Register No.: …… Name: ……..

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

SECOND SEMESTER M.TECH DEGREE EXAMINATION (R,S), MAY 2024

MACHINE DESIGN

(2021 Scheme)

Course Code: **21MD201**

Course Name: **Finite Element Analysis**

Max. Marks: **60** **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. Explain the term 'Shape Functions'. Why polynomial terms are preferred for shape functions in finite element method?
2. Differentiate between linear bar element and quadratic bar element
3. Differentiate between bar element and truss element.
4. Explain classical beam theory.
5. Explain the isoparametric concept in finite element analysis.
6. What is an axisymmetric element? Mention its characteristics.
7. What are the unknowns in plane stress problems? Explain them.
8. Define plane strain. Explain with an example the plane strain equation condition.

PART B

(Answer one full question from each module, each question carries 6 marks)

MODULE I

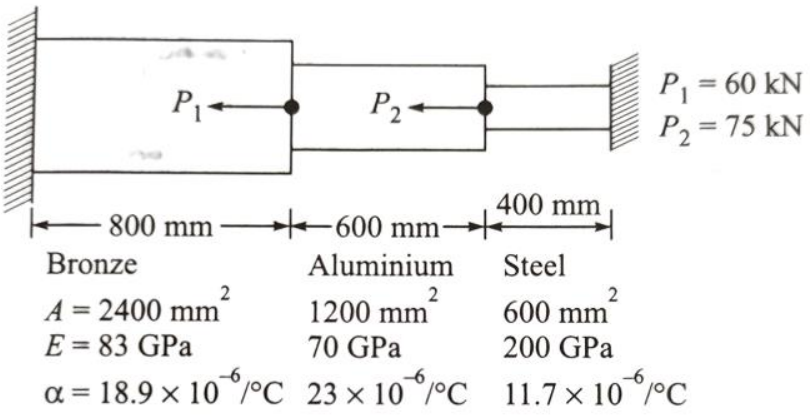
9. Determine the shape function for a two noded bar element using natural co-ordinate system. (6)

OR

10. Explain general procedure for finite element analysis (6)

MODULE II

11. The structure shown in the figure is subjected to an increase in temperature of 80^0C. The reference temperature is 20^0C. Determine the nodal displacements and element stresses. (6)

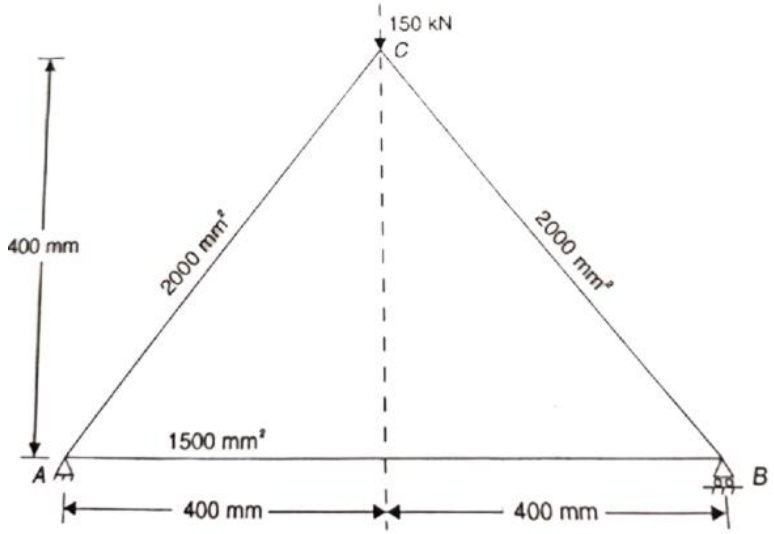


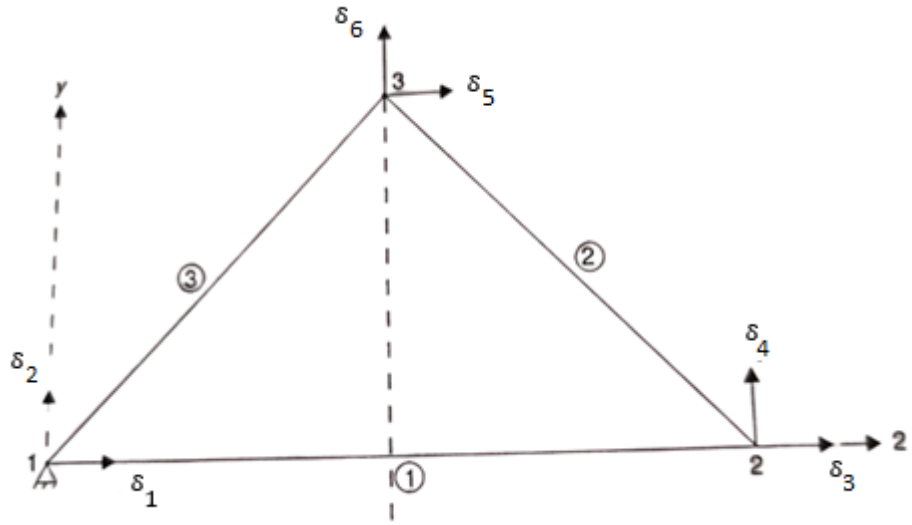
OR

12. Derive the shape function for a quadratic one dimensional bar element (6)

MODULE III

13. Determine the nodal displacements for the three-bar truss shown in figure. Take the modulus of elasticity as 200 GPa. [$\theta_1 = 0^0$, $\theta_2 = 135^0$, $\theta_3 = 45^0$] (6)





OR

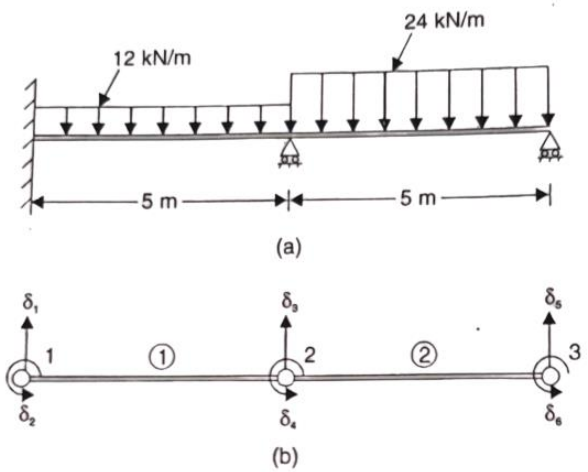
14. Derive the elemental stiffness matrix and stress equation for a truss element. (6)

MODULE IV

15. Derive the stiffness matrix for a frame element (6)

OR

16. Formulate the stiffness matrix using finite element method for the beam shown in figure. E = 2 x 10^5 N/mm^2 and I = 5 x 10^6 mm^4. (6)



MODULE V

17. a) What are cylindrical coordinates? Explain (3)
    b) Explain axisymmetric elasticity (3)

OR

18. a) Explain the isoparametric representation of 2D elements. (3)
    b) Explain the completeness check for isoparametric formulation (3)

MODULE VI

19. Explain weak and strong forms of governing equations used for plane stress problems. (6)

OR

20. Derive the finite element equations to model plane stress and plane strain problems. (6)

****