Code No: M0122 **R07** **Set No.1**

IV B.Tech. I Semester Regular Examinations, November, 2011

FINITE ELEMENT METHODS IN CIVIL ENGINEERING

(Civil Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions

All Questions carry equal marks

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1. Explain Finite Element method of elastic analysis step by step.

2. Derive constitutive relation (σ-ε) matrix for a linear elastic 2D problem.

3. A bar structure is subjected to a point load P at its centre as shown in Fig.1. Analyse the structure using Finite element method and find a) Reactions b) Stress function c) Draw stress distribution along its axis.

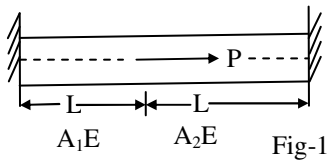

Fig-1

4. Explain plane stress and plane strain through examples.

5. a) What do you mean by shape function and Derive shape function for 3-noded triangular element.
   b) Derive stiffness matrix of a 3-noded triangular element, in terms of Cartesian coordinates (x_1, y_1), (x_2, y_2) and (x_3, y_3).

6. Derive the Lagrangian shape functions N for a 8-noded rectangular element.

7. Explain how axisymmetric problem be solved using Finite Element Method.

8. Write short notes on the following
   a) Numerical Integration
   b) Static condensation
   c) Isoparametric element
   d) Local and global coordinates.

Code No: M0122 **R07** **Set No.2**

IV B.Tech. I Semester Regular Examinations, November, 2011

FINITE ELEMENT METHODS IN CIVIL ENGINEERING

(Civil Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions

All Questions carry equal marks

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1. Analyse the cantilever beam AB shown in Fig. 1using Rayleigh- Ritz method of functional approximation. Determine maximum deflection @ B and comment on you results.

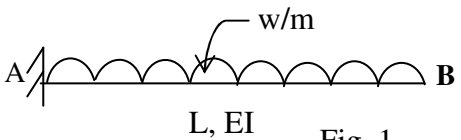

Fig. 1

2. a) Derive material stiffness matrix for plane stress problem.
   b) What are the assumptions made in plane strain problems

3. a) Write about local coordinates and global coordinates.
   b) Derive stiffness matrix of the bar structure shown in Fig.2 and sketch stress distribution along its axis.

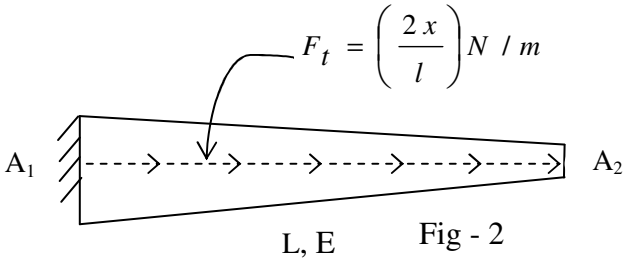

Fig - 2

4. a) What are the convergency requirements and explain them.
   b) Explain how 2D elastic problems are solved using Finite Element Method.

5. A rectangular element has nodal displacements as shown in Fig.3. Find Jocobian, J and stress – displacement matrix B. Take E= 2×10^5 N/mm^2 and μ =0.3. The displacements @ nodes are u={0,0, 0.05, 0.075, 0.15, 0.08, 0,0}

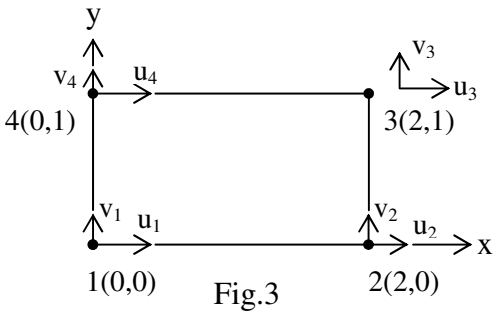

Fig.3

6. Derive shape functions in terms of global coordinates of a triangular element shown in Fig.4.

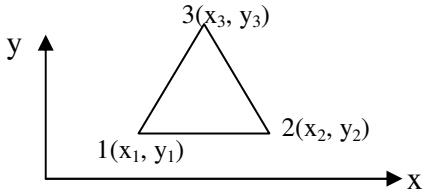

Fig.4

7. Explain how axi-symmetric problems are solved using finite element method.

8. Write short notes on the following
   a) Static Condensation
   b) Assembling of elements
   c) Numerical integration
   d) Geometric invariance

Code No: M0122 **R07** **Set No.3**

IV B.Tech. I Semester Regular Examinations, November, 2011

FINITE ELEMENT METHODS IN CIVIL ENGINEERING

(Civil Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. a) What the basic principles of Rayleigh –Ritz method of functional approximation.
   b) Derive total potential of a bar structure.

