CBCS SCHEME

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15AU73

Seventh Semester B.E. Degree Examination, Aug./Sept.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.

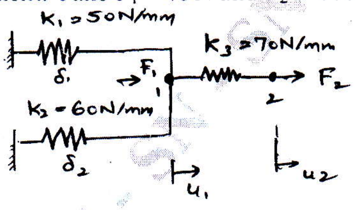
Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. 2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Explain with neat sketch plane stress and plane strain. **(08 Marks)**

b. For the spring system shown in Fig.Q.1(b) using principle of minimum potential energy determine the nodal displacement. Take F_1 = 75N and F_2 = 100N. **(08 Marks)**

Fig.Q.1(b)



OR

2 a. Derive the equilibrium equation for 3D elastic body. **(08 Marks)**

b. By RR method for a bar of cross section area A, elastic modulus E, subjected to uniaxial loading P. Show that a distance X from fixed end is $u = \left(\frac{P}{AE}\right)X$ **(08 Marks)**

Module-2

3 a. What is FEA? Explain the basic steps involved in FEM. **(08 Marks)**

b. Derive the stiffness matrix for the bar subjected to axial load F using direct method. **(08 Marks)**

OR

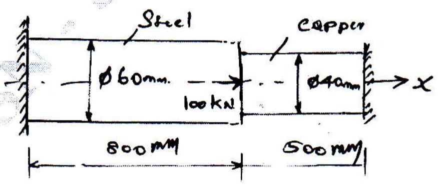
4 a. What is shape function? Derive the shape function for 1D bar element in global coordinates. **(08 Marks)**

b. What are the convergence requirements? Discuss three condition of convergence requirement. **(08 Marks)**

Module-3

5 a. Determine the nodal displacement stress in each element and support reaction in the bar shown in Fig.Q5(a). **(08 Marks)**

Fig.Q5(a)



b. Solve the following system of simultaneous equation by gauss elimination method:

$4x_1 + 2x_2 + 3x_3 = 4$

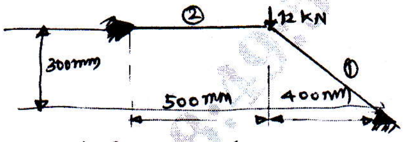
$2x_1 + 3x_2 - 5x_3 = 2$

$2x_1 + 7x_2 = 4$ **(08 Marks)**

OR

6 a. For the two bar truss shown in Fig.Q.6(a). Determine the nodal displacements. Take $E = 2 \times 10^5$MPa, $A = 200mm^2$. **(08 Marks)**

Fig.Q.6(a)



b. Derive the elemental stiffness matrix for a truss element. **(08 Marks)**

Module-4

7 a. Derive the shape function using lagrangian interpolation for linear Quadrilateral element. **(08 Marks)**

b. Briefly explain subparametric elements and super parametric elements. **(08 Marks)**

OR

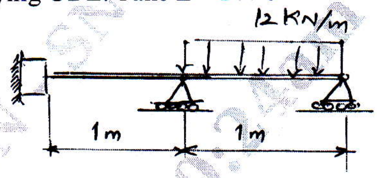
8 a. Derive the hermite shape function for a 2 noded beam element. **(08 Marks)**

b. Briefly explain the finite element formulation of 2D Constant Strain Triangular Element (CST). **(08 Marks)**

Module-5

9 a. For the beam shown in Fig.Q.9(a). Determine the end reaction and deflection at the center of the portion of the beam carrying UDL. Take E = 200GPa $I = 4 \times 10^6 mm^4$. **(08 Marks)**

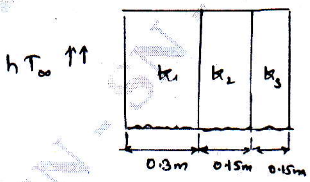
Fig.Q.9(a)



b. Solve for temperature distribution in the composite wall as shown in Fig.Q.9(b) using 1D heat elements, use penalty approach of handling boundary conditions.

$K_1 = 20 W/m°C$
$K_2 = 30 W/m°C$
$T_0 = 20°C$
$K_3 = 50 W/m°C$
$h = 25 W/m^2C$

Fig.Q.9(b)



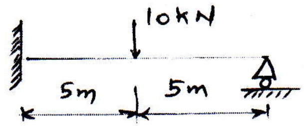
(08 Marks)

OR

10 a. Derive the expression for stiffness matrix for 1D heat conduction. **(08 Marks)**

b. For the beam element shown in Fig.Q.10(b). Determine deflection under the given load. Take $E = 2 \times 10^8 kN/m^2$ and $I = 4 \times 10^{-6} m^4$ **(08 Marks)**

Fig.Q.10(b)



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