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05MPM/MSE/MPT/MPE/MPY243

24

Second Semester M.Tech. Degree Examination, Dec.08/Jan.09

Finite Element Analysis

Time: 3 hrs. Max. Marks:100

Note: *Answer any FIVE full questions*

1 a. Explain the following with appropriate constitutive equations: i) Plane stress ii) Plane strain iii) Axisymmetry. **(10 Marks)**

b. Using Rayleigh Ritz method determine the deflection of a Cantilever beam at its free end carrying a point load P at its tip having a span of L. Use a suitable trial function having at least two Ritz constants. **(10 Marks)**

2 a. Solve for stresses in the bar using principle of minimum potential energy. Refer figure Q2(a). **(12 Marks)**

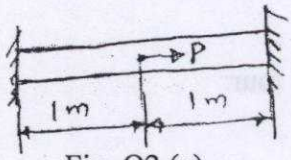


Fig. Q2 (a)

$P = 2N$
$E = 1\ N/m^2$
$A = 1\ m^2$

b. Using two point formula, evaluate

i) $\int_{-1}^{1} N d\xi$ ii) $\int_{-1}^{1} N^T N d\xi$

where $[N]=[N_1, N_2]=\left[\frac{1-\xi}{2}, \frac{1+\xi}{2}\right]$. **(08 Marks)**

3 a. Derive an expression for $[B]$ and $[K]$ for 3 noded 1 D element with uniform cross sectional area. **(12 Marks)**

b. Discuss the penalty approach of handling boundary conditions. **(08 Marks)**

4 a. Derive $[J]$, $[B]$ and $[K]$ for CST element. **(15 Marks)**

b. Explain Galerkin's approach of solving engineering problems. **(05 Marks)**

5 a. Evaluate the shape functions at point P given the coordinates as shown in figure Q5 (a). **(10 Marks)**

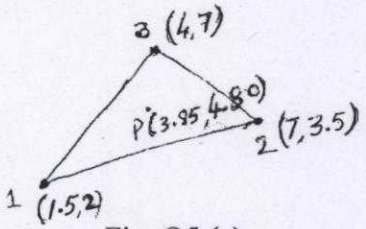


Fig. Q5 (a)

b. Derive the shape functions of nine noded quadrilateral elements. **(10 Marks)**

6 a. Determine the slopes at point 2 and 3 and also the deflection at centre of beam protion carrying UDL as shown in figure Q6 (a). **(15 Marks)**

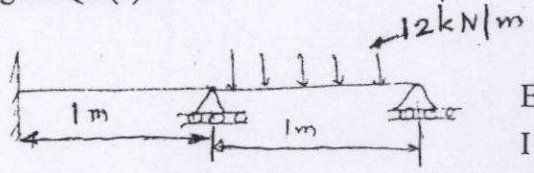
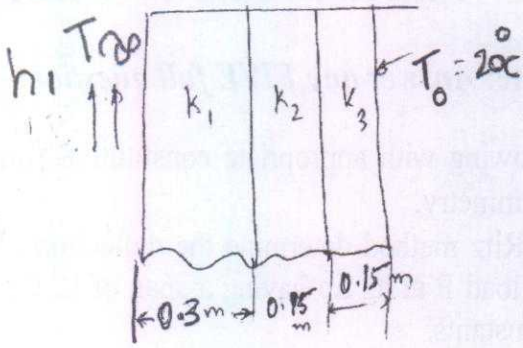


Fig. Q6 (a)

$E = 200$ GPa
$I = 4\times10^6\ mm^4$

b. Sketch the shape function of 2 noded beam elements. **(05 Marks)**

7 a. Determine the temperature distribution in a composite wall as shown in figure Q7 (a). Use penalty approach of handling BCs. **(16 Marks)**



$K_1 = 20$ W/m°C
$K_2 = 30$ W/m°C
$K_3 = 50$ W/m°C
$h = 25$ W/m^2°C
$T = 800$°C

Fig. Q7 (a)

b. Explain the boundary conditions as regards t_0 solution in heat transfer problems by FEM. **(04 Marks)**

8 Write short notes on any four:

a. Elemental mass matrix.
b. Lumped mass.
c. Convergence criteria.
d. Truss element.
e. Eigen values and vectors. **(20 Marks)**

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