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CBCS SCHEME

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18MEA21

Second Semester M.Tech. Degree Examination, July/August 2021
Finite Element Methods

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

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.

1 a. Write a short notes on FEM, applications and limitations. **(10 Marks)**

b. Explain the convergence criteria in FEM with requirements. **(10 Marks)**

2 a. Briefly explain the steps involved in FEM. **(08 Marks)**

b. The Fig.Q2(b) shows a bar fixed at both ends subjected to an axial load as indicated. Determine the displacement at loading point and the corresponding stress.

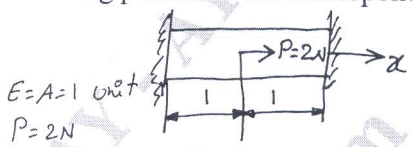

Fig.Q2(b) **(12 Marks)**

3 a. Derive the stiffness matrix for bar element. **(06 Marks)**

b. A bar is loaded as shown in Fig.Q3(b), E = 200GPa by using penalty method find :

i) Nodal displacements

ii) Reactions at the supports

iii) Stresses in each element.

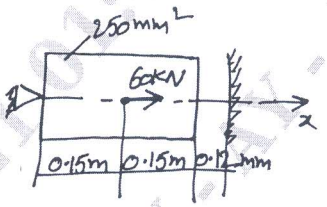

Fig.Q3(b) **(14 Marks)**

4 a. Derive the stiffness matrix to 3D truss element. **(10 Marks)**

b. For a truss element shown in Fig.Q4(b) determine the nodal displacement, take $A = 200mm^2$; E = 200GPa.

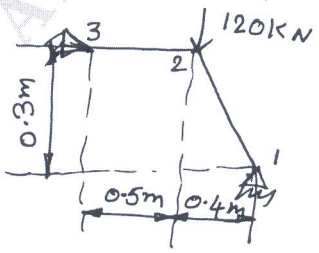

Fig.Q4(b) **(10 Marks)**

5 a. Derive the shape function for 4 noded quadrilateral elements. **(10 Marks)**

b. Explain isoparametric, subparametric and super parametric elements with examples. **(10 Marks)**

6 a. Drive the shape function of quadratic quadrilateral 9-noded 2D element. **(10 Marks)**
b. Derive the shape function for Hexa-8 3D element. **(10 Marks)**

7 a. Explain the FE formulation for triangular plate element. **(08 Marks)**
b. Explain classical thin plate theory for shell and plate elements. **(12 Marks)**

8 Give the detail FE formulation of :
a. Flat element
b. Curved elements
c. Cylindrical elements
d. Conical shell elements. **(20 Marks)**

9 a. Derive the mass matrix for CST element. **(10 Marks)**
b. Derive the mass matrix for truss element. **(10 Marks)**

10 Find the eigen values and eigen vector for stepped bar when it is subjected to axial vibration with fixed free end condition as shown in Fig.Q10.

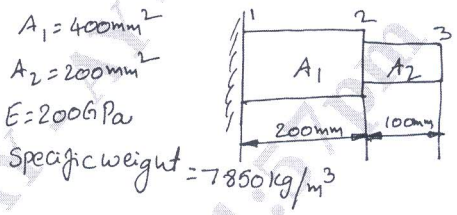

Fig.Q10 **(20 Marks)**

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