CBCS SCHEME

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20MMD21

Second Semester M.Tech. Degree Examination, June/July 2024
Advanced Finite Element Analysis

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. In detail discuss about Finite Element procedure. **(10 Marks)**

b. Derive shape functions for Quadratic Borr element with variation of shape function representation. **(10 Marks)**

OR

2 a. Derive shape function for CST (Tria3) element. **(10 Marks)**

b. Derive stiffness matrix for 10 Borr elements. **(10 Marks)**

Module-2

3 a. Obtain [B] matrix for an axisymmetric triangular element. **(10 Marks)**

b. An axisymmetric surface is shown in Fig.Q.3(b). Determine the equivalent loads at nodes 6, 4 and 2 the coordinates of nodes are point 6 are (60, 40)mm point 4 are (40, 55)mm and point 2 are (20, 70)mm.

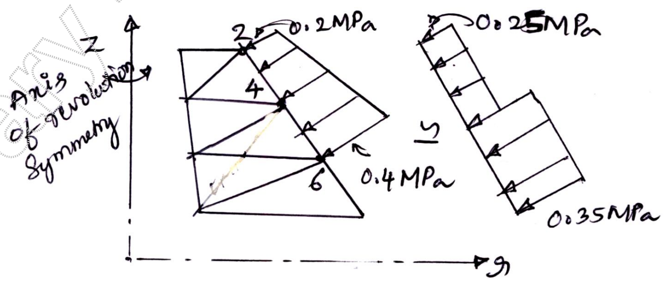

Fig.Q.3(b) **(10 Marks)**

OR

4 Derive stiffness matrix, consistent load vector due to body force and traction force for axisymmetric triangular element. **(20 Marks)**

Module-3

5 a. Derive shape function for 8-noded hexahedral element. **(10 Marks)**

b. Determine the 'J' matrix for 4-noded tetrahedral element. **(10 Marks)**

OR

6 a. Derive shape function for 20 noded hexahedral elements. **(15 Marks)**

b. Write short notes on Pascal pyramid. **(05 Marks)**

t 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-4

7 a. Derive element mass matrix or consistent mass matrix for a bar element. **(06 Marks)**

b. For a beam shown in Fig.Q.7(b), determine the eigen values and corresponding natural frequencies.
Take E = 200GPa, ρ = 7840kg/mm^3, A = 240mm^2, I = 200mm^4.

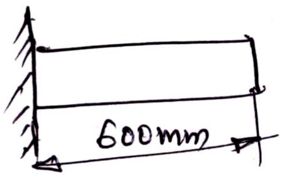

Fig.Q.7(b) **(14 Marks)**

OR

8 For the stepped bars shown in Fig.Q.8. Determine the eigen values and eigen vectors. E = 200GPa, ρ = 7830kg/m^3.

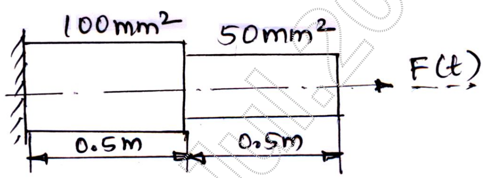

Fig.Q.8 **(20 Marks)**

Module-5

9 Determine the temperature distribution in the composite wall shown in Fig. Q9 1 D heat elements, use elimination method approach of handling boundary conditions.
Given K_1 = 20 W/m°C, K_2 = 30 W/m°C, K_3 = 55 W/m°C, h = 30 W/m^{2}C,
$T_\infty = 900\,°C$, A = unit area.

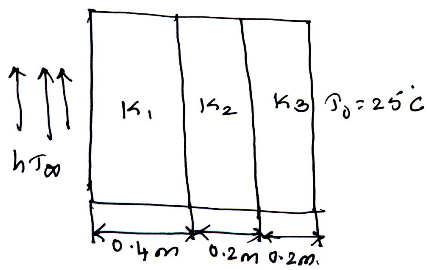

Fig. Q9 **(20 Marks)**

OR

10 a. Derive the stiffness matrix for one dimensional fluid flow element. **(10 Marks)**

b. For the smooth pipe shown in Fig. Q10 (b) with uniform cross section 1 m^2. Determine the flow velocities at the centre and right end, knowing the velocity at the left is V_x = 2 m/sec.

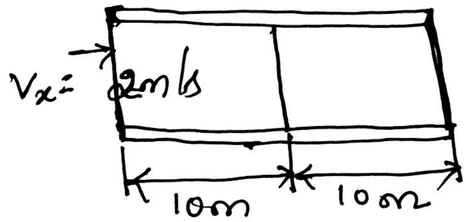

Fig. Q10 (b) **(10 Marks)**

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