cantilever beam is subjected to UDL over entire span and it is subjected to a point load at the centre of the span. Calculate the deflection at the free end by using Rayleigh-Ritz method and compare with exact solution. (16)

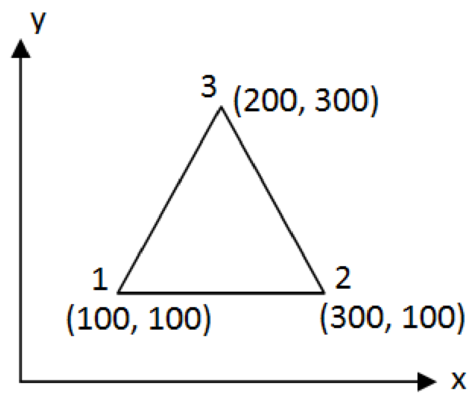
12. (a) Derive the displacement function (u), shape function (N), stiffness matrix and finite element equation for one dimensional bar element. (16)

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 $E = 2 \times 10^5\ N/mm^2$ and figure 2 shown below. (16)



13. (a) Determine the stiffness matrix for the CST element shown in figure. Assume plane stress condition. Take $\mu = 0.25$, $E = 2 \times 10^5$ N/mm^2 and t = 20 mm.



Co-ordinates in the figure are in mm (16)

Or

(b) Explain the following

(i) Derive an expression for the two dimensional plane stresses. (10)

(ii) Explain the Isoparametric element. (6)

14. (a) (i) Discuss p and h methods of refinement and give applications of each method. (10)

(ii) Comment on discretisation error with an example. (6)

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

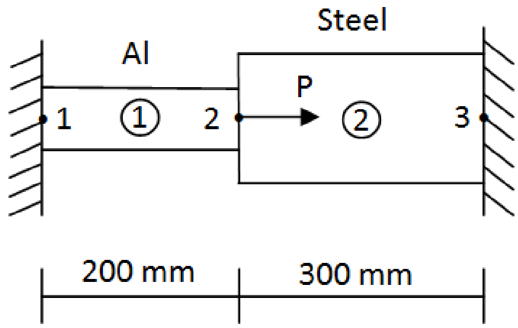
(i) Nodal displacements

(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)