23MET204
MECHANICS OF MACHINES
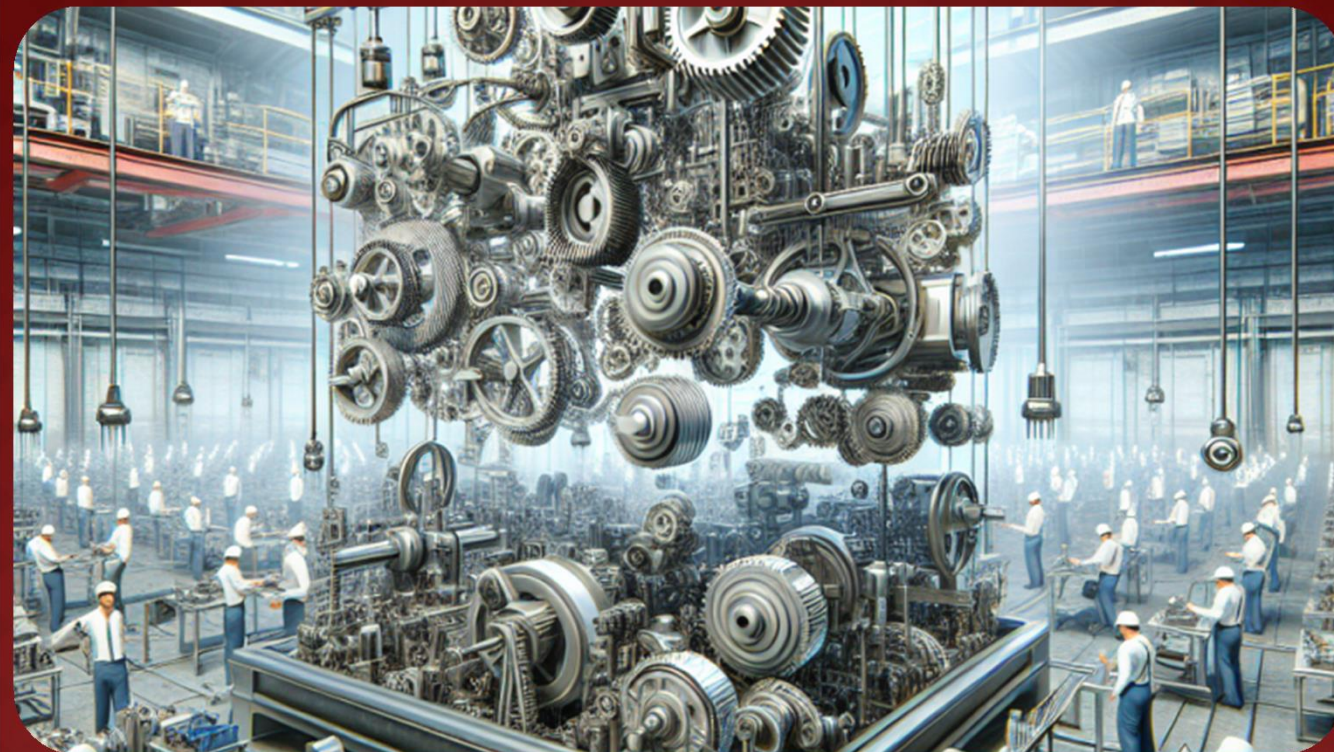
MECHANICS OF MACHINES - AN OVERVIEW

Presented by

B.Balamurali
AP/MECH

RECAP !!!

STRUCTURE

Structure is an assemblage of number of resistant bodies having no relative motion between them.

CONSTRAINED MOTIONS

- ❖ **Completely Constrained Motion**
- ❖ **Incompletely Constrained Motion**
- ❖ **Successfully Constrained Motion**

CONSTRAINED MOTIONS

- **Completely Constrained Motion –** When the relative motion between two links is limited to a definite direction, then the motion is said to be a completely constrained motion.

CONSTRAINED MOTIONS

- **Incompletely Constrained Motion -** When the relative motion between two links can take place in more than one direction, then the motion is said to be a incompletely constrained motion.

CONSTRAINED MOTIONS

- **Successfully Constrained Motion -** When the relative motion between two links is not completely by itself, but it is achieved by some other means, then the motion is said to be a successfully constrained motion.

CONDITION TO FORM A KINEMATIC CHAIN

$$J+h/2 = (3/2)n-2$$

Where,

       n = Number of Links

       p = Number of Pairs

       j = Number of binary Joints

       h = Number of higher pairs

A.W. Klien's Criterion of Constraint is used to Determine the nature of chain

➢ If **L.H.S > R.H.S.,** then the given chain is called locked chain or structure.

