Code: ME7T3

IV B.Tech - I Semester –Regular / Supplementary Examinations
JANUARY - 2022

FINITE ELEMENT METHODS
(MECHANICAL ENGINEERING)

Duration: 3 hours   Max. Marks: 70

PART – A

Answer ***all*** the questions.   All questions carry equal marks

11x 2 = 22 M

1.

a) Define Discrete system with an example.
b) What do you mean by boundary conditions?
c) Describe the characteristics of shape functions.
d) List various forces acting on a 1D linear Bar element.
e) Distinguish between local coordinate system and global coordinate system.
f) Write down the finite element equation for a beam element.
g) Define Plane stress and Plane Strain conditions.
h) Write down the strain displacement matrix for 4 noded quadrilateral element.
i) What are the thermal boundary conditions for a composite wall?
j) Write down the Stress-Strain relationship matrix for an axi-symmetric triangular element.
k) List some of the software packages available for Finite Element Methods.

PART – B

Answer any ***THREE*** questions. All questions carry equal marks.

3 x 16 = 48 M

2. Explain the Raleigh – Ritz method of functional approximation with the help of an example in detail. 16 M

3. Consider the bar as shown in Figure 1. Determine the nodal displacements, stresses induced in the elements and Reaction forces at the supports. 16 M

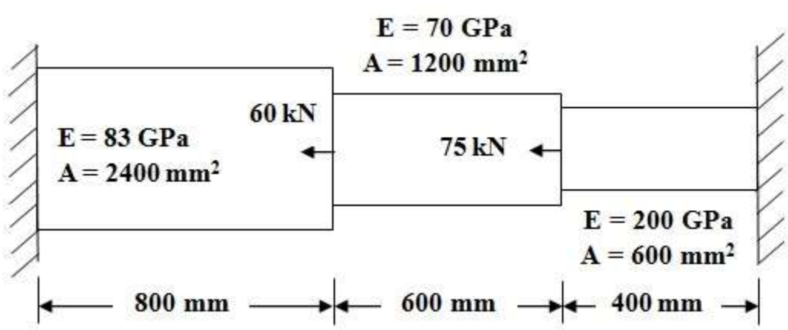

Figure 1

4. For beam shown in Figure 2, **compute** the deflection at the element nodes. The modulus of elasticity is E = 200 GPa and the cross section is as shown in figure. Use the finite element method with minimum number of elements. 16 M

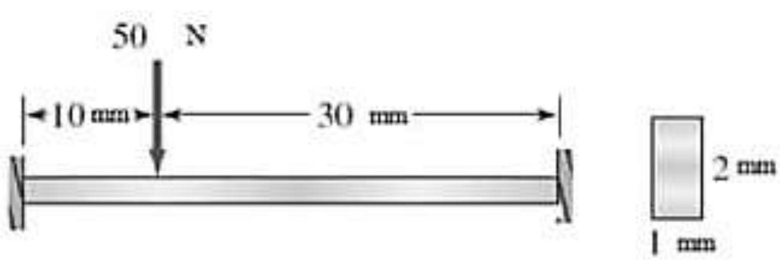

Figure 2

5. Derive the element stiffness matrix for a 3 nodded triangular element (CST) and also derive the equivalent nodal force matrix for Traction force and Body force terms. 16 M

6. A composite wall consists of 3 materials shown in Figure 3 below. The outer temperature is $T_0 = 20\ ^0C$. Convection heat transfer takes place on the inner surface of the wall with $T_\infty=800^0C$ and $h = 25\ W/m^2\ ^oC$. Determine the temperature distribution in the wall. 16 M

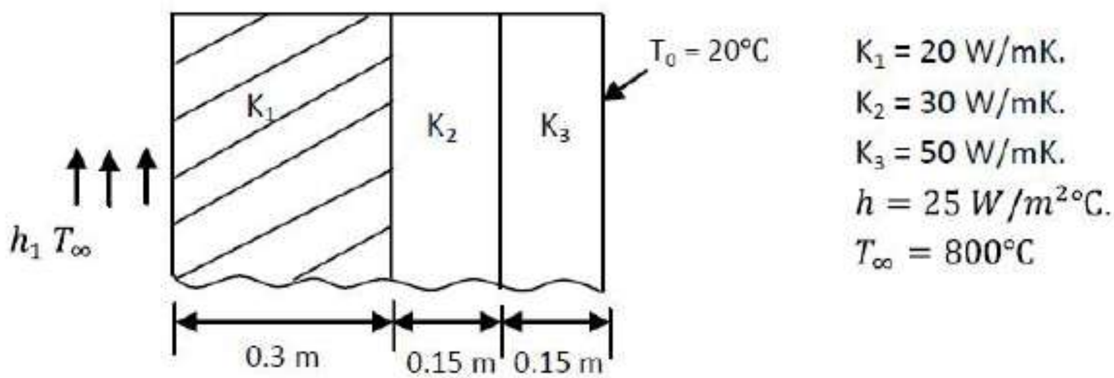

Figure 3