M.Tech(with Credits)-Regular-Semester 2012-Structural Engineering & Construction Sem II

STC201 - Finite Element Method

P. Pages : 2 **GUG/W/16/3972**

Time : Four Hours * 3 6 5 4 * Max. Marks : 70

Notes :
1. All questions carry equal marks.
2. Answer **any five** questions.
3. Due credit will be given to neatness and adequate dimensions.
4. Assume suitable data wherever necessary.
5. Illustrate your answers wherever necessary with the help of neat sketches.
6. Non programmable calculator is permitted.

1. a) Explain the procedure for Finite Element analysis starting from a given differential equation. **6**

b) Write the weighted Residual statement and construct the weak form for the following differential equation. **8**

$$AE\frac{d^2u}{dx^2}+ax=0$$

Subjected to $AE\frac{d^2u}{dx^2}(L)=0$.

2. a) Distinguish between essential and natural boundary conditions in FEM. **4**

b) Find the displacements and the member end forces for the beam with $EI=4\times10^6\ N-m^2$ shown in Fig (1) **10**

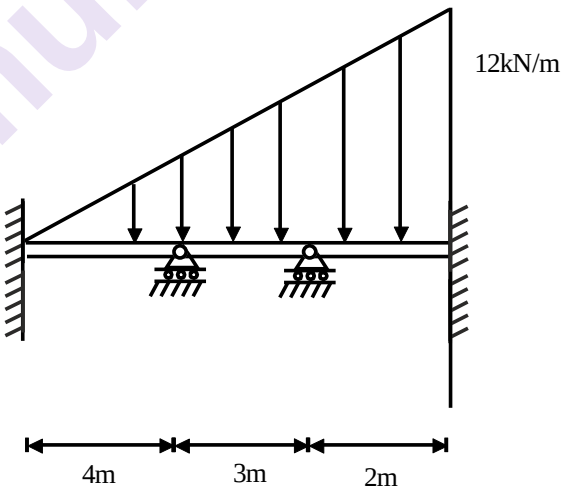

Fig - 1

3. a) Find the shape functions of a brick element in terms of natural co-ordinates. **4**

b) For the quadratic, isoparametric triangular element shown in Fig (2) map the point $\xi = 0.5$ and $\eta = 0.25$ on the parent element to the corresponding point on the distorted element. **10**

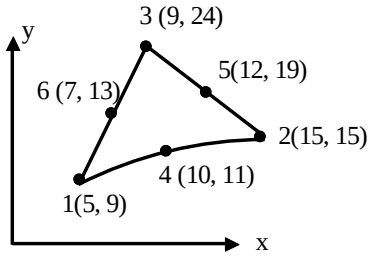

Fig - 2

4. Formulate the finite element equations for triangular torsion element shown in fig (3). **14**

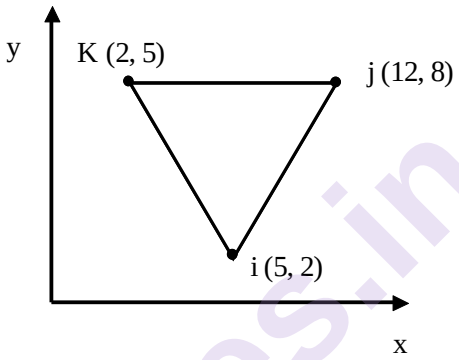

Fig 3

5. a) Explain Mindlin's approximations for bending of plates. **6**

b) Imagine that each side of a rectangular box is modeled by a mesh of that shell elements. Internal pressure is applied. Along the edges where the sides intersect what is DOF can probably be set to zero, and why ? **8**

6. a) Discuss the stiffness formulation of anyone non confirming plate bending element. **6**

b) Using Gauss quadrature (two points) evaluate the following integral and compare with exact value. **8**

$$I = \int_{4}^{6} \int_{-2}^{2} (1-x)^2 (4-y)^2 \, dx \cdot dy .$$

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