➢ If **L.H.S = R.H.S.,** then the given chain is called constrained kinematic chain.

➢ If **L.H.S < R.H.S.,** then the given chain is called unconstrained kinematic chain.

A.W. KLIEN'S CRITERION OF CONSTRAINT IS USED TO DETERMINE THE NATURE OF CHAIN
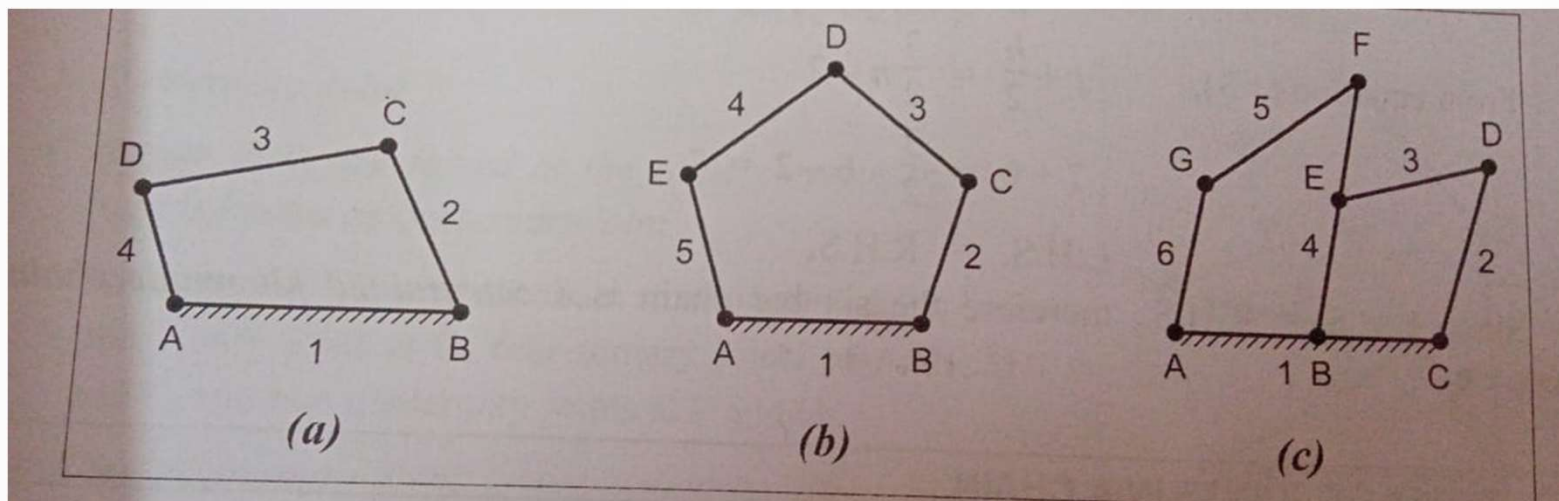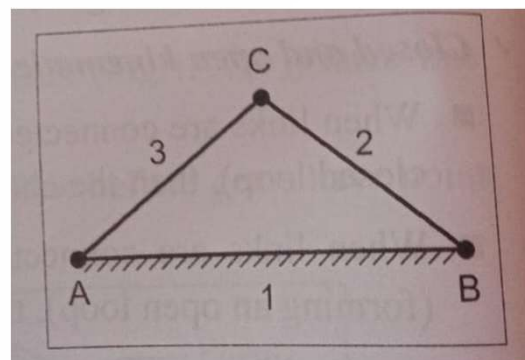
TYPES OF JOINTS

- **Binary Joint –** If the two links are joined at the same connection, the joint is known as binary joint.

- **Ternary Joint –** If the three links are joined at the same connection, the joint is known as ternary joint.

No. of Binary joints, j = No. of binary joints + 2(No. of ternary joints)

- **Quaternary Joint –** If the four links are joined at the same connection, the joint is known as quaternary joint.

