Roll No. Total No. of Pages : 02

Total No. of Questions : 09

B.Tech.(Aerospace Engg.) (2012 Onwards) (Sem.–6)

FINITE ELEMENT METHODS

Subject Code : ASPE-313

M.Code : 72458

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A

1. Answer briefly :

a) Define basis or shape functions in FEM. What are the properties of shape function?

b) Explain the coordinate systems used in FEM.

c) Explain the difference between natural boundary condition and essential boundary condition.

d) Explain the term C^r- continuity in FEM.

e) Explain convergence requirement of shape functions in FEM.

f) Lagrange's Polynomial and Hermitian Polynomial.

g) Triangular and rectangular element.

h) Weighted residual and Variational Method.

i) Rayleigh-Ritz Method.

j) Beam and Bar element.

SECTION-B

2. What is the concept of Jaccobian Matrix? Derive Jaccobian matrix for 2-D problems where local normalized coordinates are expressed in Cartesian coordinate system.

3. What is the requirement of numerical integration in finite element method? Derive Gauss points and corresponding weighting factor for two-point Gauss-Quadrature rule for 1-D problem.

4. Explain the concept of deriving shape function employing Lagrange interpolation function. Derive shape function of a nine-noded rectangular element employing the above concept.

5. Derive strain-displacement matrix and stress-strain matrix for plane stress problem in finite element sense.

6. Evaluate the integral using two point gauss quadrature :

$$I = \int_{-1}^{1} [3e^{x} + x^{2} + \frac{1}{x+2}]dx$$

SECTION-C

7. Determine the nodal displacements for the truss shown in Fig. 1. Area of each member is $500mm^2$. E=200GPa and each member of truss is 2m in length.

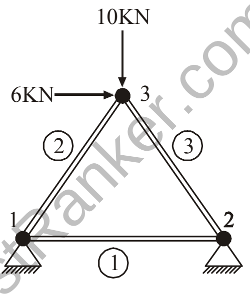

Fig.1

8. Derive a finite element matrix equations from the governing differential equation of 2-D steady state heat conduction problem applying Galerkin's weighted residual approach.

9. What is isoparametric formulation in FE analysis? A straight line element has co-ordinates X_A= 2mm and X_B= 7mm. Evaluate the integral,

$$K_{12} = \int_{XA}^{XB} (1+x)\frac{d\psi_1}{dx}\frac{d\psi_2}{dx}dx$$

by direct integration and by two-point Gauss-Legendre quadrature (points : $\pm\sqrt{1/3}$ and weights: 1.0, 1.0) using isoparametric formulation, ψ_1 and ψ_2 are the linear Lagrange interpolation functions. Comment on the correctness of the integration had you used (i) one point and (ii) three point integration.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.