CBCS Scheme

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

15AE651

Sixth Semester B.E. Degree Examination, June/July 2018
Finite Element Method

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain plane stress and plane strain problems with stress strain relationship. **(04 Marks)**

b. State and explain the principle of minimum potential energy with usual notations. **(04 Marks)**

c. For the spring shown in Fig Q1 (c) determine the nodal displacements using the principle of minimum potential energy. **(08 Marks)**

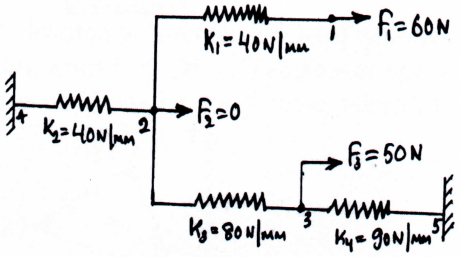

Fig Q1(c)

OR

2 a. Explain simplex, complex and multiplex elements. **(06 Marks)**

b. For the bar shown in Fig Q2(b), determine the displacement at the point of loading and the corresponding stresses using Rayleigh Ritz method. Use second degree polynomial approximation for the displacement. **(10 Marks)**

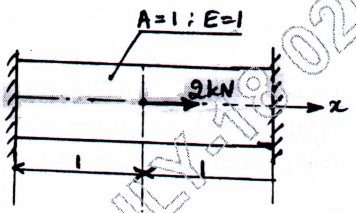

Fig Q2(b)

Module-2

3 a. Derive shape functions for 1D bar element in global co-ordinate system. **(08 Marks)**

b. For the two bar truss shown in Fig Q3 (b). Determine the nodal displacement. Take E = 200GPa, A_e = 200 mm^2. **(08 Marks)**

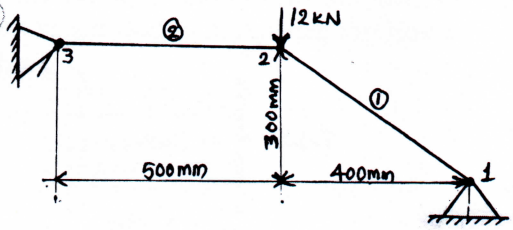

Fig Q3(b)

OR

4 a. Derive the Hermite shape function for a beam element in natural coordinate system. **(08 Marks)**

b. A bar having uniform cross sectional area of $300mm^2$ is subjected to a load P = 600kN as shown in Fig Q4(b). Determine the displacement field. Consider the bar to be made of two elements. Take E = 200GPa. **(08 Marks)**

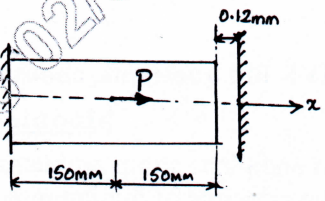

Fig Q4(b)

Module-3

5 a. Derive shape functions for CST element in natural co-ordinate system. **(10 Marks)**

b. Determine the shape functions (N_1, N_2, N_3) for a triangular element shown in Fig Q5(b). The X co-ordinate of interior point P is 3.85 and Y co-ordinate of interior point P is 4.8.

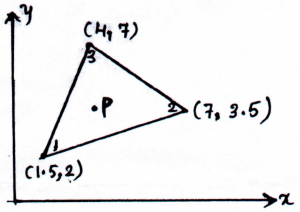

Fig Q5(b) **(06 Marks)**

OR

6 a. Derive shape functions for tetrahedral element in NCS. **(08 Marks)**

b. Explain Lagrange and serendipity family elements and also mention their advantages and disadvantages. **(08 Marks)**

Module-4

7 a. Explain the concepts of iso, sub and super parametric elements. **(08 Marks)**

b. Explain the structure of computer program for FEM analysis. **(08 Marks)**

OR

8 Formulate strain – displacement matrix for axisymmetric linear triangular element. **(16 Marks)**

Module-5

9 a. Derive the governing equation for 1D heat conduction problem with usual notations. **(08 Marks)**

b. Determine the temperature distribution in a 1D fin with physical properties given in Fig Q9(b). There is a uniform generation of heat inside the wall Q = 400 W/m^3.

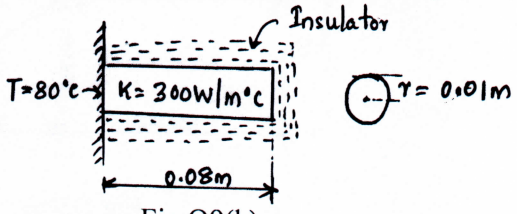

Fig Q9(b) **(08 Marks)**

OR

10 a. Explain Hamilton's principle for dynamic analysis of spring mass system. **(06 Marks)**

b. Determine the temperature distribution through the composite wall as shown in Fig Q10 (b), when convective heat loss occurs on the right surface. Assume a unit area.

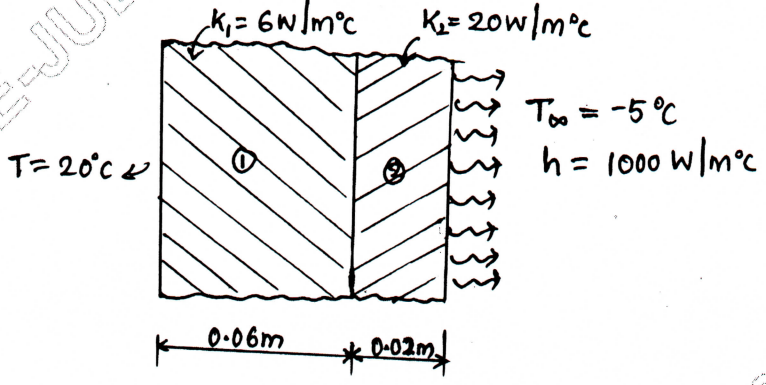

Fig Q10(b) **(10 Marks)**

* * * * *