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

Question Paper Code: 52621

M.E. DEGREE EXAMINATION, MAY 2017

Second Semester

Structural Engineering

15PSE201 - FINITE ELEMENT ANALYSIS FOR STRUCTURAL ENGINEERING

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5 Marks)

1. Rayleigh Ritz method is also known as ___________ method.

   (a) Variational (b) Weighted residual
   (c) Analytical (d) Experimental

2. The shape function has ...... value at one nodal point and _______ value at other nodal points.

   (a) 1, 0 (b) 0, 0 (c) 2, 1 (d) 2, 0

3. Which one of the following triangular element is LST element

   (a) 3 noded (b) 12 noded (c) 6 noded (d) 9 noded

4. As aspect ratio increases, the stiffness matrix will become

   (a) Unsymmetric (b) Singular (c) Reversible (d) Square

5. The eigen values in dynamic analysis represents

   (a) mode shape (b) error (c) natural frequency (d) strain

PART B - (5 x 3 = 15 Marks)

6. What are the major advantages of finite element methods?

7. Define shape function.

8. Draw the Pascal's triangle and state its advantages.

9. What is meant by error evaluation in FEM?

10. List out the solution methods for non linear problems.

PART C - (5 x 16 = 80 Marks)

11. (a) Using the Rayleigh-Ritz method calculate the deflection at the centre of a simply supported beam of span L, loaded with a uniformly distributed load of intensity w/m run throughout the span. Consider the first term of the trigonometric series in the trial function. (16)

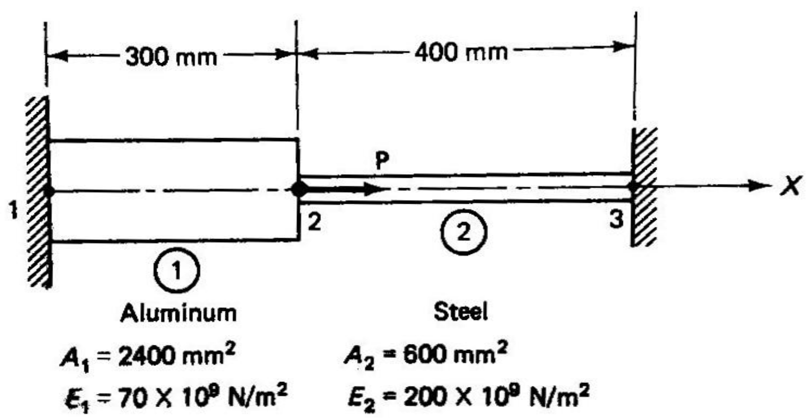
Or

(b) List and briefly describe the general steps of the finite element method. (16)

12. (a) Derive the stiffness matrix for an axially loaded bar element of length l. The cross sectional area of the bar is A and the Young's modulus of the material of the bar is E. (16)

Or

(b) Consider the bar shown in figure having an axial load P= 200 kN applied as shown. Determine 1. Nodal displacements.2. Stress in each material.3. Reaction forces.



(16)

13. (a) Derive the strain-displacement relation matrix 'B' for a constant strain triangular element. (16)

Or

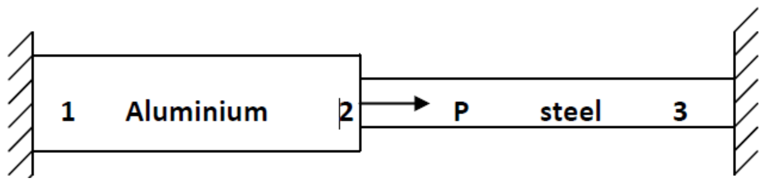
(b) The vertices of a constant strain triangular element is given by (3, 2), (7, 9) and (12, 5). Determine the shape functions at the interior point P (10, 4) and Strain-Displacement matrix B. (16)

14. (a) Explain the automatic mesh generation techniques with suitable examples. (16)

Or

(b) Discuss the approximation errors in finite element method and explain how they can be rectified to get accurate results. (16)

15. (a) Determine the nodal displacement at node 2**,** stress in each material and support reactions in the bar shown in figure below due to the applied force $P = 400 \times 10^3$ N and temperature rise of 80˚C.$A_1 = 2400mm^2$, $A_2 = 1200mm^2$, $L_1=300mm$, $L_2=400mm$,$E_1 = 0.7 \times 10^5$ N/mm^2 and $E_2 = 2 \times 10^5$ N/mm^2 , $\alpha_1 = 22 \times10^{-6}/^oC$ and $\alpha_2 = 12 \times10^{-6}/^oC$. (16)



Or

(b) Explain the iterative procedure of handling geometric non-linearity problems in structural mechanics. (16)