No. of Binary joints, j = No. of binary joints + 2(No. of ternary joints) + 2(No. of quaternary joints)

TYPES OF JOINTS

(a) 9-link chain

(a) 12-link chain
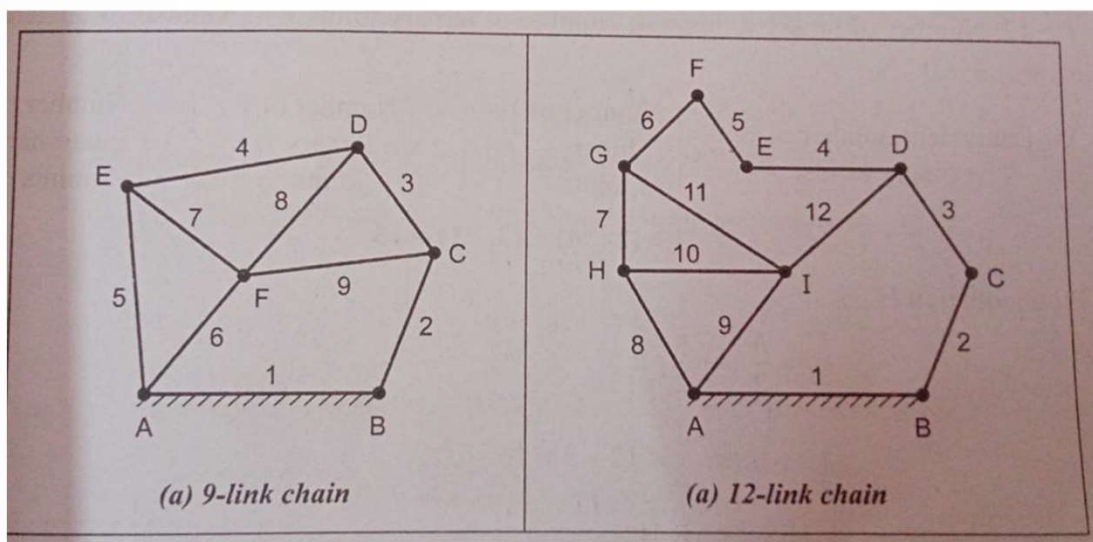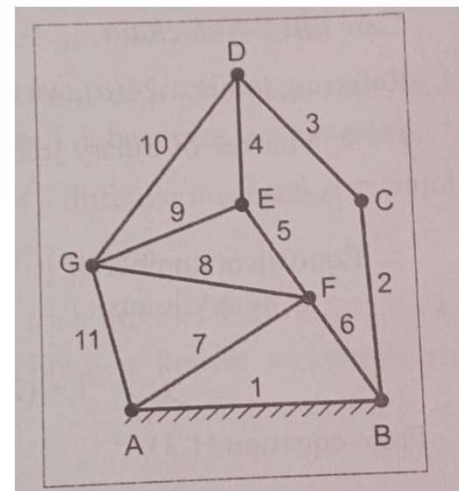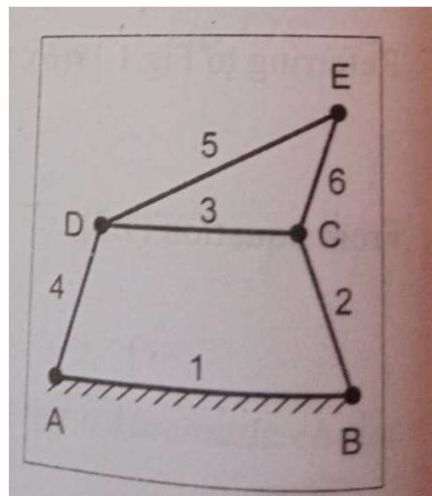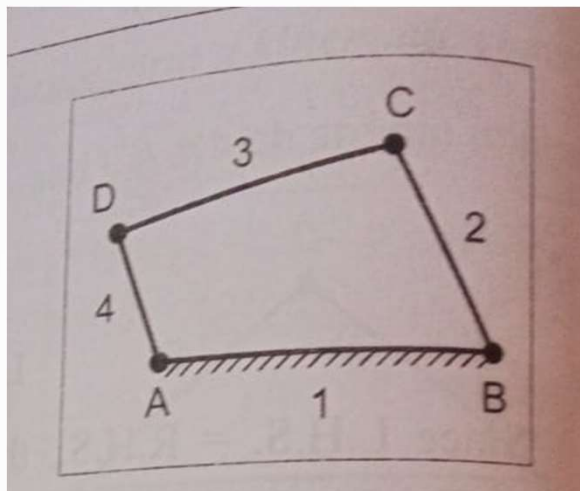
DEGREES OF FREEDOM

The degrees of freedom of a mechanical system refer to the number of independent parameters or variables required to completely specify the position and orientation of the system in space.

