No. of Printed Pages : **3**

BIMEE-013

B.Tech. MECHANICAL ENGINEERING (BTMEVI)

00511

Term-End Examination
December, 2013

BIMEE-013 : FINITE ELEMENT ANALYSIS

Time : 3 hours *Maximum Marks : 70*

Note : *(i) Answer **any five** questions.*
*(ii) Scientific calculator is **allowed**.*
*(iii) All questions carry **equal** marks.*

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1. (a) Write a note on variational functions. **4**

(b) What is connectivity in finite element Models ? **4**

(c) Compare the formulation of one dimensional finite element problems using two-node linear elements versus three node quadratic elements. **6**

2. An axial load $P = 400 \times 10^3 N$ is applied at 20°C to the rod as shown in figure 1. The temperature is then raised to 60°C Determine the element stresses. **14**

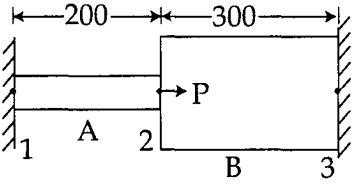

Figure - 1

$E_A = 70 \times 10^9 \ N/m^2$
$E_B = 200 \times 10^9 \ N/m^2$
$A_A = 900 \ mm^2$, $A_B = 1200 \ mm^2$
$\alpha_A = 23 \times 10^{-6}$ per°C
$\alpha_B = 11.7 \times 10^{-6}$ per°C.

3. Compute the reactions for the beams shown in Figure 2. 14

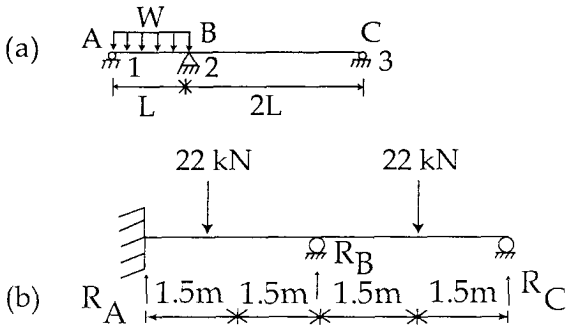

Figure - 2

4. Assume a uniform section rod of elastic material fixed at both ends and 3L long with uniform body force loading F. Use three linear elements of length 'L' and formulate the Rayleigh-Ritz solution using shape functions rather than interpolation formulas. 14

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

(b) Three springs are assembled colinear as shown in figure 3. Nodes 1 and 4 fixed and axial loads of 10 kN and 20 kN are applied at node 2 and 3 respectively. Determine the displacement at node 2 and 3. 7

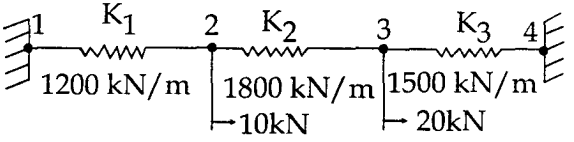

Figure - 3

6. (a) Describe what are shape functions ? 5

(b) A set of springs connected together as shown in figure 4 is subjected to axial loads of 10 kN, 20 kN at node points 1 and 4. Determine the displacements as node 1,2 and 4. 9

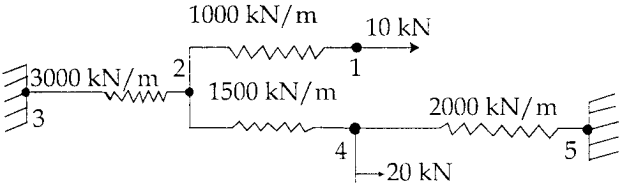

Figure -4

7. Derive the transformation matrix and corresponding stiffness matrix for a beam oriented in a local ξ, η coordinate system and referenced to the global x, y coordinate system. 14