05MPM/MSE/MPY/MPT/MPE243

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

NEW SCHEME

Second Semester M.Tech. Degree Examination, June 2007
Finite Element Analysis

Time: 3 hrs.] [Max. Marks:100

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

1 a. Bring out the differences between FEM and continuum methods. **(06 Marks)**

b. Evaluate $\int_{-1}^{1} N^T.N d\xi$, where $[N]=\left[\left(\frac{1-\xi}{2}\right),\left(\frac{1+\xi}{2}\right)\right]$ **(06 Marks)**

c. Discuss the general algorithm for solving the simultaneous equations by Gauss Elimination method. **(08 Marks)**

2 a. State the principle of minimum potential energy and virtual work. **(06 Marks)**

b. Using Rayleigh-Ritz method, determine the deflection at the center of simply supported beam carrying a point load P at its center. **(14 Marks)**

3 a. Define shape functions and classify them. **(06 Marks)**

b. Derive [B] and [K] for 3 noded 1-D element. **(10 Marks)**

c. Mention any four elements used in FEA. **(04 Marks)**

4 a. Solve for stresses considering the self weight of the tapered plate subjected to loading as shown in Fig.4(a). Consider E = 210 GPa, thickness to be 10 mm and density as 7.8 g/cm^3. **(10 Marks)**

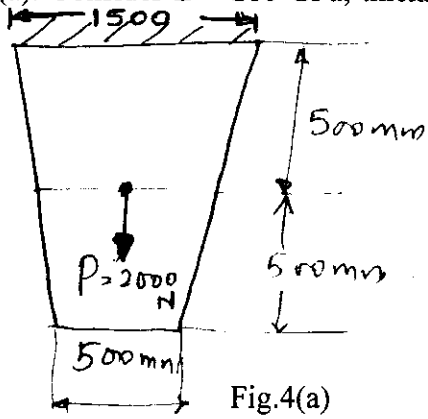

Fig.4(a)

b. Solve for stresses in the composite rod structure given E_{AL} = 70 GPa, E_{steel} = 210 GPa as shown in Fig.4(b). Use penalty approach. **(10 Marks)**

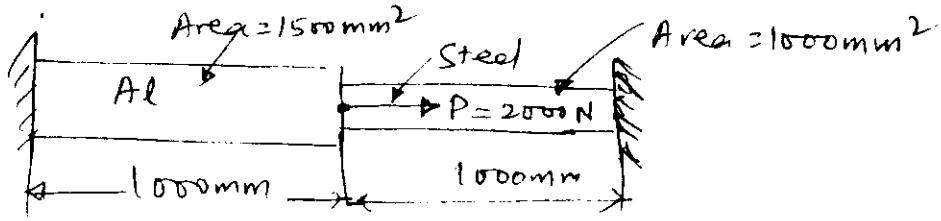

Fig.4(b)

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5 a. Derive: i) Shape function ii) [B] iii) [J] and [K] for a CST element. **(15 Marks)**

b. Write the relation between stress and strain for axisymmetric element. **(05 Marks)**

6 a. Derive an expression for stiffness matrix of 2 noded truss element. **(06 Marks)**

b. Solve for i) Slopes at 2 and 3 ii) Vertical deflection at midpoint of distributed load for a beam subjected to loading of indicated in Fig.6(b). Consider E = 200 GPa and $I = 4 \times 10^6$ mm^4. **(14 Marks)**

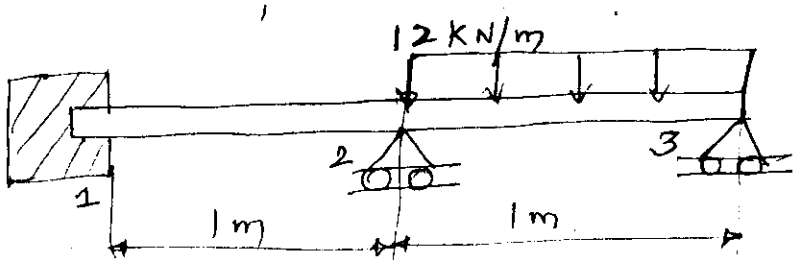

Fig.6(b)

7 a. Derive elemental mass matrix of 2-noded 1-D element. **(05 Marks)**

b. A composite wall shown in Fig.7(b) consists of 3 materials. Determine the temperature distribution in the wall. Consider the following data:
$K_1 = 20$ W/m^{0}C, $K_2 = 30$ W/m^{0}C, $K_3 = 50$ W/m^{0}C, $h_\infty = 25$ W/m^{0}C, $T_\infty = 800^0$C and $T_0 = 20^0$C. **(15 Marks)**

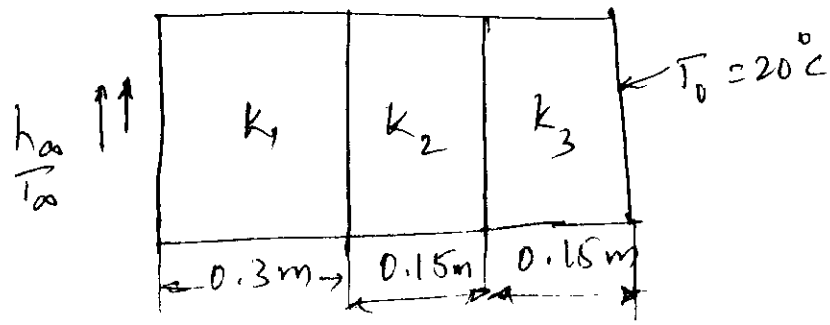

Fig 7(b)

8 Write short notes on any four:

a. Hamilton's principle

b. Convergence criteria

c. Consistent and lumped mass matrices

d. Gaussian quadrature

e. Stiffness matrix of 4 noded Quadra element. **(20 Marks)**

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