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

Question Paper Code: 42261

M.E. DEGREE EXAMINATION, MAY 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. Galarkin's method is also known as _______ method.

   (a) variational   (b) weighted residual

   (c) analytical   (d) experimental

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. The expression of shape function *N* and temperature function, *T* for one dimensional heat conduction problem is

   (a) $T=N_1T_1+N_2T_2$ (b) $T=N_1T2+N_2T_1$

   (c) $T=N_1T_1-N_2T_2$ (d) $T=N_2T_2-N_1T_1$

PART - B (5 x 3 = 15 Marks)

6. Name the few weighted residual methods.
7. Write the properties of a Global stiffness matrix.
8. Define iso-parametric element. What is the purpose providing of iso-parametric element?
9. What is mean by discretisation and assemblage?
10. Name the 1*D*, 2*D* and 3*D* finite elements available in the commercial FEA software.

PART - C (5 x 16 = 80 Marks)

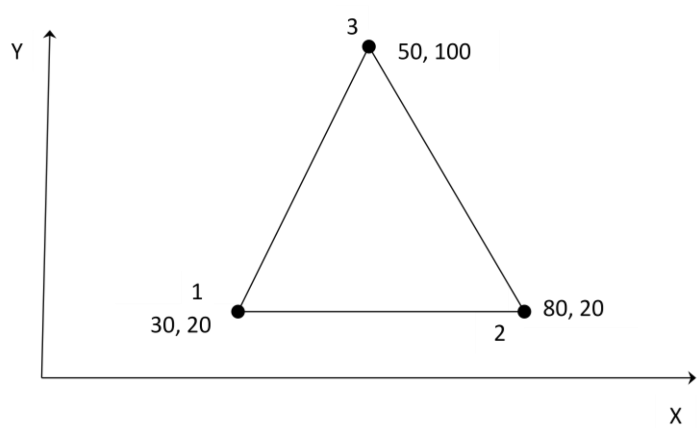
11. (a) Using Raleigh-Ritz method, obtain the deflection at the centre of a simply supported beam of span *L* subjected to uniformly distributed load over the entire span. (16)

Or

(b) (i) List the advantages and disadvantages of FEM. (10)

(ii) Write short notes on approximate solutions. (6)

12. (a) Evaluate the element stiffness matrix for the plane stress element shown in below figure. Consider $E = 2.1 \times 10^5$, Poisson's ratio = 0.25 and element thickness = 10 *mm*. The co-ordinates are in *mm*. (16)



Or

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

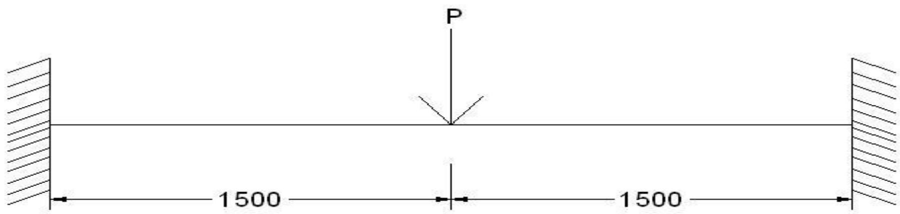


Figure 2

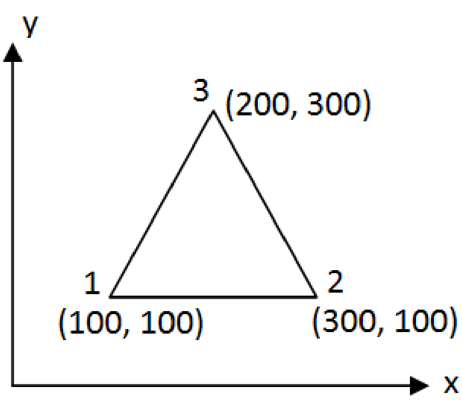
13. (a) Explain the following:

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

(ii) Explain the Isoparametric element. (6)

Or

(b) Determine the stiffness for the CST element shown in below figure. Assume plane stress condition. Take $\mu = 0.25$, $E = 2 \text{ x}10^5$ N/mm^2 and t = 20 *mm*. Co-ordinates are in *mm*. (16)



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

Or

(b) Write short note on the following:

(i) *P* and *H* methods of refinement (8)

(ii) Ill conditioned elements (8)

15. (a) An axial load of 4×10^5 N is applied at 30^o C to the rod as shown in below figure. The temperature is then raised to 60^o C. Calculate

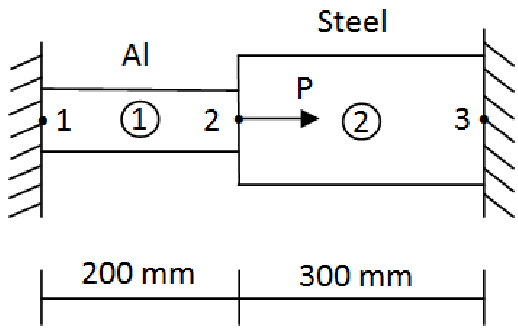
(i) Nodal displacements

(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; $\alpha_1 = 23 \times 10^{-6}$ $/^oC$

For Steel $A_2 = 1500$ mm^2; $E_2 = 2 \times 10^5$ N/mm^2; $\alpha_2 = 12 \times 10^{-6}$ $/^oC$ (16)



Or

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

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