(Pages 2)

Reg. No: ..... Exam Slot: C

Name: .....

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

First Semester M.Tech Degree Examination, December 2015

Department: Mechanical Engineering

Specialization: Machine Design

01ME6103: FINITE ELEMENT METHODS

Time: 3 Hours Max. Marks: 60

Instructions: Answer ***any two*** questions from each part

Part A

1. a) Discuss h, p and r methods of refinement. **(4 Marks)**
   b) Derive the stiffness matrix for a beam element **(5 Marks)**

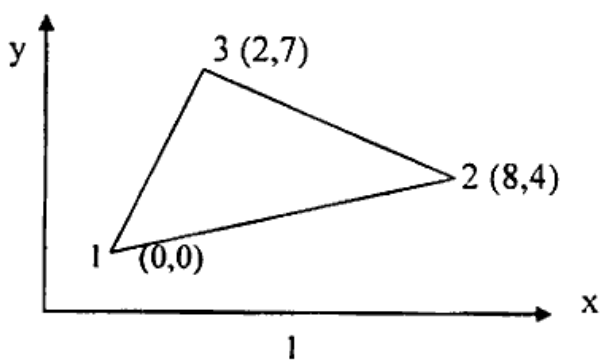
2. a) Prove that $[k]_{global} = \lambda [k]_{local}$ where λ is the transformation matrix **(4 Marks)**
   b) Discuss the solution techniques of FE equilibrium equations. **(5 Marks)**

3. a) Determine the shape functions of four-noded two dimensional element **(5 Marks)**
   b) Using a 2 element discretization, find the displacements, strains and stresses in a rod suspended vertically, and subjected to self weight alone. **(4 Marks)**

Part B

4. a) What are the considerations for selection of interpolation functions? **(5 Marks)**
   b) Explain about Reduced integration technique and Selective integration technique. **(4 Marks)**

5. a) For a linear triangular element shown, evaluate the Jacobean for (x-y) to (ξ,η) transformation. Also obtain the strain displacement matrix [B] and determine. The displacement $q = (0.001,-0.004, 0.003,0.002,-0.002,0.005)^T$. **(5 Marks)**



P.T.O

b) Explain Galerkin's method. **(4 Marks)**

6. a) Derive the stiffness matrix for a plate bending finite element. **(5 Marks)**
   b) Write down the shape functions for an eight noded hexahedral element in natural coordinates. **(4 Marks)**

Part C

7. a) Discuss axisymmetric analysis. Explain how problems with axisymmetric geometry having non-axisymmetric loads are handled in FEM. **(8 Marks)**
   b) Discuss rigid body modes of vibration analysis **(4 Marks)**

8. a) Distinguish between lumped mass matrix and consistent mass matrix. **(4 Marks)**
   b) Write short notes on Lagrange and serendipity elements. **(8 Marks)**

9. a) Explain the inverse iteration method for finding eigen values and eigen vectors. **(4 Marks)**
   b) Estimate the natural frequency of natural vibration of a cantilever bar using FEM. Length=1meter, Young's modulus=210GPa, density=7800Kg/m^3, Area of cross section= 30 x 10^{-6} m^2. **(8 Marks)**

****