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M.E. DEGREE EXAMINATIONS: MAY / JUNE 2010

Second Semester

STRUCTURAL ENGINEERING

SEE505: Finite Element Analysis

**Time: Three Hours**   **Maximum Marks: 100**

Answer All the Questions:-

PART A (10 x 2 = 20 Marks)

1. What is the basis of FEM?

2. A Rayleigh- Ritz solution is usually approximate. Why?

3. What is a shape function?

4. What are lumped loads?

5. What is meant by an Isoparametric element?

6. Define local and global coordinates.

7. What is meant by discretization and assemblage?

8. What are the two types of boundary conditions that exist in a structure?

9. Name any four FEA soft wares.

10. State the methods of engineering analysis.

PART B (5 x 16 = 80 Marks)

11. (a) Determine the deflection and bending moment at centre of the given beam using Galerkine's method

L, E, I, A
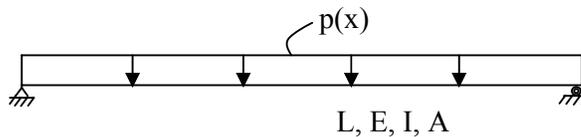
[OR]

(b) A uniform rod fixed at one end and free at the other end is subjected to a uniform axial load q_0 per meter run as shown in figure below. Find the value of stress at any point and compare with the exact result.
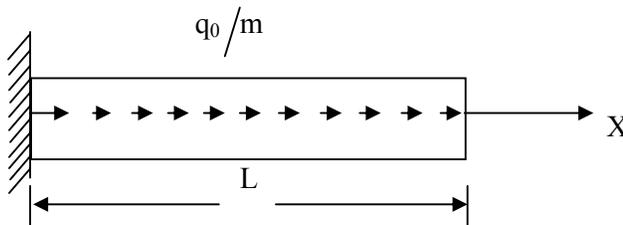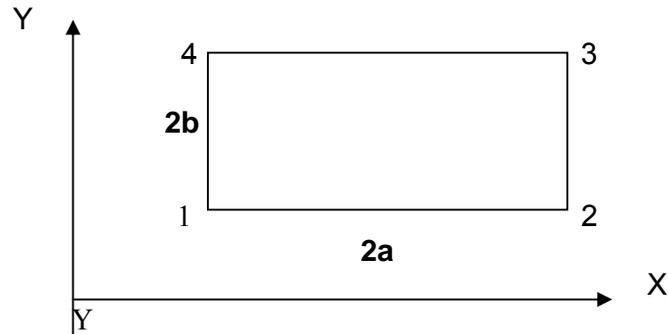

12. (a) Write the advantages, disadvantages and applications of Finite element method? Write step up step general produce of FEM.

(b) Determine the shape function for 4 noded rectangular elements shown in figure below. Use natural coordinate system.


13. (a) Determine the stiffness matrix for the constant strain triangular (CST) element shown in figure, the co-ordinates are given in units of millimeters. Assume plane stress conditions. Take E= 210 GPa, v = 0.25 and t = 10mm.
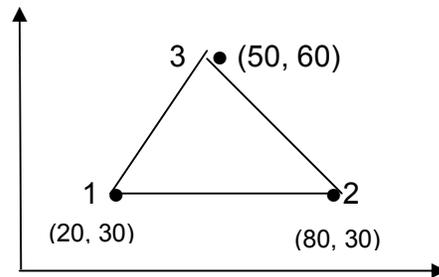
[OR]

(b) For the isoparametric four noded quadrilateral element shown in figure, determine the Cartesian co-ordinates of point P which has local co-ordinates r = 0.5 and s= 0.5
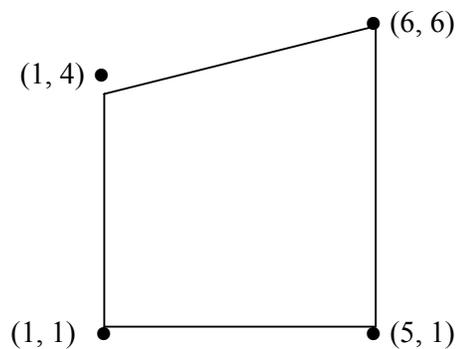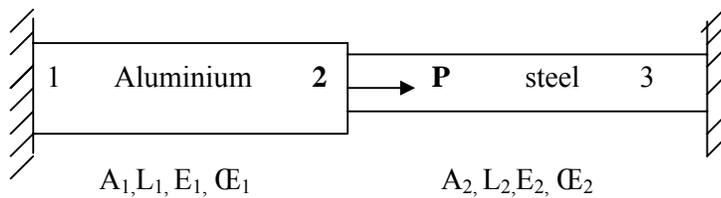
14. (a) Determine the nodal displacement at node **2,** stress in each material and support reactions in the bar shown in figure below. Due to the applied force $P = 400 \times 10^3$ N and temperature rise of $80°C$.

$A_1 = 2400mm^2$, $\qquad$ $A_2 = 1200mm^2$, $\quad$ $L_1 = 300mm$, $L_2 = 400mm$

$E_1 = 0.7 \times 10^5$ N/mm^2 $\qquad$ $E_2 = 2 \times 10^5$ N/mm^2

$Œ_1 = 22 \times 10^{-6}/°C$ $\qquad$ $Œ_2 = 12 \times 10^{-6}/°C$

$A_1, L_1, E_1, Œ_1$ $\qquad\qquad\qquad$ $A_2, L_2, E_2, Œ_2$

[OR]

(b) Determine the nodal displacements and the stress in each member of truss shown in figure below. Find support reaction also. Take modus of elasticity as 200 GPa.
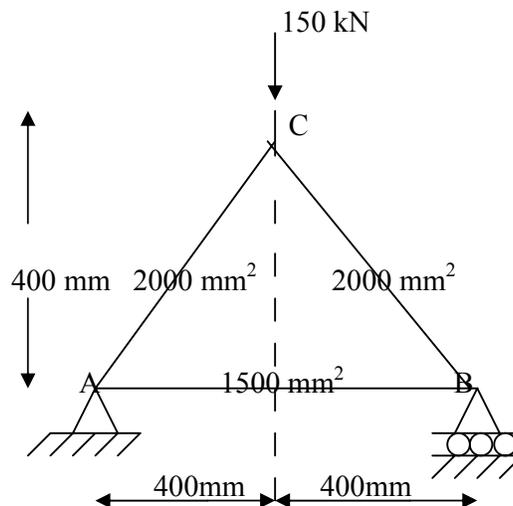
15. (a) Explain the general requirements of Pre & Post processing and Methods of finite element model generation.

[OR]

(b) Write short note on Finite Element Analysis Software and commercially available FEM software packages

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