

LIB
20/6/13FN

Reg. No. :

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Question Paper Code : 71781

M.E. DEGREE EXAMINATION, JUNE/JULY 2013.

Second Semester

Structural Engineering

ST 9221/ST 921/UST 9121/10211 SE 201 — FINITE ELEMENT ANALYSIS

(Common to M.E. (Part-Time) Structural Engineering and Construction)

(Regulation 2009/2010)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is the requirement of displacement field to be satisfied in the use of Rayleigh-Ritz method?
2. Give examples of Eigen value problems in structural mechanics.
3. What are the properties of shape functions?
4. What are the advantages of expressing displacement field in Natural Co-ordinates than generalised co-ordinates?
5. What is meant by an Isoparametric element?
6. Define the Lagrange interpolation polynomials used for higher order elements.
7. List the sources of errors in finite element analysis.
8. List the methods used for evaluation of Eigen values and eigen vectors.
9. Write the equation for calculating element mass matrix in terms of shape functions.
10. State the functions of a preprocessor in a FEA software package.

PART B — (5 × 16 = 80 marks)

11. (a) Discuss Rayleigh-Ritz and Galerkin methods of formations by taking an example.

Or

- (b) Show from first principle that the stiffness matrix of a general finite element can be evaluated in the form of $K = \int_V B^T C B dr$.

12. (a) (i) Evaluate the shape functions N_1, N_2, N_3 at the interior point $P(3.85, 4.8)$ for the triangular element shown in Figure 1. (10)

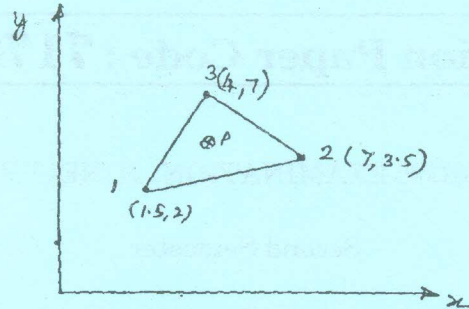


Figure 1.

- (ii) Discuss the convergence requirements of interpolation polynomials.

Or

- (b) The nodal co-ordinates of a quadrilateral element as given as (0, 7), (9, 4), (7, 9) and (2, 8). Evaluate the integral $\int_A (x^2 + y^2 - 3xy) dA$ over the area of the element of second order Gaussian quadrature.
13. (a) Derive the displacement interpolation matrix, strain-displacement interpolation matrix B , and Jacobian operator J for the three-node truss element shown in Figure 2. Also sketch the interpolation functions.

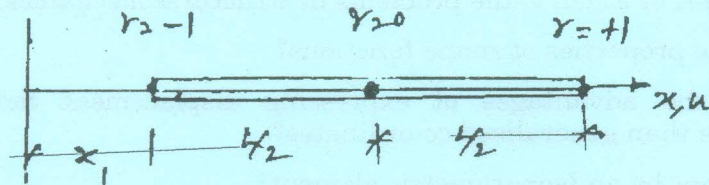


Figure 2.

Or

- (b) State the need for mesh refinement. Discuss the methods of mesh refinement.
14. (a) Explain the problems involved in the analysis of material non linearity and explain how a solution procedure for search problems may be established for structures made of ductile materials.

Or

- (b) (i) Explain how the consistent mass matrix for a pin-jointed bar element is obtained. (8)
- (ii) Discuss the vector iteration method of eigen value problems. (8)

15. (a) Discuss the modeling procedure using software by taking an example of a plate bending problem.

Or

- (b) Write short notes on :
- (i) One dimensional heat transfer problems in finite element analysis. (8)
 - (ii) Error evaluation in FEA. (8)
-