DEPARTMENT OF CIVIL ENGINEERING

CE3502- STRUCTURAL ANALYSIS-1

UNIT-5- STIFFNESS METHOD

2 MARKS QUESTIONS

S.No	QUESTIONS	CO'S
1.	**Define static indeterminacy.** The excess number of reactions that make a structure indeterminate is called static indeterminacy. Static indeterminacy = No. of reactions – Equilibrium conditions	CO5
2.	**Define flexibility of a structure.** This method is also called the force method in which the forces in the structure are treated as unknowns. The no of equations involved is equal to the degree of static indeterminacy of the structure.	CO5
3.	**Write down the equation of element stiffness matrix as applied to 2D plane element.** The equation of element stiffness matrix for 2D plane element is $K = \frac{EI}{L}\begin{bmatrix} 4 & 2 \\ 2 & 4 \end{bmatrix}$	CO5
4.	**Define degree of freedom of the structure with an example. What is degree of kinematic indeterminacy and give an example.** Degree of freedom is defined as the least no of independent displacements required to define the deformed shape of a structure. There are two types of DOF: (a) Nodal type DOF and (b) Joint type DOF. For example:  i = r – e where, r = no of reactions, e = no of equilibrium conditions r = 4 and e = 3 i = 4 – 3 = 1	CO5
5.	**Write a short note on global stiffness matrices.** The size of the global stiffness matrix (GSM) = No: of nodes x Degrees of freedom per node.	CO5
6.	**Write a note on element stiffness matrix.**	CO5

	The element stiffness is K1 , K2 , K3 etc..... $K = \begin{bmatrix} K_1 & 0 & 0 \\ 0 & K_2 & 0 \\ 0 & 0 & K_3 \end{bmatrix}$	
7.	**List out the properties of rotation matrix.** • Matrix multiplication has no effect on the zero vectors (the coordinates of the origin). • It can be used to describe rotations about the origin of the coordinate system. • Rotation matrices provide an algebraic description of such rotations. • They are used extensively for computations. • Rotation matrices are square matrices with real entries.	**CO5**
8.	**What are the basic unknowns in stiffness matrix method?** In the stiffness matrix method nodal displacements are treated as the basic unknowns for the solution of indeterminate structures.	**CO5**
9.	**List the properties of the stiffness matrix.** • The properties of the stiffness matrix are: • It is a symmetric matrix • The sum of elements in any column must be equal to zero. • It is an unstable element therefore the determinant is equal to zero.	**CO5**
10.	**Compare flexibility method and stiffness method.** **Flexibility matrix method:** • The redundant forces are treated as basic unknowns. • The number of equations involved is equal to the degree of static indeterminacy of the structure. • The method is the generalization of consistent deformation method. • Different procedures are used for determinate and indeterminate structures. **Stiffness matrix method:** • The joint displacements are treated as basic unknowns • The number of displacements involved is equal to the no of degrees of freedom of the structure • The method is the generalization of the slope deflection method. • The same procedure is used for both determinate and indeterminate structures.	**CO5**