B.Tech. MECHANICAL ENGINEERING (BTMEVI)

Term-End Examination

December, 2015

BIMEE-013 : FINITE ELEMENT ANALYSIS

Time : 3 hours   *Maximum Marks : 70*

Note : *Attempt any* ***five*** *questions. All questions carry equal marks. Standard notations and symbols have their usual meaning.*

1. Discuss in detail about the general procedure for finite element analysis and describe its applications.   *14*

2. (a) What are the general requirements of pre-processor and post-processor of a finite element package ?   *7*

   (b) Using generalized coordinate approach, find the shape function of a two noded bar element.   *7*

3. (a) Derive the strain displacement matrix for an axisymmetric triangular element.   *7*

   (b) Derive the stiffness matrix for plane truss element.   *7*

4. (a) Distinguish between the following :   7

      (i) Plane stress and Plane strain condition.

      (ii) Axisymmetric boundary condition and Polar symmetric boundary condition.

  (b) Derive the characteristic matrix for a two dimensional heat conduction problem using triangular element.   7

5. The figure given below depicts assembly of two bar elements made of different materials. Determine the nodal displacements, element stresses and reaction force.   *14*
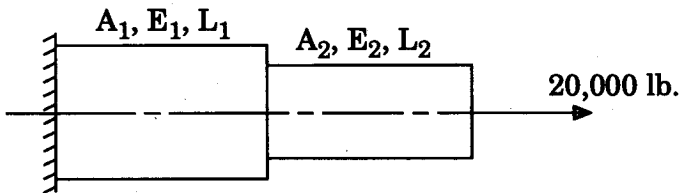

Figure 1

$A_1 = 4$ inch^2

$E_1 = 15 \times 10^6$ lb/ inch^2

$L_1 = 20$ inch

$A_2 = 2 \cdot 25$ inch^2

$E_2 = 10 \times 10^6$ lb/ inch^2

$L_2 = 20$ inch

6. A long rod is subjected to loading and a temperature increase of 30°C. The total strain at a point is measured to be $1{\cdot}2 \times 10^{-5}$.

If E = 200 GPa, $\alpha = 12 \times 10^{-6}$ /°C, determine the stress at the point.   *14*

7. Answer any *two* of the following questions :   *7+7*

   (a) Explain about Galerkin method and principle of minimum potential energy.

   (b) Discuss about the Linear and Quadratic shape function.

   (c) Specify strain displacement matrix of CST element and comment on it.

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