2. a) What is meant by interpolation functions and write their properties and significances.
   b) Derive strain- displacement expressions for 2D –elastic body under external loading.

3. Explain how 2D framed structure is analysed using Finite Element Method.

4. Explain how stiffness matrix of a 8-noded rectangular element is determined using interpolation function.

5. Write about
   a) Isoparametric element
   b) Lagrangian element
   c) Serendepity element

6. The nodal displacements of a triangular element shown in Fig.1 are q_1=0.001, q_2= -0.004; q_3=0.003; q_4=0.002; q_5=0.002 and q_6=0.005.
   Determine strain-Displacement matrix [B] and find strains ε_x, ε_y and γ_{xy}.

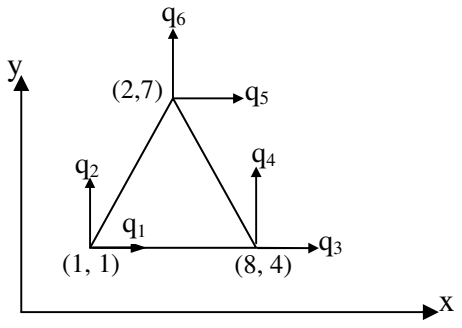

Fig.1

7. Derive shape functions and explain how element stiffness matrix for an axisymmetric is determined.

8. Write short notes on
   a) Traction
   b) Gauss – quadrature
   c) Static condensation

d) Total potential

Code No: M0122 **R07** **Set No.4**

IV B.Tech. I Semester Regular Examinations, November, 2011

FINITE ELEMENT METHODS IN CIVIL ENGINEERING

(Civil Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions

All Questions carry equal marks

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1. List out the various advantages and disadvantages of Finite Element Method.

2. A fixed beam is subjected to uniformly distributed load w/m as shown in Fig.1. Analyse the beam using Rayleigh – Ritz method of functional approximation. Determine maximum deflection and maximum bending moment in the beam. Comment on results.

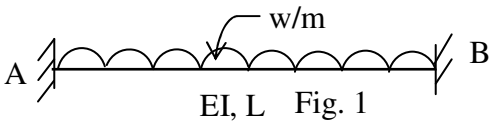

Fig. 1

3. A 2 member truss shown in Fig. 2 is loaded with P vertically. Analyse the truss using Finite element method and determine member forces. Take E=70 GPa, A=200mm^2 for each member.

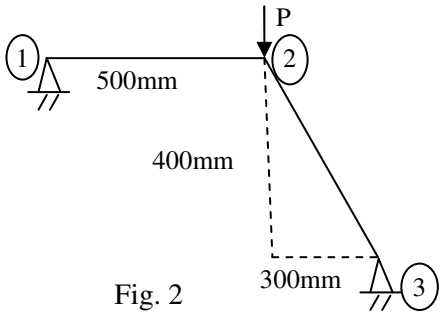

Fig. 2

4. Four noded quadrilateral element is subjected to traction as shown in Fig. 3. Determine the consistent Nodal load vector.

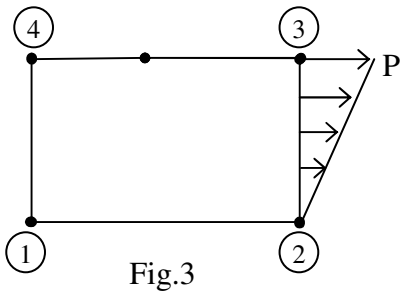

Fig.3

5. a) What do you mean by constant-strain triangular element and explain it.
   b) What do you mean by pascal's triangle in the context of assuming displacement function and explain.

6. A Rectangular element with coordinates in terms of global axis is as shown in Fig. 4. Derive shape functions in terms of global coordinates.

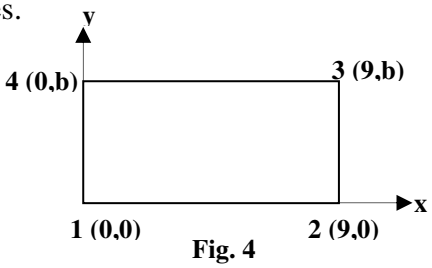

Fig. 4

7. Derive material stiffness matrix for axi-symmetric element.

8. Compare and contrast Lagrangian elements and serendipity elements.