Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – SUMMER • 2014

Subject code: 1720801 **Date: 16-06-2014**

Subject Name: Finite Element Method

Time: 02:30 pm - 05:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 (A) Describe the general steps of the FEM. Also discuss the engineering application of FEM **05**

(B) A two step bar is subjected to loading condition as shown in figure is fixed at one end and free end is at a distance of 3.0 mm from the support. P= 50 KN . Determine (1) the distance at nodal points,(2) the stresses in elements(3) reactions at supports. A1= 250 mm^2 , A2= 400 mm^2 and elastic constant E= 200GPa **09**

Q.2 (A) For two bar truss as shown in figure , determine nodal displacements , elementa stresses and support reactions. A force of P= 800 KN is applied at node 1. E= 200GPa, A1= 500 mm^2 for each element **07**

(B) Derive the stiffness matrix for the truss element **07**

OR

(B) Explain mesh generation technique for finite element method. **07**

Q.3(A) Explain mathematical model for plane stress and plain strain in brief. **(4)**

(B) Two dimensional plate is shown in figure. Determine displacements of node 1 and node 2 using plane stress conditions. Body force may be neglected in comparison with external forces. t= 1 cm, modulus of elasticity E = 20 X 10^6 N/mm^2 , poisons ratio = 0.3 **(10)**

OR

Q.3(A) Derive the equation for stiffness matrix for a beam element in finite element method. **07**

(B) For the beam loading as shown in figure. Determine slopes at 2 and 3 and , the vertical deflection at the midpoint of distributed load. E= 200Gpa, I= $5x10^5$ mm^4 **07**

Q.4(A) Explain mathematical formulation for isoparametric element **07**

(B) Explain following elements used in FEA with their specific appliacation. Also sketch the elements. **07**

1. Axisymetric element 2. Curved shell element 3. 3 D tetrahedral element

OR

Q.4(A) What is numerical integration in two dimensional finite element analysis ? Explain with example. **07**

(B) Write a governing equation and boundary condition used to completely define a rod extrusion problem. Also derive its weak form. **07**

Q.5(A) Explain the finite element formulation for two dimensional steady state heat conduction problem. **07**

(B) Giving suitable example explain langrangeôs method for a three degree of freedom spring mass system for FEM. Get the required equation of motion. **07**

OR

Q.5(A) Uniform cross section bar of length L made up of a material with young modulus and density are given by E and ɟ . Estimate the natural frequencies of axial vibration of the bar using both consistent and lumped mass matrix. **07**

(B) Enlist all the methods for solving an Eigen value problem. Explain any one method which is more convenient. **07**

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