

- b) Both A and R is true. But R is not the correct reason for A.
 c) A is true. But R is false.
 d) Both A and R is false.
5. Classify $[C]$ and $[\beta]$ [K₂]
1. Equilibrium matrices
 2. Transformation matrices
 3. Compatibility matrices
- a) 1,2 b) 1,3
 c) 2,3 d) 1,2,3
6. Select which type of structures can be solved using equilibrium equations. [K₂]
- a) Indeterminate truss b) Indeterminate frame
 c) Determinate truss d) All of these
7. Rewrite the following sequentially [K₂]
- 1) Draw SFD and BMD
 - 2) Use $[K]$ or $[a]$ to find $\{u\}$
 - 3) Calculate $\{\delta\}$
 - 4) Evaluate $\{P\}$
- a) 1,2,3,4 b) 4,2,1,3
 c) 2,3,4,1 d) 3,2,1,4
8. Identify the method used to solve $[c_1]\{X\}=\{c_2\}$ [K₂]
- a) Gaussian method b) Langrangian method
 c) Terzaghi method d) Bernoulli's method
9. Assertion (A): For frames and beams it is easier to formulate $[b]$. [K₂]
 Reason (R): For frames and beams $[E]$ is assembled from joint equilibrium equations and not the member equilibrium equations.
- a) Both A and R is true. And R is the correct reason for A.
 b) Both A and R is true. But R is not the correct reason for A.
 c) A is true. But R is false.
 d) Both A and R is false.
10. Identify the method used to select redundancy [K₂]

- a) Topology method
- b) Runge kutta method
- c) Hermitian method
- d) Rank Technique

PART B (10 x 2 = 20 Marks)

- 11. Relate Static indeterminacy and kinematic indeterminacy with stiffness method and flexibility method. [K₃]
- 12. Identify number of generalized coordinates for the structure shown in fig.12. [K₂]

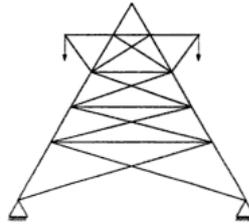


Fig.12

- 13. Estimate the equivalent stiffness and flexibility for the springs shown in fig.13. [K₂]

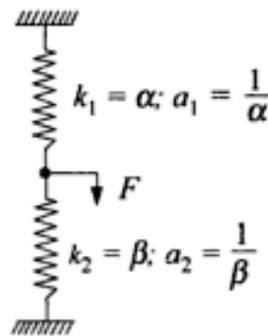


Fig.13

- 14. Distinguish stiffness and flexibility coefficients. [K₂]
- 15. Indicate the properties of stiffness and flexibility matrices. [K₂]
- 16. Relate transformation matrix and rotation matrix. [K₃]
- 17. List the assumptions in principle of superposition. [K₁]
- 18. Explain what is meant by static condensation. [K₂]
- 19. Explain what is the difficulty of implementing flexibility method in computer programs? [K₂]
- 20. List some software packages used for matrix calculations. [K₁]

PART C (6 x 5 = 30 Marks)

21. Compute the flexibility matrix or stiffness matrix using principle of superposition and find the other matrix using reciprocal relationship for structure in fig.21. [K₃]

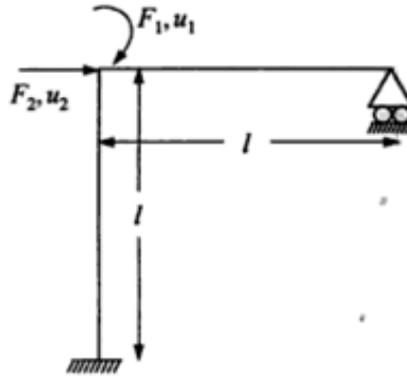


Fig.21

22. Draw the shear force diagram and bending moment diagram for the beam shown in fig.22 [K₃]

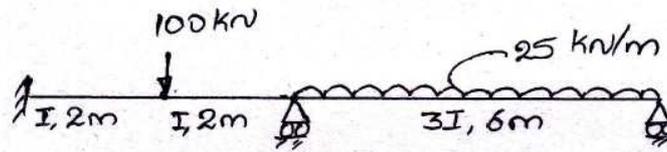


Fig.22

23. Defend contra-gradient law using both stiffness and flexibility approaches. [K₂]

24. Analyse the truss shown in fig.24. Assume $AE = \text{constant}$ [K₄]

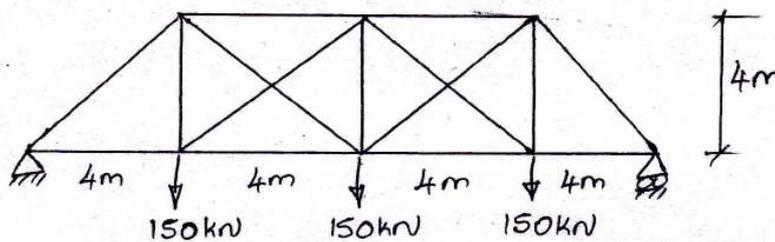


Fig.24

25. Compute the stiffness matrix and using static condensation technique, eliminate the internal degree of freedom for the element shown in fig. 25. [K₃]

