

**GUJARAT TECHNOLOGICAL UNIVERSITY****M. E. - SEMESTER – II • EXAMINATION – WINTER 2012****Subject code: 1722001****Date: 29-12-2012****Subject Name: Finite Element Method****Time: 10.30 am – 01.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Briefly discuss all the steps involved in finite element method. **07**  
 (b) Discuss the use of iso-parametric elements in F. E. M. Also discuss how Cartesian derivatives and integrals are converted in iso-parametric integrals. **07**
- Q.2** (a) Discuss the use of gauss point integration method in detail giving an example. **07**  
 (b) Discuss the use of pascle's triangle for selection of the displacement function. Also give the various examples for the same giving convergence criteria. **OR** **07**  
 (b) Define axi-symmetric element. Give the various strains those are to be considered for the same. Also give some real life structures those can be solved by axi-symmetric element. **07**
- Q.3** A constant strain triangle element has the three nodes as (0,0), (5,0) and (5,4). Calculate the Stiffness matrix for the element to be used in plane stress analysis. Assume  $E = 200 \text{ kN/mm}^2$ , thickness = 20mm and Poisson's ratio as 0.2. **14**
- OR**
- Q.3** A beam element has length L and Flexural rigidity EI. Derive the Stiffness matrix for the same from basic principles. Also derive the consistent load vector equation if it is loaded by a udl W over entire span. **14**
- Q.4** Analyze the continuous beam as shown in the figure.1 making use of symmetry. Assume  $EI = 18000 \text{ kN-m}^2$ . **14**
- OR**
- Q.4** Analyze the continuous beam as shown in the figure.1 if the supports B and C are spring supports having spring constant of  $10000 \text{ kN/m}$  by making use of symmetry. Assume the value of  $EI = 27000 \text{ kN-m}^2$ . **14**
- Q.5** (a) Derive the shape functions for an eight noded iso-parametric element. Hence or otherwise derive the shape functions for the six noded iso-parametric quadrilateral element where middle nodes of two adjacent sides are removed from eight noded quadrilateral element. **07**  
 (b) Discuss the importance of aspect ratio in F. E. M. analysis for two dimensional analysis giving a few examples. **07**
- OR**
- Q.5** (a) Explain lagrange and hermitian interpolation functions. Also give the examples how they are used in F. E. M. analysis. **04**  
 (b) Derive the stiffness matrix for a three noded axial column element having nodes at  $x=0$ ,  $x=4$  and  $x=10\text{m}$ . **10**

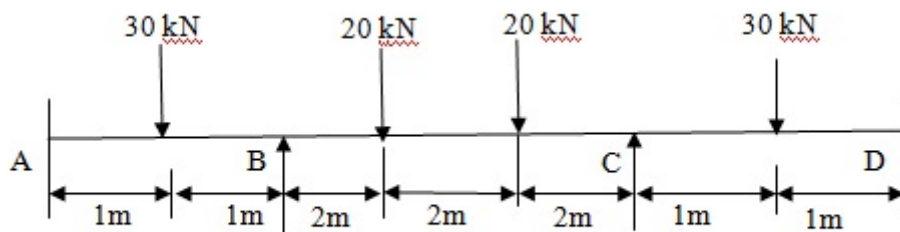


Figure.1

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