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M.E DEGREE EXAMINATIONS: JANUARY 2011

First Semester

CAD/CAM

CCM502: Advanced Finite Element Analysis

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

Answer ALL Questions: -

PART A (10 x 2 = 20 Marks)

1. What is meant by Functional approximation?
2. Mention the advantages of weighted-residual method.
3. Define aspect ratio. State its significance.
4. Give meaning of CST element and state its properties.
5. Distinguish with suitable examples about plane stress and plane strain analysis.
6. Provide an example for axisymmetric problem?
7. Differentiate between material non linearity and geometric non linearity.
8. Classify the importance of isoparametric, super parametric and sub parametric elements.
9. Indicate the merits of lumped and consistant mass matrix
10. List out the methods of solution of eigen value problems.

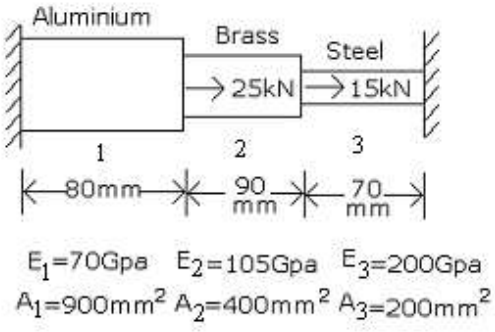
PART B (5 x 16 = 80 Marks)

11. (a) (i) Derive the generalized stiffness matrix from minimum potential energy principle. (4)

(ii) Prove that structure stiffness matrix is always symmetric. (12)

(OR)

(b) For the three stepped bar shown in figure.



Determine

(i) The displacements at Nodes 2 and 3

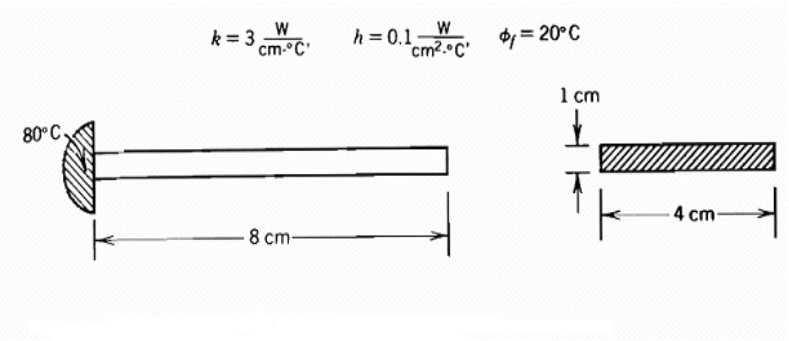
(ii) Stresses in three sections

(iii) Reactions at the ends.

12. (a) Derive shape function for Constant strain triangular (CST) element.

(OR)

(b) Calculate the temperature distribution in a one dimensional fin with the physical properties given in figure. The fin is rectangular in shape, and is 8cm long 4cm wide and 1cm thick. Assume that convection heat loss occurs from the end of the fin. The fin modeled by four elements with a length of 2cm.



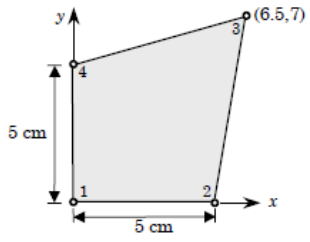
13. (a) Calculate the shape functions at point p (40, 50) of a CST whose Coordinates are 1(5, 45), 2(75, 5) and 3(50, 60), and also calculate stiffness matrix for plane stress condition. Take t=10mm and E = 2 × 105 N/mm^2.

(OR)

(b) The nodal coordinates for an axisymmetric triangular element are 1(20mm, 10mm), 2(40mm, 10mm) and 3(30mm, 50mm). Determine the strain-displacement matrix for that element.

14. (a) (i) What is a 'jacobian transformation'? (4)

(ii) Determine the Jacobian matrix and the transformation equations for the elements given in Fig. (12)



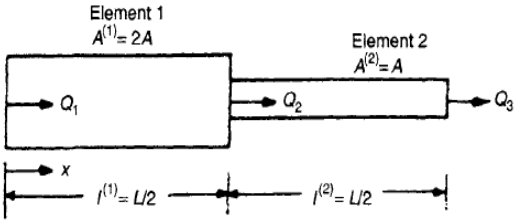
(OR)

(b) (i) What are the advantages of 'Gaussian quadrature' numerical integration for isoparametric elements? (4)

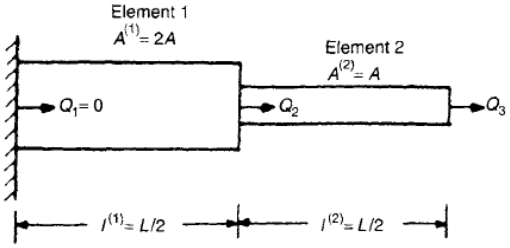
(ii) Evaluate the integral I= $\int_{-1}^{1}\left[3e^{x}+x^{2}+\frac{1}{(x+2)}\right]dx$ using one point and two point gauss-quadrature. Compare this with exact solution. (12)

15. (a) Find the natural frequencies of longitudinal vibration of the unconstrained and constrained stepped bar shown in Figure.

Unconstrained

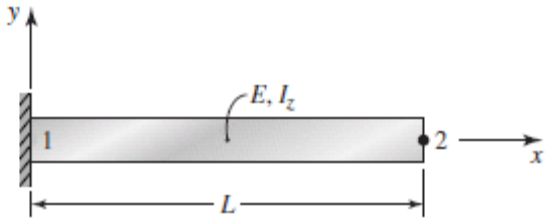


Constrained



(OR)

(b) Using a single finite element as shown in figure, determine the natural circular frequencies of vibration of a Cantilevered beam of length L, assuming constant values of ρ, E, and A.



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