| BIMEE-013 |

B.Tech. MECHANICAL ENGINEERING
(BTMEVI)

Term-End Examination

OO153

December, 2016

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 concepts of FEM formulation. Explain with step-by-step procedure. Also list out the major applications of FEM.   *14*

2. (a) What do you understand by finite element model ? Explain and give an example of modelling of a mechanical component.   *7*

    (b) Describe the shape functions and its characteristics. Discuss why polynomials are generously used as shape functions.   *7*

3. (a) Develop the stress – strain matrix equation and strain displacement matrix for an axi-symmetric triangular element.   *7*

(b) Distinguish between the following : 7

    (i) Essential boundary condition and Natural boundary condition

    (ii) Boundary value problem and Initial value problem

4. (a) Describe the variational functions. 4

    (b) Two thin rods of stiffness 12 kN/mm and 8 kN/mm are connected as shown in the figure given below and are subjected to a load of 6 kN at node 3. The system is fixed at node 1. Determine the displacement at node 2 and node 3. 10
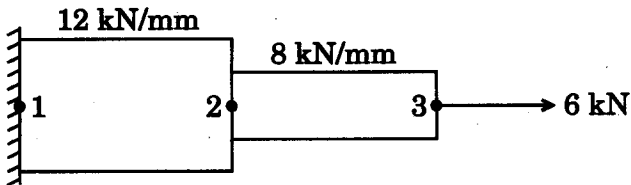
5. A circular bar of uniform cross-section A, length L, Young's modulus E, and density ρ is vertically suspended under its own weight using four-element model. Find the state of deformations and strain under its own weight. 14

6. **(a)** Derive the element stiffness matrix for a 1-D bar problem using Galerkin approach. **7**

(b) Define internal and external indeterminacies. Describe with the suitable formula for degree of indeterminacy for a 2-D truss. **7**

7. Write short notes on the following : $4 \times 3\frac{1}{2} = 14$

(a) Nodal Points

(b) Static and Dynamic Analysis

(c) Influence Coefficients

(d) Weight Factors

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