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Question Paper Code : 21042

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2012.

Sixth Semester

Mechanical Engineering

080120032 –FINITE ELEMENT ANALYSIS

(Common to Automobile Engineering)

(Regulation 2008)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Compare the Rayleigh Ritz method with Nodal Approximation method.
2. On what basis, collocation points are selected?
3. Define p-refinement.
4. What are the factors which govern the selection of nodes?
5. Define continuity.
6. When triangular element is preferred over quadrilateral elements?
7. Why variational formulation is called as weak formulation?
8. Differentiate between upper bound and lower bound solutions with an example.
9. What are the characteristics of shape functions?
10. What is meant by natural coordinate system?

PART B — (5 × 16 = 80 marks)

11. (a) An alloy bar 1 m long and 200 mm² in cross section is fixed at one end is subjected to a compressive load of 20 kN. If the modulus of elasticity for the alloy is 100 GPa, find the decrease in the length of the bar. Also determine the stress developed and the decrease in length at 0.25 m, 0.5 m and 0.75m. Solve by collocation method. (16)

Or

- (b) An alloy bar 1m long and 200 mm^2 in cross section is fixed at one end is subjected to a compressive load of 20 kN. If the modulus of elasticity for the alloy is 100 GPa, find the decrease in the length of the bar. Also determine the stress developed and the decrease in length at 0.25 m, 0.5 m and 0.75m. Solve by Ritz method. (16)
12. (a) A tapered bar of aluminum is having a length of 500 cm. The area of cross section at the fixed end is 80 cm^2 and the free end is 20 cm^2 with the variation of the sectional area as linear. The bar is subjected to an axial load of 10 kN at 240 mm from the fixed end. Calculate the maximum displacement and stress developed in the bar. (16)

Or

- (b) A fixed beam AB of 5 m span carries a point load of 20 kN at a distance of 2m from A. Determine the slope and deflection under the load. (16)
- Assume $EI = 10 \times 10^3 \text{ kN} - \text{m}^2$.
13. (a) Find the temperature at a point P (2, 1.5) inside the triangular elements with nodal temperatures given as $T_i=40^\circ\text{C}$, $T_j=54^\circ\text{C}$ and $T_k=46^\circ\text{C}$. The nodal coordinates are 1(0, 0), J (4, 0.5) and K (3, 6). (16)

Or

- (b) A circular aluminum rod is having a length of 700 cm. The area of cross section is 60 cm^2 . The bar is subjected to an axial compressive load of 50 kN at the fixed end. Calculate the maximum displacement and stress developed in the bar. Solve using two dimensional coordinates. (16)
14. (a) What are lagrangian interpolation functions? Using lagrangian polynomials derive the shape functions for ID quadratic element/cubic element. (16)

Or

- (b) Derive constitutive matrix for axisymmetric analysis. (16)
15. (a) (i) Explain with an example of each of the following
- (1) sub parametric element,
 - (2) iso parametric element,
 - (3) Super parametric element. (12)
- (ii) Define bandwidth in finite element analysis and its significance in the solution of global system matrices? (4)

Or

- (b) (i) Derive the shape function for the one dimensional quadratic element in Natural Coordinates? (8)
- (ii) Derive the stiffness matrix for heat transfer using shape functions for a four noded quadrilateral element. (8)