CBCS SCHEME

USN | | | | | | | | | | |

15AU73

Seventh Semester B.E. Degree Examination, Dec.2019/Jan.2020
Finite Element Modeling and Analysis

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define FEM, write the limitations and applications of FEM. **(08 Marks)**

b. Differentiate between plane stress and plane strain problems with examples. Write the stress – strain relations for both. Write the assumption for both. **(08 Marks)**

OR

2 a. Write the equilibrium equation of 3-D body. **(07 Marks)**

b. A bar of length L, cross section area A and modulus of elasticity E, is subjected to distributed axial load q = cx, where c is a constant as shown in Fig Q2(b). Determine the displacement of the bar at the end using Rayleigh – Ritz method.

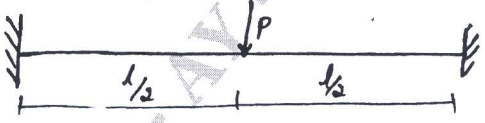

Fig Q2(b) **(09 Marks)**

Module-2

3 a. Derive an expression for jacobain matrix for a four noded quadrilateral element. **(05 Marks)**

b. Write the basic steps involved in FEM for stress analysis of elastic solid bodies. **(04 Marks)**

c. Write the shape function for 1-D linear bar element using natural co-ordinates. **(07 Marks)**

OR

4 a. Explain convergence requirements and compatibility conditions. **(05 Marks)**

b. Write the stiffness matrix for 1-D bar element. **(06 Marks)**

c. Explain the Pascal triangle with neat sketch. **(05 Marks)**

Module-3

5 Consider the bar shown in Fig Q5. Using penalty method of handling boundary condition. Determine the nodal displacement, stress in each element and support reactions. Due to applied force P = 100kN. Take E_{steel} = 200GPa, E_{cu} = 100GPa.

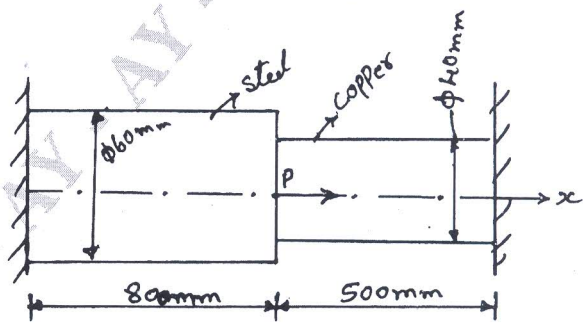

Fig Q5 **(16 Marks)**

OR

6 For the two bar truss shown in Figure Q6, determine the nodal displacement and the stress in each member. Also find the support reaction. Take E = 200GPa.

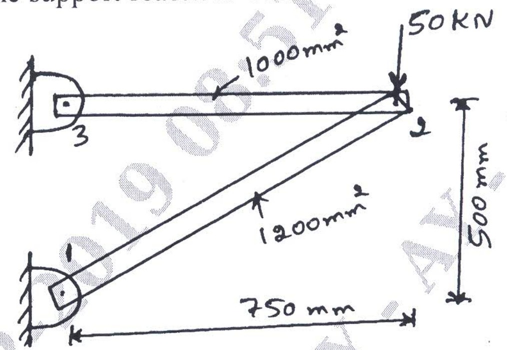

Fig Q6 **(16 Marks)**

Module-4

7 a. Write the shape function of 2D quadrilateral element by using natural coordinates. **(08 Marks)**

b. Write the shape function for 2D triangular element by using natural coordinates. **(08 Marks)**

OR

8 Write the Hermit shape function for Beam element. Write the variation diagram also. **(16 Marks)**

Module-5

9 For the beam element shown in Fig Q9. Determine deflection under the given load. Take E = 200GPa and $I = 4 \times 10^6 mm^4$.

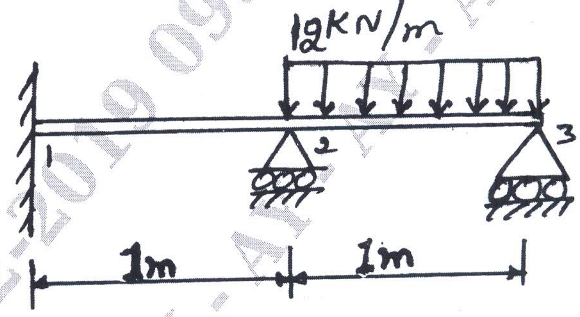

Fig Q9 **(16 Marks)**

OR

10 a. Derive the Governing equations for 1-D heat conduction element with neat sketch. **(06 Marks)**

b. Find the temperature distribution and heat transfer through an iron fin of thickness 5mm. Length is 50mm and width 1000mm. The heat transfer coefficient around the fin is $10 W/m^2$. K and ambient temperature is 28°C. The base of fin is at 108°C. Take K = 50 W/m.k. Use two elements. **(10 Marks)**

* * * * *