Formula for Planar Mechanisms:
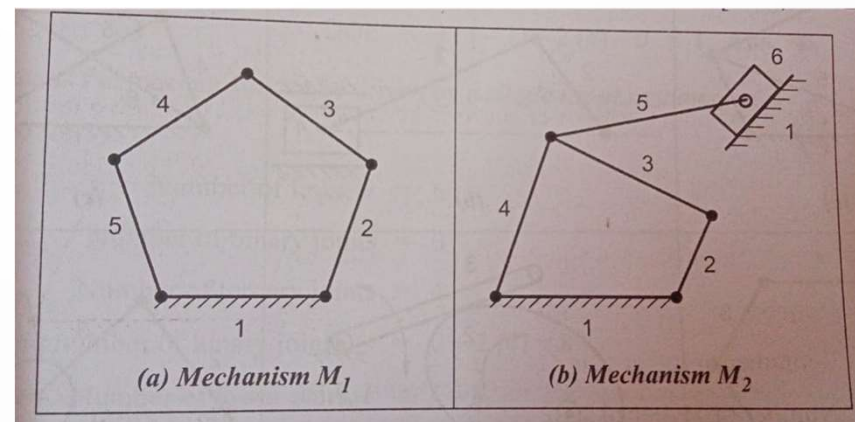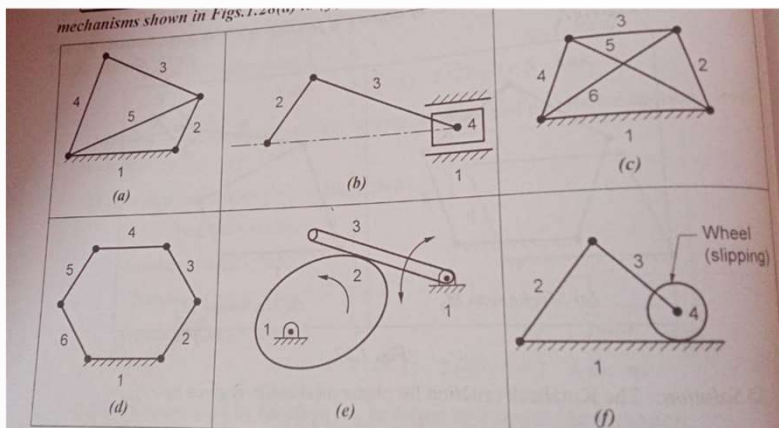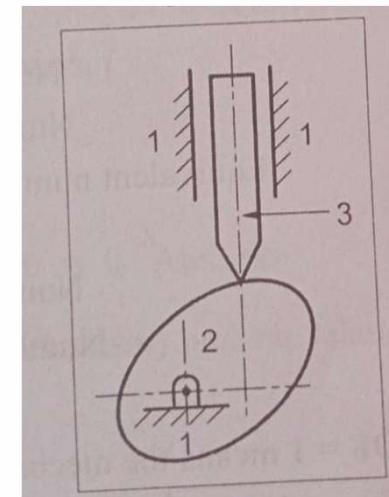Gruebler's equation:
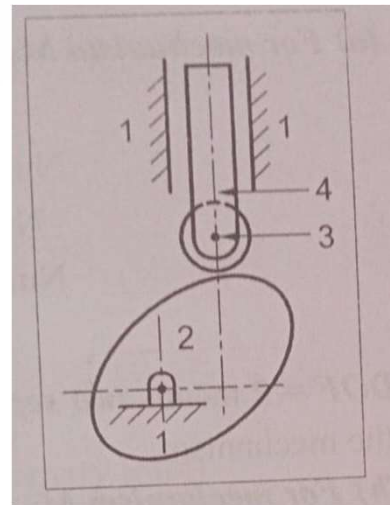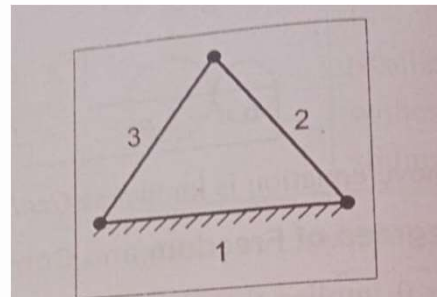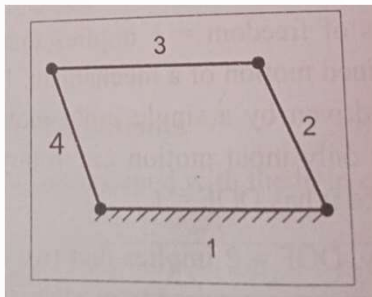
$$DOF = 3(n-1) - 2j - h$$

Where:

n: Number of links (including the fixed link).

j: Number of lower pairs (e.g., revolute or prismatic joints).

h: Number of higher pairs (e.g., cams or gear contacts).

DEGREES OF FREEDOM

ASSESSMENT !!!