B.Tech. MECHANICAL ENGINEERING (BTMEVI)

00745

Term-End Examination

June, 2017

BIMEE-013 : FINITE ELEMENT ANALYSIS

Time : 3 hours *Maximum Marks : 70*

*Note : Attempt any **five** questions. All questions carry equal marks. Use of scientific calculator is permitted. Standard notations and symbols have their usual meaning.*

1. What is the basic concept of FEM ? Explain the standard procedure of finite element analysis of a machine component. Also list out various applications of FEA. *14*

2. (a) Define shape function. Write the shape function of a four-noded Quadrilateral Element. *7*

   (b) How do you classify the elements used in FEM ? Describe their features and characteristics. *7*

3. (a) How do you formulate the frame element that would be able to model a buckling problem ? Explain. 7

   (b) Using Galerkin approach, derive the element stiffness matrix for a 1-D bar problem. 7

4. (a) Distinguish between the following : 7

   (i) Cartesian Co-ordinate and Natural Co-ordinate systems

   (ii) Static Analysis and Dynamic Analysis

   (b) Derive the constitutive relation matrices for plane stress and plane strain situations. 7

5. (a) Distinguish between a truss and a frame. 7

   (b) Derive the stiffness matrix for a spring element (shown in Figure 1) consisting of 2 nodes with a single degree of freedom (axial deflection) at each node. 7
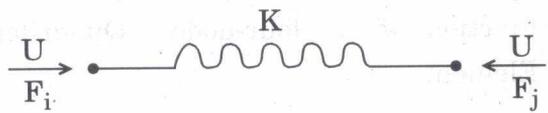

$$\underset{F_i}{\overset{U}{\longrightarrow}} \bullet \overset{K}{\sim\!\sim\!\sim\!\sim} \bullet \underset{F_j}{\overset{U}{\longleftarrow}}$$

Figure 1

6. Use finite element method to calculate the displacement and stress of a bar shown in Figure 2.   *14*
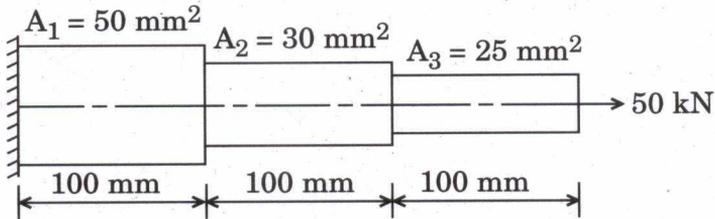

Figure 2

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

(a) Degree of Freedom

(b) Influence Coefficients

(c) FEA Software Packages

(d) ISO – Parametric Elements

(e) Mesh Generation

(f) Finite Element Modelling

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