

**GUJARAT TECHNOLOGICAL UNIVERSITY****M. E. Sem. – II<sup>nd</sup> - Examination – June/July- 2011****Subject code: 1722001****Subject Name: Finite Element Method****Date: 22/06/2011****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) Derive the load vector for 2-noded bar element if it is loaded with (i) Uniformly distributed load along length (ii) Uniformly varying load along length **07**
- (b) Derive the shape function for 3-noded two dimensional element. **07**

- Q.2** (a) Explain the concept of iso-parametric in finite element analysis. **07**
- (b) Using natural co-ordinate system, list and draw, the shape functions and its variation, for four noded plate element. **07**

**OR**

- (b) Derive stiffness matrix for three noded bar element having middle node at center. **07**

- Q.3** (a) (i) Justify "Computers are mandatory for FEM implementation". **07**
- (ii) List any four software used for FE analysis.
- (iii) List 2-D elements used by ANSYS or other software.
- (b) (i) Describe in detail the Load Case comment used in ANSYS. **07**
- (ii) Describe the analytical capabilities and range of application of ANSYS.

**OR**

- Q.3** (a) List and explain various steps involve in finite element analysis. **07**
- (b) Using FEM, determine nodal displacements, elemental stresses and reaction forces for bar subjected to axial force shown in fig.1. **07**

- Q.4** (a) Distinguish between a plane stress and plane strain problem with suitable examples. Also give their strain stress linking matrices. **07**
- (b) Using FEM, determine nodal displacements and reaction forces for bar subjected to torque shown in fig.2. **07**

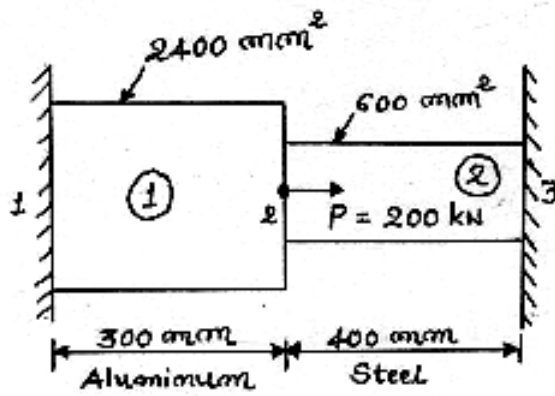
**OR**

- Q.4** (a) Using iso-parametric formulation, derive stiffness matrix of two-node iso-parametric line (bar) element. **07**
- (b) Derive the shape function for four noded rectangular element by langrangian polynomial. **07**

- Q.5** (a) Derive stiffness matrix for beam element using general finite element approach. **07**
- (b) For the beam and loading as shown in fig.3, where  $E=200 \text{ GPa}$  and  $I=4.0 \times 10^6 \text{ m}^4$ . Determine slope at B and C. **07**

**OR**

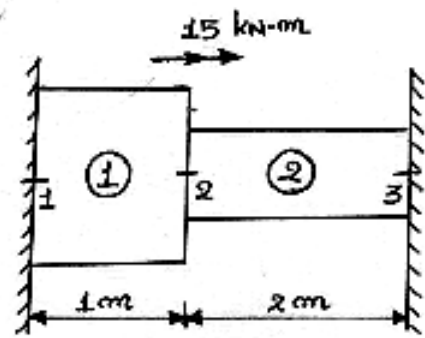
- Q.5** (a) Define axsymmetric problem. Discuss type of stresses and strains induced in axsymmetric element. **07**
- (b) Derive strain displacement matrix for axsymmetric element shown in fig.4. Take  $E=200 \text{ GPa}$ ,  $\mu=0.25$ . **07**



$$E_1 = 70 \times 10^9 \text{ N/m}^2$$

$$E_2 = 200 \times 10^9 \text{ N/m}^2$$

Fig. 1



$$J_1 = 3 \times 10^7 \text{ mm}^4$$

$$J_2 = 2 \times 10^7 \text{ mm}^4$$

$$G = 60 \text{ GN/m}^2$$

Fig. 2

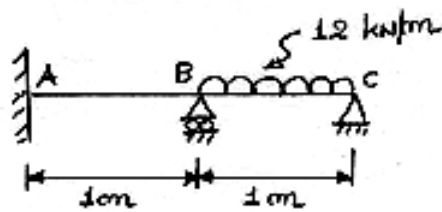


Fig. 3

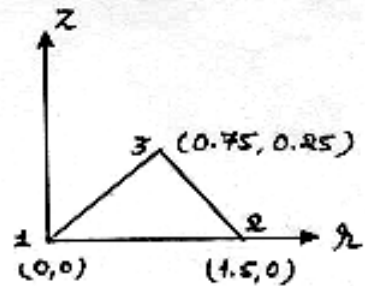


Fig. 4

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