

UNIT - 1

Kinematics of Machines

Basic Terms:

Kinematics:

- Deals with the relative motion between various parts of the machines.

Dynamics:

- Deals with the forces & their effects, while acting upon the machine parts in motion.

Kinetics:

- Deals with the inertia forces which arise from the combined effect of the mass & motion of the machine parts.

Statics:

- Deals with the forces & their effects while the machine parts are at rest. (Mass of the parts is assumed to be negligible).

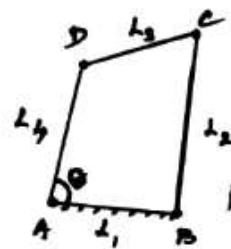
Mechanism :

If a number of bodies are assembled in such a way that the motion of one body causes constrained & predictable motion to the other body, is known as mechanism.

The function of a mechanism is to transmit and modify a motion.

(i) Simple Mechanism:

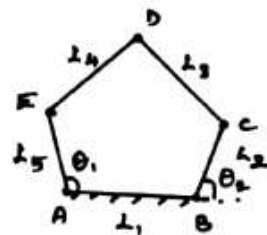
A Mechanism with four links is known as Simple mechanism



Four bar chain

(ii) Compound Mechanism:

A mechanism with more than four links is known as Compound mechanism.

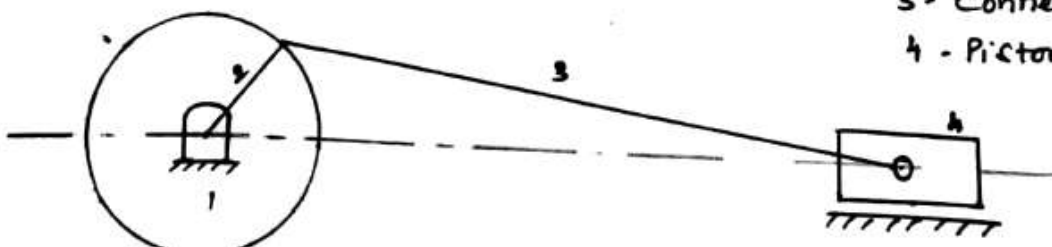


Five bar chain.

Machine :

A machine is a combination of mechanisms which, apart from imparting definite motions to the parts, also transmits & modifies the available energy into some kind of desired work.

- 1 - Fixed link
- 2 - Crank
- 3 - Connecting rod
- 4 - Piston.



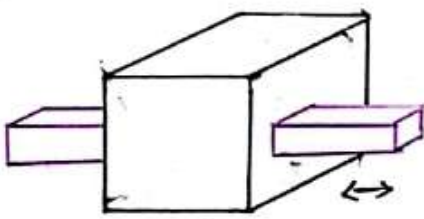
Types of Constrained Motion:

There are three types of constrained motion

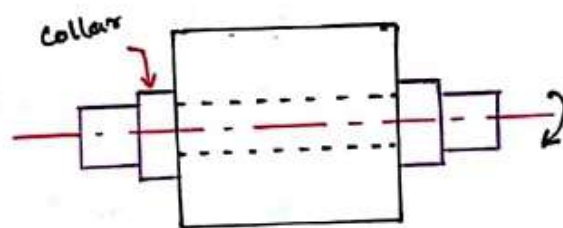
- (i) Completely constrained motion
- (ii) Incompletely constrained motion
- (iii) Successfully constrained motion

(i) Completely constrained Motion:

When the motion between two elements of a pair is in a definite direction irrespective of the direction of the force applied, it is known as completely constrained motion.



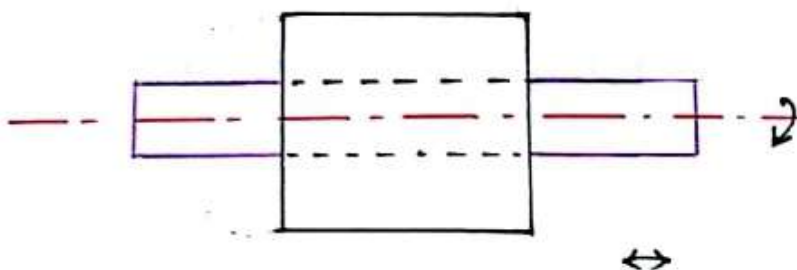
Sliding pair.



Turning pair.

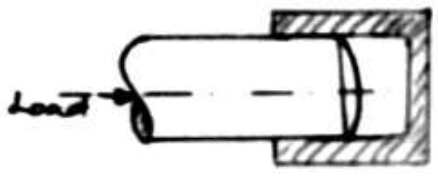
(ii) Incompletely constrained motion:

When the motion between the two elements of a pair is possible in more than one direction and depends upon the direction of force applied, it is known as Incompletely constrained motion.



(iii) Successfully Constrained Motion:

When the motion between the two elements of a pair is possible in more than one direction but is made to have motion in only one direction by using some external means (or force), it is known as successfully constrained motion.



the rotary & linear motion is possible. But linear is restricted. Only rotary motion is possible.
As: Foot slip bearing.

Rigid & Resistant bodies:

A body is said to be rigid if under the action of forces, it doesn't suffer any distortion.

In a mechanism, a link or element need not to be a rigid, it must be resistant body. If a body is capable of transmitting the required force with negligible deformation, then the body is said to be resistant body.

Kinematic link (or) element:

Each part of the machine which moves to some other part, is known as kinematic link or element. A link may consist of several parts which are rigidly fastened together.

Types of link :

Rigid link

Flexible link - Belt, ropes, chains

Fluid link - Hydraulic press, Jack

Kinematic pair :

Two links or elements of a machine, when in contact with each other are said to form a pair.

If the relative motion between them is completely or successfully constrained, then the pair is said to be kinematic pair.

Kinematic chain :

When the kinematic pairs are coupled in such a way that the last link is joined to the first link to transmit definite motion, it is called kinematic chain.

Structure :

It is an assemblage of number of resistant bodies having no relative motion between them & meant for carrying loads having restraining action.

Ex :

Railway bridge

Roof Truss

Machine frames

Machine

Parts move relative to each other

Transforms available energy into useful work

Links of a machine may transmit both power & motion.

Structure

Parts (or member) of a structure does not move

No energy transformation.

Members of a structure transmit force only.

Classification of kinematic pairs

* According to the type of relative motion:

- a) Sliding pair
- b) Turning pair
- c) Rolling pair
- d) screw pair
- e) Spherical pair

* According to the type of contact:

- (a) Lower pair
- (b) Higher pair

* According to the type of closure:

- (a) Self closed pair
- (b) Force - closed pair

Types of joints:

- * Binary joints
- * Ternary joints
- * Quaternary joints