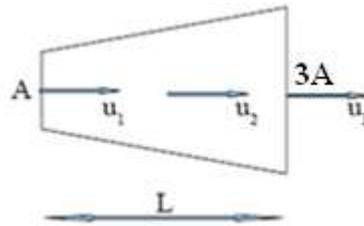


Fig.25

26. Write a program in C to perform matrix operations (Addition, multiplication and inverse). [K₃]

PART D (4 x 10 = 40 Marks)

27. The degrees of freedom of the system shown in fig.27 are θ_A and θ_F . Using the stiffness method, compute the rotations and the forces in the spring. [K₃]
- Write the equations of equilibrium necessary to apply the stiffness method.
 - Define the spring constants in terms of θ_A and θ_B .
 - Define the force displacement relation.
 - Solve for θ_A and θ_F
 - Solve for spring forces.

Assume $k_b = 2500$ kN/cm, $k_c = 3000$ kN/cm and $k_e = 2000$ kN/cm.

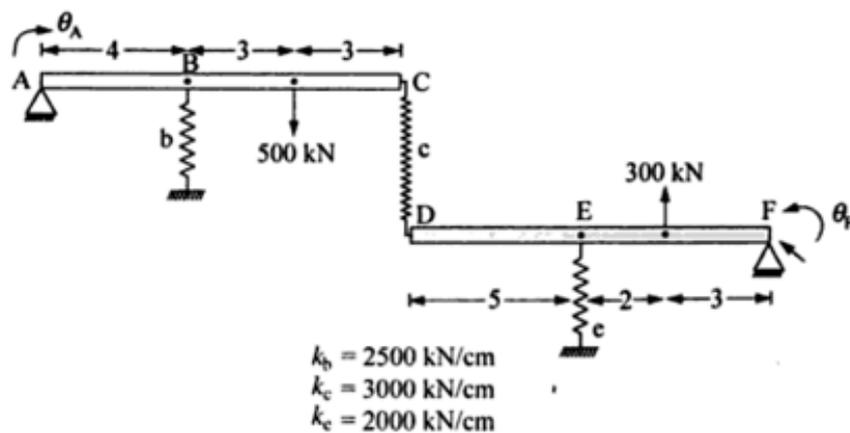


Fig.27

28. Form the flexibility matrix for the beam shown in fig.28 and compute the displacements at coordinates, if $F_1 = 10$ kN and $F_2 = F_3 = F_4 = 0$. Assume that EI is constant for the beam. [K₃]

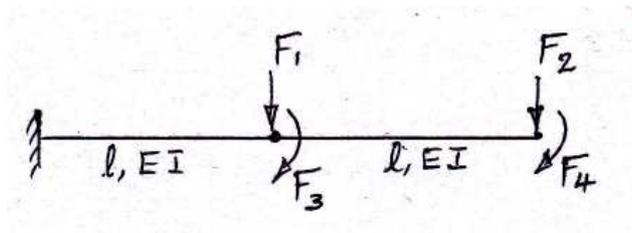


Fig.28

29. Using Direct Stiffness method, Analyse the truss shown in fig.29. [K₄]

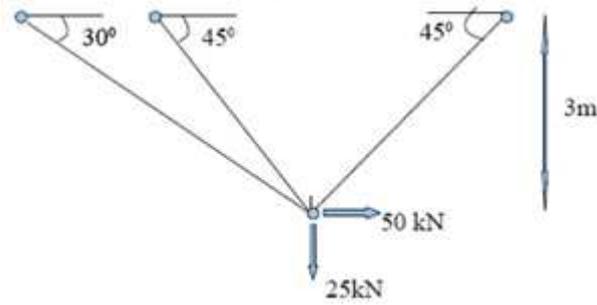


Fig.29

30. Compute the slope at the supports and deflection at the mid span for the beams shown in fig.30. [K₃]

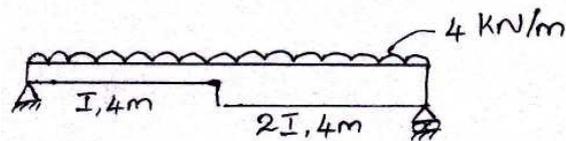


Fig.30
