Total No. of Questions : 8]

SEAT No. :

**P3063**

[Total No. of Pages : 2

**[5059]-520**

**B.E.(Civil Engineering)**

**FINITE ELEMENT METHOD IN CIVIL ENGINEERING**

**(2012 Course) (Elective-III)(5)(Semester-II)(End Sem.)(401009E)**

*Time :2½Hours]* *[Max. Marks : 70*

***Instructions to the candidates:***

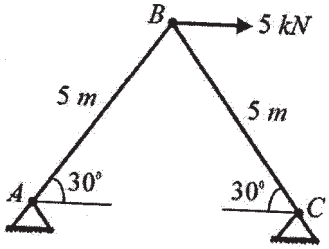
1) *Answer Q1 or Q2,Q3 or Q4,Q5 or Q6 , Q7 or Q8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicates full marks.*
4) *Use of electronic pocket calculator is allowed.*
5) *Assume suitable data if necessary.*

***Q1)*** a) Write short note on: **[6]**

i) Discretization of structure

ii) Aspect ratio of element

b) Determine displacements at loaded joint of truss shown in figure using finite element method. Take A=1000 $mm^2$ and E=200 GPa **[8]**

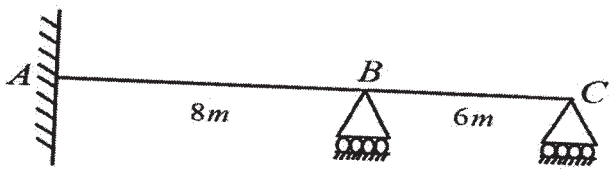



c) Derive the transformation matrix for two noded frame element having six degrees of freedom. **[6]**

OR

***Q2)*** a) State the convergence criteria for the choice of the displacement function in FEM. **[6]**

b) Determine rotations at supports B and C of continuous beam ABC if support B sinks by 10mm. Take EI=6000kN.$m^2$. Use finite element method. **[8]**




c) Derive the stiffness matrix for the grid element considering six degrees of freedom. **[6]**

***P.T.O.***

***Q3)*** Write short note on: **[16]**

a) Principle of minimum potential energy.

b) Principle of virtual work.

c) CST and LST elements

d) 3D Tetrahedron and Hexahedron elements.

OR

***Q4)*** Derive connectivity matrix[A], elasticity matrix[D], strain-displacement matrix[B] and stiffness matrix[K] for the four noded rectangular element in Cartesian coordinate system using finite element formulation. **[16]**

***Q5)*** Derive shape functions for the following elements using Lagrange's interpolation function.

a) Two noded bar element **[4]**

b) Four noded rectangular element **[6]**

c) Nine noded rectangular element **[8]**

OR

***Q6)*** a) Derive the area coordinates for the three noded CST element having Cartesian coordinates node 1 (1,2),node 2 (3,3) and node 3 (2,4). **[10]**

b) Drive shape functions for the eight noded serendipity element in natural coordinate $(\xi,\eta)$ system. **[8]**

***Q7)*** Write short note on:

a) Isoparametric, sub-parametric and super-parametric elements. **[5]**

b) Theorems of isoparametric formulations. **[5]**

c) Jacobian matrix **[6]**

OR

***Q8)*** Derive the Jacobian matrix for the four noded quadrilateral isoparametric element having Cartesian coordinates at node 1(1, 1), node 2 (4, 1), node 3 (1, 2) and node 4 (4,2). **[16]**