

B. Tech. Aerospace Engineering (Semester – 7th)
FINITE ELEMENT ANALYSIS
Subject Code: BASES1701
Paper ID: 19113031

Time: 03 Hours

Maximum Marks: 60

Instruction for candidates:

1. Section A is compulsory. It consists of 10 parts of two marks each.
2. Section B consist of 5 questions of 5 marks each. The student has to attempt any 4 questions out of it.
3. Section C consist of 3 questions of 10 marks each. The student has to attempt any 2 questions.

Section – A

(2 marks each)

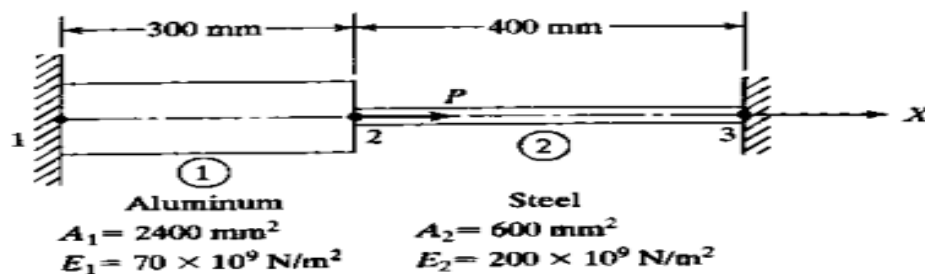
Q1. Attempt the following:

- a. What do you mean by FEM? What are its applications?
- b. What do you mean by Shape functions?
- c. Give the comparison between local and global co-ordinate systems.
- d. Explain the significance of convergence criteria in the finite element method.
- e. State one advantage and one limitation of using triangular elements in finite element analysis.
- f. Name one advantage of finite element methods over other numerical techniques in engineering.
- g. Write the general FEM equation.
- h. Write down the general solution steps in FEM
- i. State one advantage and one limitation of finite difference method over finite element analysis.
- j. Define isoparametric elements and their significance in numerical analysis.

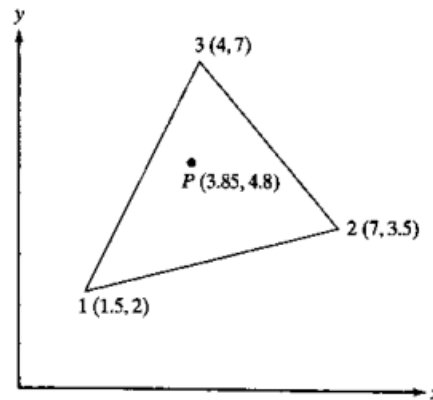
Section – B

(5 marks each)

- Q2. Derive the equations for element mass matrices for the 1D bar Element?
- Q3. Explain the formulation of an axisymmetric element. How does it differ from the plane stress and plane strain elements?
- Q4. Consider the bar shown in figure. An axial load $P = 200 \times 10^3$ N is applied as shown. Determine the nodal displacements.



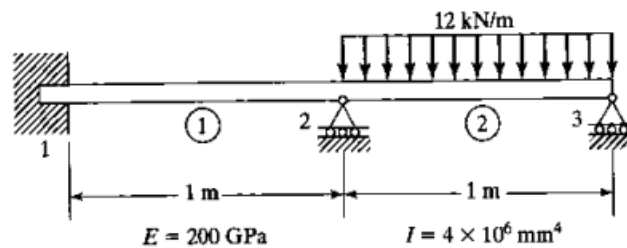
- Q5. Explain the variation approach and weighted residual approach in the context of solving structural mechanics problems.
- Q6. Evaluate the shape functions N_1 , N_2 , and N_3 at the interior point P for the triangular element shown in the figure.



Section – C

(10 marks each)

- Q7. Define numerical integration techniques for evaluating elemental matrices of isoparametric elements. Discuss their importance in ensuring accurate solutions in finite element analysis.
- Q8. For the beam and loading shown in the figure determine the slopes at 2 & 3 and vertical deflection at the midpoint of the distributed load.



- Q9. Derive the shape functions for 4-nodal quadrilateral elements.