



SNS COLLEGE OF TECHNOLOGY

DEPARTMENT OF AGRICULTURAL ENGINEERING

23AGT205-STRENGTH OF MATERIALS FOR AGRICULTURAL ENGINEERING

NOTES UNIT III

DETERMINATE STRUCTURES

Every Structure must stand firm against forces - gravity, wind or weight. Engineers need to calculate internal forces (BM, SF, AF) & Reactions at Support.

A Statical determinate Structure is one where all Support-reactions & internal forces can be determined using three equations of Static equilibrium.

$$\sum F_x = 0; \sum F_y = 0; \sum M = 0$$

Example: SSB, Three Hinged arch, Simple Truss

INDETERMINATE STRUCTURES

These Structures have more unknowns than equilibrium equations.

Structure with 1 extra eqn - 1 Degree Indeterminate

2 extra eqn - 2 Degree Indeterminate

Eg: Fixed Beam, Continuous Beam, Rigid Frames.

STATIC INDETERMINACY

A Structure is said to be statically Indeterminate if Number of unknown forces (SR, IF) exceed No. of available Static equilibrium.



No. of external Member force

$$SI = r + m - 3j \rightarrow \text{Joint}$$

↓

No. of external Reaction

If $SI = 0 \rightarrow$ Statically determinate

If $SI > 0 \rightarrow$ Statically Indeterminate

If there are more than 3n unknowns (No. of members and joints), then structure is Statically indeterminate.

KINEMATIC INDETERMINACY:

It is the No. of independent displacement components (Translations & Rotations) required to describe the deformation of structure

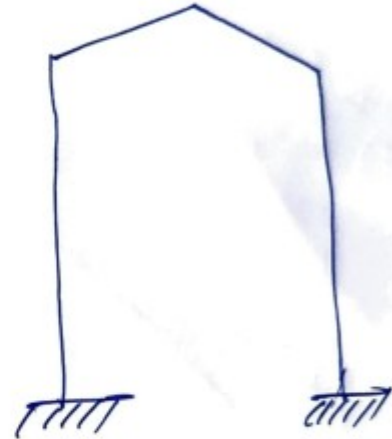
$$KI = 3j - r \rightarrow \text{Joint} \quad \text{External Restraints}$$

$KI = 0$ (Kinematically Determinate)

$KI > 0$ (Flexible)



Frame Structure



$$\text{Members (m)} = 3$$

Fixed at Base & Support = 6 Reactions

$$\text{Joint} = 3$$

$$SI = r + m - 3j$$

$$= 6 + 3 - 9 = 0$$

$$KI = 3j - r$$

$$= 3(3) - 6$$

$$= 9 - 6 = 3 \text{ (3 DOF)}$$