ME(CIVIL) 2ND SEMESTER EXAMINATION 2013
SUBJECT: NUMERICAL METHODS FOR STRUCTURAL ANALYSIS
### CE 1005

Time: 3 hours

Full Marks: 70

Answer any __FIVE__ Questions.
All questions are of equal value.

1.a) What do you mean by iso, sub and super parametric element?
b)Explain Jacobian matrix for two dimensional isoparametric element and its requirement.
c) Obtain the Jacobian matrix for a four noded element having coordinates (1, 1), (5,12), (4,5) and (2, 4). Calculate [B] matrix at Gauss point (1,1).

4+5+5

2.a)Explain the difference between Lagrange and Serendipity elements. Also show the difference using Pascal's triangle.
b) Derive the shape functions of 9 noded quadratic element using Lagrange approach.

5+4+5

3.An SDOF system having mass of 2.533, stiffness of 100 is subjected to a load as shown in the following table. Find out the response for first two cycles by Newark's Beta method. Assume that the system is undamped and at initially at rest.

Time	0.0	0.1	0.2	0.3	0.4	0.5	0.6	Use: $\gamma = 1/2, \ \beta = 1/6 \ and \ \Delta t = 0.1s$
Force	0.0	50	86	100	86	50	0	

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4.a) What is meant by half band width of overall stiffness matrix?
b) How can you find out the value of half band width from nodal connectivity? Explain how it is influenced by node numbering.
c) The figure shows a 2-D region modeled with 10 CST elements. Determine the half bandwidth NBW.
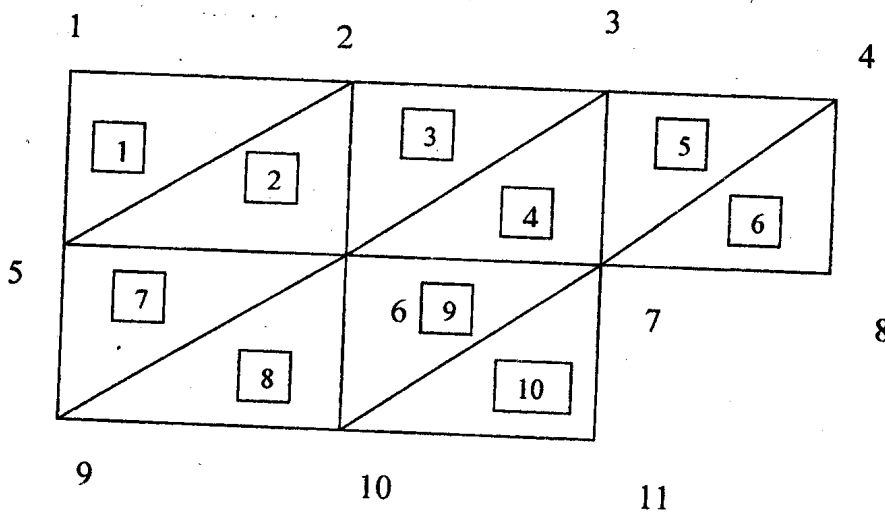
4+5+5

5. a)Derive the expression of element stiffness matrix of eight noded isoparametric quadratic plate bending element with 5 dof per node using strain displacement relationship based on Kirchoff's plate theory.

b) Using a 2×2 point rule numerical integration, evaluate the integral

$$\iint\limits_A (x^2 y + y^2) dx\, dy$$

8+6

6. a)Derive the element mass matrix of a 2 noded bar element using i)lumped and ii)consistemt mass approach.

b) Compute the natural frequencies of a 2 noded beam element of length l with 2 dof per node (w, θ) using lumped mass.

8+6

7.a) Explain strong form and weak form in variational principle.

b) Calculate the central deflection of a square plate using Galerkin's weighted residual method.

4+10

8. What are the conditions of constant strain triangle? Describe how you would derive the stiffness matrix for a three noded CST element for plane stress condition. Develop the necessary expressions.

4+10