QP Code: RO20MTECH191 Reg. No | | | | | | | | | | | AR 19

GIET UNIVERSITY, GUNUPUR – 765022

M. Tech (Second Semester Examinations) – October' 2021

MPCMD2010 – FINITE ELEMENT METHODS

(Machine Design)

Time: 2 hrs Maximum: 50 Marks

(The figures in the right hand margin indicate marks)

PART – A

Q.1. Answer ***ALL*** questions (2 x 10 = 20)

a. Write the three phases of finite element method.

b. Differentiate between the structural and non-structural problem?

c. State the principle of minimum potential energy.

d. Write the importance of post processing in FEA.

e. What is axisymmetric element ?

f. Formulate the (B) matrix for CST element.

g. Define plane stress and plane strain.

h. What isoparametric element signify ?

i. Write the basic concept of plate bending.

j. Write in brief about " Gauss- quadrature method".

PART – B **(6 x 5 = 30 Marks)**

Answer ***ANY FIVE*** questions Marks

2. The following differential equation is available for a physical phenomenon. $\boldsymbol{AE} = \frac{d^2u}{dx^2} + ax = 0$, The boundary conditions are u(0) = 0, $\boldsymbol{AE} = \left(\frac{du}{dx}\right) = 0$ (when x=L), By using Galerkin's technique, find the solution of the above differential equation. (6)

3. Axial load of 500N is applied to a stepped shaft, at the interface of two bars. The ends are fixed. Calculate the nodal displacement and stress when the element is subjected to all in temperature of 100˚C. Take E_1 = 30 x10^3 N/mm^2 & E_2 = 200 x 10^3 N/mm^2, A_1=900 mm^2 & A_2 = 1200mm^2, α_1 = 23x10-6 /˚C & α_2 = 11.7x10-6/˚C, L_1=200mm & L_2 =300mm. (6)

4. Explain the process of discretization of a structure in finite element method in detail, with suitable illustration for each aspect being and discussed. (6)

5. Derive the stiffness matrix of a beam element using the natural coordinate system and shape function. (6)

6. Discuss in detail about finite element formulation for an axisymmetric shell with an axisymmetric loading. Determine the matrix relating strains and nodal displacements for an axisymmetric three nodded triangular element. (6)

7. The Cartesian coordinates of the corner nodes 1, 2 and 3 of a triangular element are given by (1,3), (4,2) and (3,5) respectively. Determine the shape functions N_1 , N_2 and N_3 at a interior point P(2,4) . (6)

8. Derive the Jacobian of transformation for a 1D quadratic isoparametric element. (6)

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