

III B.Tech(CCC) Regular Examinations, December 2007

**FINITE ELEMENT METHODS**  
(Mechanical Engineering)

Time: 3 hours

Max Marks:100

Answer any FIVE Questions  
All Questions carry equal marks

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1. (a) Explain briefly a plane strain problem with suitable examples.  
(b) Derive the material constitutive matrix for a plane stress problem. [10+10]
2. Derive stiffness equations for a bar element from the one dimensional second order equation by variational approach. [20]
3. Consider the truss element with the coordinates i(10,10) & q(50,40) If the displacement vector is  $q=[15 \ 10 \ 21 \ 43]^T$  mm, then determine
  - (a) The trace vector F
  - (b) Stress in each element
  - (c) Stiffness matrix if  $E= 70$  GPA and  $A= 200$  mm<sup>2</sup>. [7+6+7]
4. Derive the methodology to develop a stiffness matrix and load vector for a 2-noded beam element with 4 degrees of freedom? [20]
5. (a) Calculate the nodal load vector due to surface traction for the four noded rectangular element shown in Figure1.

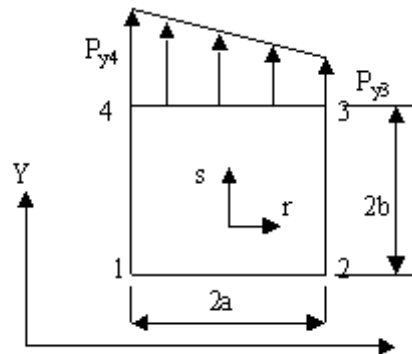


Figure 1:

- (b) Using Gaussian three point formula evaluate  $\int_1^3 dx/x$ . [10+10]
6. Discuss the finite element methodology to solve the torsion problems from the first principles? [20]
7. Explain the following with examples.

- (a) Lumped parameter model.
  - (b) Consistant mass matrix model. [10+10]
8. (a) Explain the convergence criteria in finite element discretization.
- (b) Derive the shape function for a 8 node brick element. [10+10]

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