CBCS SCHEME

USN 1BR19ME027 **18ME61**

Sixth Semester B.E. Degree Examination, July/August 2022
Finite Element Methods

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain steps in finite element method. **(10 Marks)**

b. Explain simplex, complex and multiplex elements. **(10 Marks)**

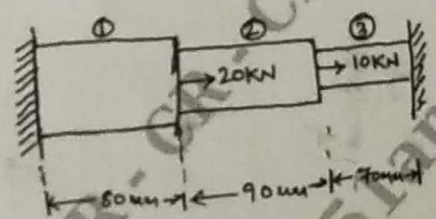
OR

2 a. Explain node numbering scheme. **(10 Marks)**

b. Obtain the shape functions for linear one dimension elements. **(10 Marks)**

Module-2

3 For the bar shown in Fig Q3, find the nodal displacements, stress in the middle portion and left support reaction.



$E_1 = 70$ GPa
$E_2 = 105$ GPa
$E_3 = 200$ GPa
$A_1 = 900\ mm^2$
$A_2 = 400\ mm^2$
$A_3 = 200\ mm^2$

Fig Q3 **(20 Marks)**

OR

4 A four bar truss element as shown in Fig Q4, determine nodal displacement and stress in each element. Area = $100 mm^2$ $E = 2 \times 10^5\ N/mm^2$

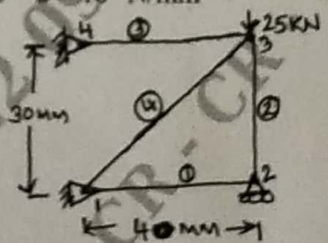


Fig Q4 **(20 Marks)**

Module-3

5 For the beam and loading shown in Fig Q5, determine mine the slopes at 2 and 3.

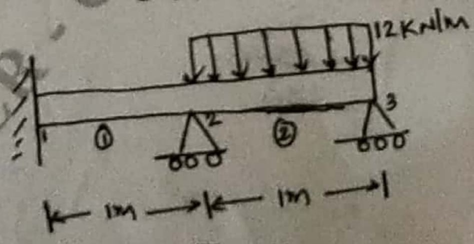


Fig Q5

Take : $E = 200$ GPa, $I = 4 \times 10^6 mm^4$ **(20 Marks)**

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.

OR

6 A bar of circular cross section having a diameter 50mm is firmly fixed at its ends. It is subjected to torque as shown in Fig Q6. Determine the angle of twist and shear stress. Take $G = 7 \times 10^4$ N/mm^2, $E = 2 \times 10^5$ N/mm^2.

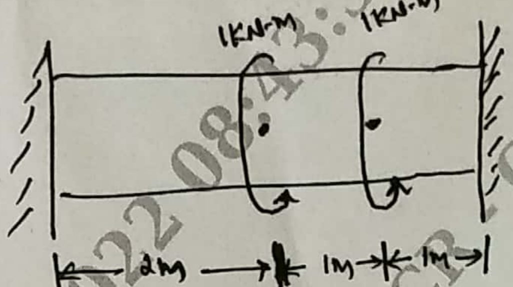
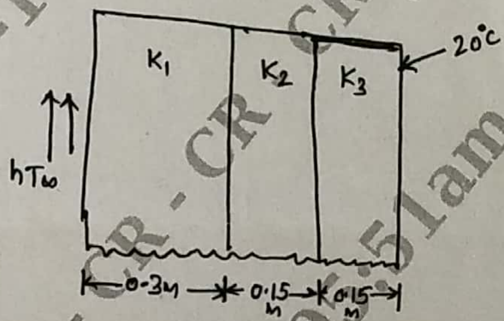


Fig Q6 **(20 Marks)**

Module-4

7 A composite wall consists of three materials, as shown in Fig Q7. The outer temperature is T_0 = 20°C, convective heat transfer takes place on the inner surface of the wall with T_∞ = 800°C and h = 25W/m^2°C. Determine the temperature distribution in the wall.



K_1 = 20W/m°C
K_2 = 30W/m°C
K_3 = 50W/m°C

Fig Q7 **(20 Marks)**

OR

8 a. Derive stiffness matrix for flow through porous medium. **(10 Marks)**
b. Derive 1D heat conductive finite element matrix using variational method. **(10 Marks)**

Module-5

9 a. Derive shape function for axisymmetric triangular element. **(10 Marks)**
b. Derive stiffness matrix of axisymmetric bodies with triangular element. **(10 Marks)**

OR

10 For the stepped bar shown in Fig Q10, determine the Eigen values and Eigen vectors. Take $A_1 = 400$mm^2, $A_2 = 200$mm^2, $\rho = 7850$ kg/m^3, E = 200GPa.

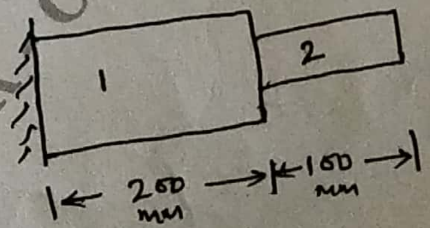


Fig Q10 **(20 Marks)**

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