USN | | | | | | | | | | | **18AS/AE63**

Sixth Semester B.E. Degree Examination, Jan./Feb. 2023
Finite Element Method

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Explain the principle of minimum potential energy, with the help of a continuum. **(10 Marks)**

b. A fixed beam subjected to a point load at its centre using R-R method. Derive an equation for maximum deflection.

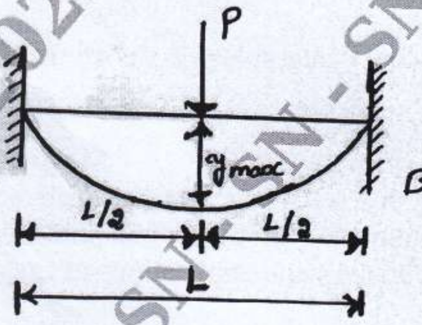

Fig Q1(b) **(10 Marks)**

OR

2 a. Derive a relation between Cartesian Co-ordinate and natural co-ordinate system. **(08 Marks)**

b. A simply supported beam is subjected to UDL, determine the max deflection using Galerkin's method.

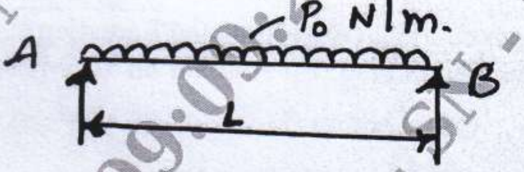

Fig Q2(b) **(12 Marks)**

Module-2

3 a. Derive the shape function for a 1D bar element in natural co-ordinate system, also show the variation of shape function. **(10 Marks)**

b. A compound bar is loaded as shown in Fig Q3(b) E_{Steel} = 200GPa, E_{CU} = 100GPa, using elimination method of boundary condition, find

i) Nodal displacement ii) Stresses in each element

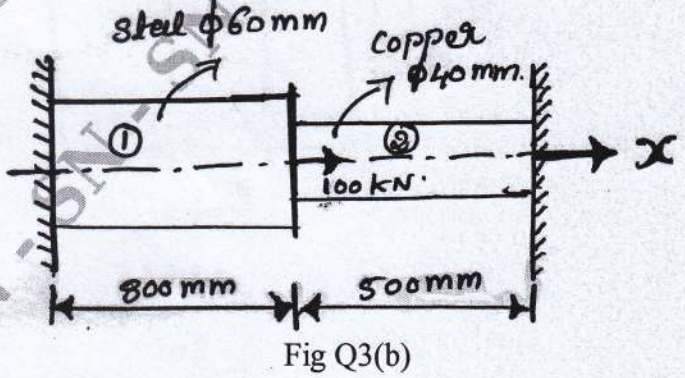

Fig Q3(b) **(10 Marks)**

OR

4 a. Derive the stiffness matrix of a truss element. **(10 Marks)**
b. Derive the shape function of Beam element. **(10 Marks)**

Module-3

5 a. Derive the shape function of a CST element. **(10 Marks)**
b. Derive the shape function of a four noded Quadrilateral element. **(10 Marks)**

OR

6 a. Using Lagrangian interpolation, derive the shape function for 8-Noded Hexahedron element [HEXA-8]. **(10 Marks)**
b. Using Serendipity Interpolation, derive the shape function of 8-noded quadrilateral element. **(10 Marks)**

Module-4

7 a. Explain ISO, sub and super parametric element. **(06 Marks)**
b. Explain preprocessor, processor and post processor in finite element analysis. **(08 Marks)**
c. Give the advantages and applications of finite elements method. **(06 Marks)**

OR

8 a. Formulate an axisymmetric element showing the potential energy functional and strains. **(06 Marks)**
b. Derive the shape function of axiysmmetric triangular element and also the strain matrix. **(14 Marks)**

Module-5

9 a. Explain conduction, convection and Radiation. **(09 Marks)**
b. Derive the Differential, equation for an 3D – heat conduction. **(11 Marks)**

OR

10 a. Derive the stiffness matrix for 1-D fin. **(08 Marks)**
b. Determine the temperature distribution in the composite wall using 1D heat elements. Given : $K_1 = 25 W/m^oC$, $K_2 = 35 W/m^oC$, $K_3 = 55 W/m^oC$, $h = 30 W/m^2C$, $T_\infty = 900^oC$, A = unit area.

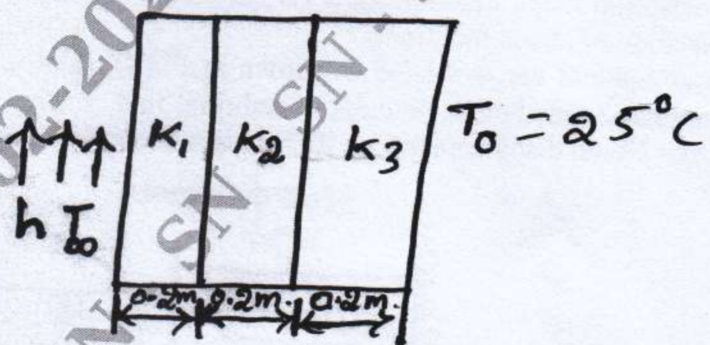

Fig Q10(b) **(12 Marks)**

* * * * *