Register No.: …… Name: ……..

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

SECOND SEMESTER M.TECH DEGREE EXAMINATION (Regular), JULY 2022

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. What does discretization mean in the finite element method? Explain with an example.
2. What are the characteristics of structural bar members?
3. Differentiate between bar element and truss element.
4. What are the assumptions of classical beam theory?
5. Explain method of weighted residuals.
6. Explain the isoparametric concept in finite element analysis.
7. Define plane stress. Explain with an example the plane stress equation condition.
8. What are the unknowns in plane stress problems? Explain them.

PART B

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

MODULE I

9. Explain general procedure for Finite Element Analysis (6)

OR

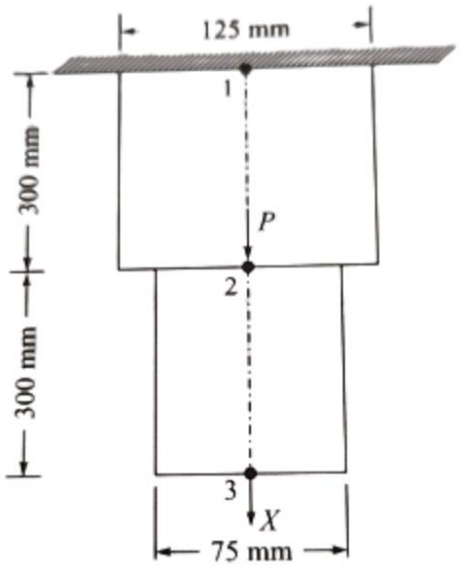
10. a) What are numerical methods? Explain them briefly. (3)
    b) List at least six engineering applications of FEM. (3)

MODULE II

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

OR

12. The plate shown in figure has a uniform thickness t = 25 mm, Young's modulus E = 200 GPa and weight density ρ = 7850 kg/m^3. In addition to its self weight the plate is subjected to a point load P = 1200 N at its midpoint. Determine the following (i) Global stiffness matrix and nodal displacements (ii) Stress in each element (6)

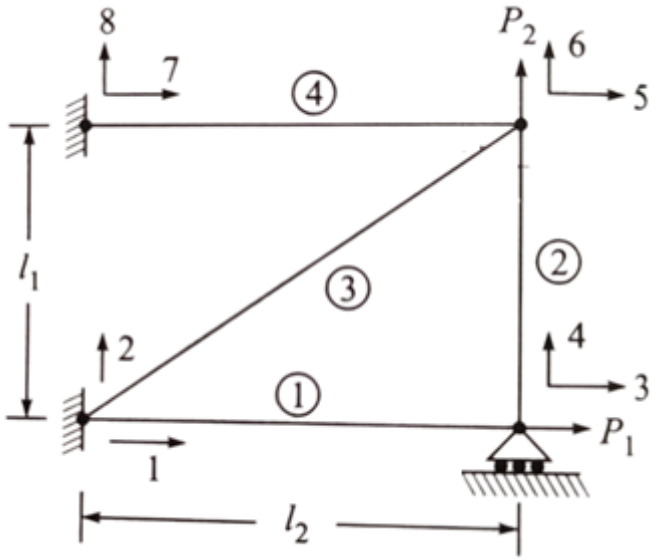


MODULE III

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

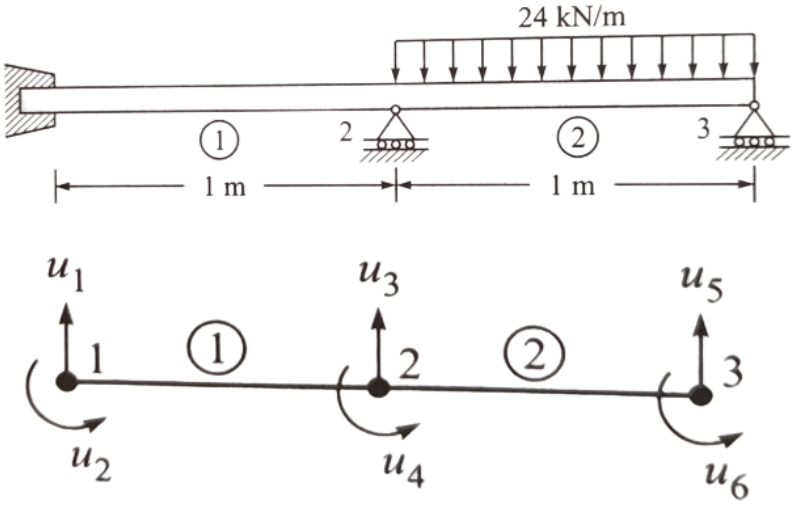
OR

14. A four bar truss shown in figure is subjected to the loading conditions. The modulus of elasticity of material is 20000 N/mm^2. The area of the bar used for the truss is 60 mm^2 for all elements. The length l_1 = 75cm and l_2 = 100cm. The load P_1 = 20 kN and P_2 = 25kN. Determine (i) The element stiffness matrix for each element. (ii) Assemble the structural stiffness matrix for the entire truss. (6)



MODULE IV

15. For a beam shown in figure determine the slope at node 2 and 3. All the elements have E = 200 GPa and I = 5 x 10^6 mm^4. (6)



OR

16. Derive the stiffness matrix for a beam element (6)

MODULE V

17. a) State and explain the three basic laws on which isoparametric concept is developed (3)
    b) Explain the terms isoparametric, subparametric and superparametric elements (3)

OR

18. a) What is an axisymmetric element? Mention its characteristics (3)
    b) Explain axisymmetric elasticity (3)

MODULE VI

19. Explain the mathematical model of plate in plane stress (6)

OR

20. Derive the governing equations of plane stress (6)

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