

**B. Tech. Sem - VIII (Mechanical Engg.) (2014 COURSE) (CBCS) :**

**SUMMER - 2019**

**SUBJECT: ELECTIVE –III FINITE ELEMENT ANALYSIS**

Day: Thursday  
Date: 30/05/2019

**S-2019-2923**

Time: 02.30 PM TO 05.30 PM  
Max Marks: 60

**N.B.:**

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Draw neat and labeled diagram **WHEREVER** necessary.
- 4) Assume suitable **DATA** wherever necessary.

**Q.1** List and briefly describe the general steps of the finite element method. (10)

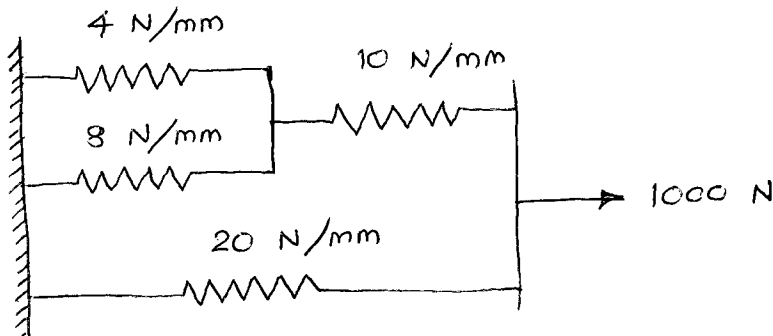
**OR**

Explain in detail the method of matrix partitioning and how it is used to impose boundary condition in FEM (10)

**Q.2** Derive shape function in natural coordinate system for two noded bar element. (10)

**OR**

Analyze the following deflection of each spring and reaction forces at support. (10)



**Q.3** Explain formulation of elemental stiffness matrix and load vector for constant strain triangles (CST). (10)

**OR**

A triangular element has nodal coordinates (10, 10) (40, 20) and (30, 50) for nodes 1, 2, and 3 respectively. For a point 'P' inside triangle, determine the X and Y coordinates if shape function  $N_1$  and  $N_2$  are 0.15 and 0.25 respectively. (10)

**Q.4** Explain iso-parametric, sub parametric and super parametric elements. (10)

**OR**

A quadrilateral element is defined by (1, 4) (4, 2) (5, 6) and (2, 7). The temperatures at nodes are  $20^\circ\text{C}$ ,  $30^\circ\text{C}$ , and  $25^\circ\text{C}$ . (10)

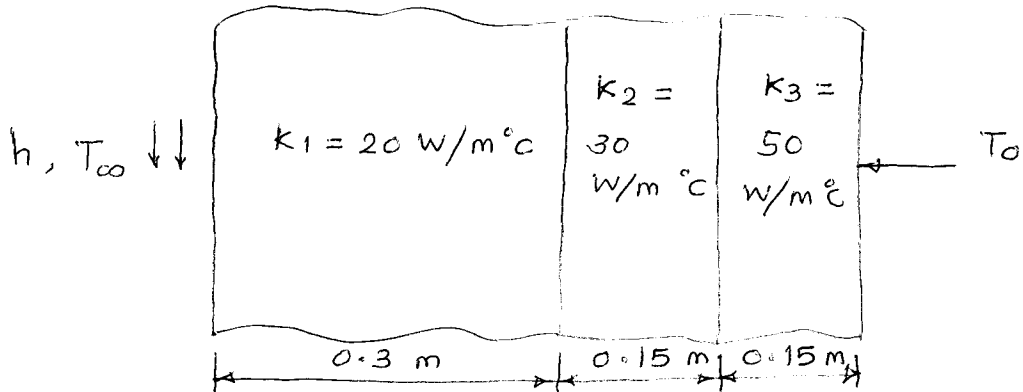
- i) find Temperature at P (3, 4)
- ii) find iso-parametric formulation.

**Q.5** Derive the stiffness matrix of a 1D steady state conduction thermal element. Assume iso-parametric variation of properties. (10)

**P.T.O.**

OR

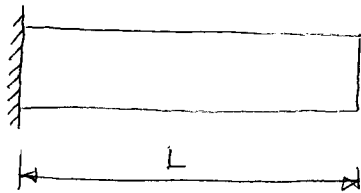
A composite wall consisting of three materials shown in fig. The outer temperature is  $T_0 = 20^\circ\text{C}$ , convection heat transfer takes place on the inner surface of the wall  $T_\infty = 800^\circ\text{C}$  and  $h = 25 \text{ W/m}^2 \text{ }^\circ\text{C}$ . Determine the temperature distribution in wall. (10)



Q.6 Explain stepwise power method used to find out largest eigenvalue and its corresponding eigenvector. (10)

OR

Find the natural frequency of vibration using consistent mass matrix method (10) with one element for bar.  $E = 2 \times 10^{11} \text{ N/m}^2$ ,  $\rho = 7800 \text{ kg/m}^3$ ,  $L = 1 \text{ m}$ .



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