d) What are the isoparametric elements? State their properties and utility in FEA.

OR

For point located in side the triangle as shown in fig. 4 the shape functions N_1 and N_2 are 0.15 and 0.25 respectively. Determine the x and y co-ordinate of point P.

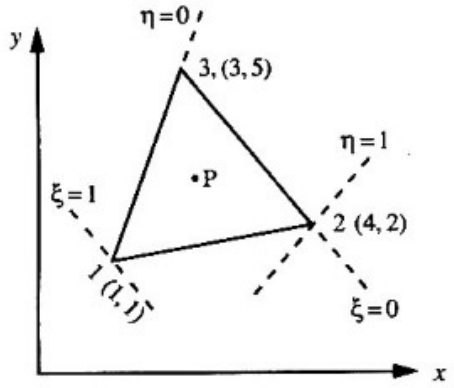

Fig. 4

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Roll No .....

CE - 7101

B.E. VII Semester

Examination, December 2015

Computational Methods in Structural Engineering

Time : Three Hours

Maximum Marks :70

Note: i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.
ii) All parts of each question are to be attempted at one place.
iii) All questions carry equal marks, out of which part A and B (Max. 50 words) carry 2 marks, part C (Max. 100 words) carry 3 marks, part D (Max. 400 words) carry 7 marks.
iv) Except numericals, Derivation, Design and Drawing etc.

Unit - I

1. a) Write the principle of contragradience.
   b) Explain degree of freedom.
   c) Compare stiffness and flexibility method.
   d) Derive the structure stiffness matrix for the system shown below:

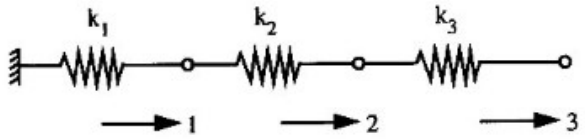

Fig. 1

Where k_1 k_2 and k_3 are the elemental stiffness.

OR

Derive the general equation of motion and its solution for damped, free vibration of a single degree of freedom system.

Unit - II

2. a) What is direct stiffness method?
   b) Explain plane grid element.
   c) How the advantage of symmetry of structure and loading is taken, in matrix structural analysis? Explain with help of examples.
   d) Analyse the beam as shown in fig. 2 by direct stiffness method (EI is constant) 20kN/m.

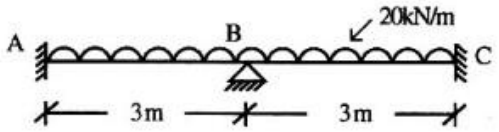

Fig. 2

OR

Analyse the truss as shown in fig. 3 by Direct Stiffness Method (DSM). Given that for both the members. $A = 400mm^2$ and E 200 GPa.

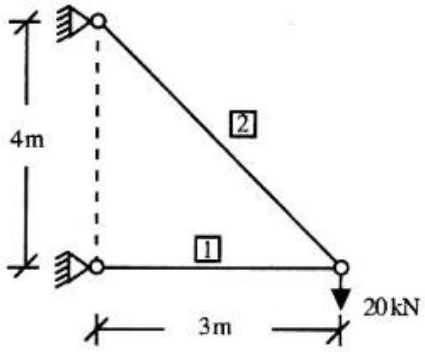

Fig. 3

Unit - III

3. a) Explain Band width concept.
   b) Explain skew symmetry scheme in structure.
   c) State various penalty methods.
   d) Explain clearly how will you exploit symmetry and antisymmetry in the formulation of the stiffness matrix and load vector of a structure, for a given loading condition.

OR

State various storage schemes for handling the structure stiffness matrix and explain the one which you think the most suitable.

Unit - IV

4. a) Write a note on convergence requirement in FEM.
   b) Write a note on Numerical integration in FEA.
   c) Write the steps of FEA of a continuum structure.
   d) Prove that the element stiffness for a finite element is given by $[k_e] = \int_V [B]^T [D][B] dV$.

OR

Derive the elasticity matrix for plane stress and plane strain 2-D problem.

Unit - V

5. a) Write a note on Jacobian matrix.
   b) What is shape functions for simplex?
   c) Write and draw the shape functions for first order rectangular element.