



Work sheet(Unit wise Objective)

UNIT-IV: Matrix Methods - Stiffness Matrix Method

PART A: Multiple Choice Questions (MCQs)

1. The stiffness matrix method is also known as the:

- A) Force Method
- B) Flexibility Method
- C) **Displacement Method**
- D) Energy Method

Answer: C) Displacement Method

2. In the stiffness method, the primary unknowns are:

- A) Member forces
- B) Support reactions
- C) Internal stresses
- D) **Joint displacements**

Answer: D) Joint displacements

3. The basic equation of the stiffness method is:

- A) $\{P\} = [F]\{D\}$
- B) $[K]\{P\} = \{D\}$
- C) $[K]\{D\} = \{P\}$
- D) $[D]\{K\} = \{P\}$

Answer: C) $[K]\{D\} = \{P\}$

4. The symbol $[K]$ represents:

- A) Load matrix
- B) Flexibility matrix
- C) Transformation matrix
- D) **Stiffness matrix**

Answer: D) Stiffness matrix

5. Degree of freedom (DOF) refers to:

- A) Number of supports
- B) Number of members
- C) **Number of independent joint displacements**
- D) Number of reactions

Answer: C) Number of independent joint displacements

6. The stiffness method is particularly suitable for:

- A) Manual calculations only
- B) Small structures only
- C) **Computer programming**
- D) Graphical analysis

Answer: C) Computer programming

7. The stiffness matrix of a beam element depends on:

- A) Load intensity only
- B) Span length only
- C) **Modulus of elasticity (E), Moment of inertia (I), and Length (L)**
- D) Support reactions only

Answer: C

8. Before solving the stiffness equations, it is necessary to:

- A) Draw SFD
- B) Draw BMD
- C) **Apply boundary conditions**
- D) Find reactions

Answer: C

9. The global stiffness matrix is obtained by:

- A) Multiplying member matrices
- B) Inverting member matrices
- C) **Assembling all member stiffness matrices**
- D) Transposing member matrices

Answer: C

10. In a fixed support, the rotation is:

- A) Free
- B) Unknown
- C) Variable
- D) **Zero**

Answer: D

11. A continuous beam has:

- A) One support
- B) Two supports
- C) **More than two supports**
- D) No support

Answer: C

12. Support settlement introduces:

- A) Axial force only
- B) Shear force only
- C) **Equivalent joint loads**
- D) Temperature stresses only

Answer: C

13. A pin-jointed plane frame carries:

- A) Bending moment only
- B) Shear force only
- C) **Axial force only**
- D) Torsion only

Answer: C

14. The stiffness method is based on:

- A) Force equilibrium
- B) Stress equilibrium
- C) **Displacement compatibility**
- D) Material failure

Answer: C

15. The maximum bending moment occurs where:

- A) Load is maximum
- B) **Shear force is zero**
- C) Reaction is zero
- D) Deflection is zero

Answer: B

16. A portal frame generally consists of:

- A) Beam only
- B) Column only
- C) **Beams and columns**
- D) Truss members only

Answer: C

17. The elastic curve represents:

- A) Shear force variation
- B) Moment variation
- C) Stress distribution
- D) **Deflected shape of the structure**

Answer: D

18. Which method is widely used in structural analysis software?

- A) Graphical Method
- B) Moment Area Method
- C) Flexibility Method
- D) **Stiffness Matrix Method**

Answer: D

19. The size of the global stiffness matrix depends on:

- A) Number of members
- B) Number of supports
- C) **Number of degrees of freedom**
- D) Length of structure

Answer: C

20. Which of the following is an advantage of the stiffness method?

- A) Difficult for computer implementation
- B) Applicable only to determinate structures
- C) Requires graphical solution
- D) **Suitable for large and complex structures**

Answer: D

PART B: Fill in the Blanks with Answers (Answers Beside the Blanks)

1. The stiffness matrix method is also called the _____. (Answer: Displacement)
2. The basic stiffness equation is _____. (Answer: $[K]\{D\} = \{P\}$)
3. The unknowns in the stiffness method are joint _____. (Answer: Displacements)
4. The symbol $[K]$ represents the _____ matrix. (Answer: Stiffness)
5. The number of independent joint movements is called the _____ of freedom. (Answer: Degree)
6. The stiffness matrix method is highly suitable for _____ analysis. (Answer: Computer)
7. A continuous beam has more than _____ supports. (Answer: Two)
8. The stiffness of a beam member depends on EI and _____. (Answer: Length (L))
9. All member stiffness matrices are combined to form the _____ stiffness matrix. (Answer: Global)
10. Support conditions are introduced by applying _____ conditions. (Answer: Boundary)
11. Support settlement produces additional _____ moments. (Answer: End)
12. Pin-jointed plane frames carry only _____ forces. (Answer: Axial)
13. A portal frame consists of beams and _____. (Answer: Columns)
14. The maximum bending moment generally occurs where the shear force is _____. (Answer: Zero)
15. The deflected shape of a beam is known as the _____ curve. (Answer: Elastic)
16. The stiffness matrix method is based on _____ compatibility. (Answer: Displacement)
17. The reactions are calculated after determining the joint _____. (Answer: Displacements)
18. The stiffness matrix method is extensively used in _____ element analysis. (Answer: Finite)
19. The size of the global stiffness matrix depends on the number of _____ of freedom. (Answer: Degrees)
20. The stiffness matrix method is one of the most widely used methods for _____ analysis. (Answer: Structural)