*Name* : .....

*Roll No.* : .....

*Invigilator's Signature* : .....

**CS/B.Tech (ME/PE)/SEM-8/ME-807/2011**

# 2011

# FINITE ELEMENT METHODS & ITS APPLICATION

*Time Allotted* : 3 Hours Full Marks : 70

*The figures in the margin indicate full marks*

*Candidates are required to give their answers in their own words as far as practicable.*

## GROUP A

## ( Multiple Choice Type Questions )

1. Choose the correct alternatives for the following : $10 \times 1 = 10$

   i) $f(\eta) = \eta^2 + 2\eta + 1$ T e value of $\int_{-1}^{+1} f(\eta)\, d\eta$ by two-point method is

   a) 2 0 b) 1·667

   c) 2 667 d) none of these.

   ii) The ircular cylinder with longer length will be treated for 2-*D* case as

   a) plane stress

   b) plane strain

   c) either plane stress or plain strain

   d) none of these.

   iii) Suitable shape function for the element is selected

   a) on the basis of variation of sides of elements

   b) one the variation of area of element

   c) strain field.

iv) Finite element can be applied to the problems of

a) Solid mechanics b) Fluid mechanics

c) Thermal science d) all of these.

v) $\sigma = a_0 + b\phi + c\xi$ is the deformation in $\phi$-$\xi$ plane in case of

a) constant strain field

b) linearly varying strain field

c) parabolic variation of strain field

d) cubic variation of strain field.

vi) Eigenvalue problem is suitable for

a) steady fluid flow problems

b) mechanical vibration analysis

c) temperature field problems

d) stress field probl ms.

vii) Solution of FEM is found by

a) Matr x inversion method

b) Gauss elimination method

c Gauss-Seidel method

d) All of these.

viii) Stiffness matrix is

a) symmetrical about top left to bottom right diagonal

b) antisymmetric

c) symmetrical about top right to bottom left diagonal

d) none of these.

ix) Convenient way of using numerical integration in FEM is

a) Gaussian quadrature formula

b) Newton-costes quadrature

c) Simpson's rule

d) Trapezoidal rule.

x) For quadrilateral element the dimension of element stiffness matrix is

a) 4 × 4 b) 2 × 4

c) 8 × 8 d) 4 × 8.

## GROUP – B
### ( Short Answer Type Questio s )

Answer any *three* of the foll wing. 3 × 5 = 15

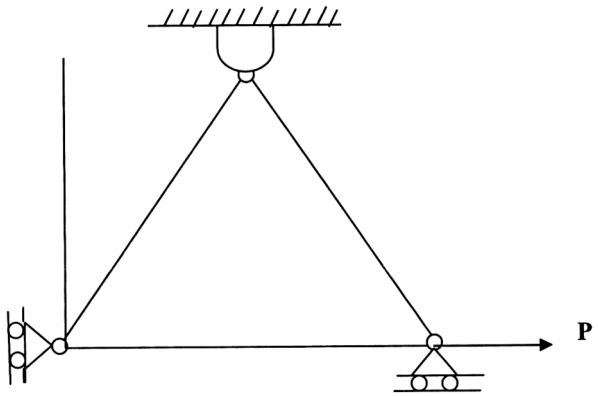
2. What is finite element method ? Write down some applications of FEM.
3. Write down the steps of FEM.
4. What do you mean by s iffness and rigidity matrices ?
5. Discuss some preprocessor and post-processor on finite element.
6. What is the Rayleigh-Ritz method ?

## GROUP – C
### ( Long Answer Type Questions )

Answer any *three* of the following. 3 × 15 = 45

7. Derive a stiffness matrix by classical method of a bar or truss element.
8. Derive a stiffness matrix of a bar element by generalized method.
9. Find out the stiffness matrix of beam element by generalized method.

10. A three bar truss is shown in figure. All bars have the same length $l$ and axial rigidity EA. Determine the displacement of node 1 and node 2.




11. A bridge is supported by several concrete piers and the geometry of the pier is shown below. The load $20\text{kN}/\text{m}^2$ on the pier represents the collective weight of the bridge and an assumed distribution of the traffic load on the bridge. The concrete weighs approximately $25\text{kN}/\text{m}^3$ and its modulus is $E = 28 \times 10^6\ \text{kN}/\text{m}^2$ Analyze the displacement and stresses with the help of FEM. ( consider one element and assume the interpolators as linear functions $\psi_1(x) = (1 - x)$ and $\psi_2(x) = (1 - x)$.