SNS COLLEGE OF TECHNOLOGY

(AN AUTONOMOUS INSTITUTION)

Department of Mechanical Engineering

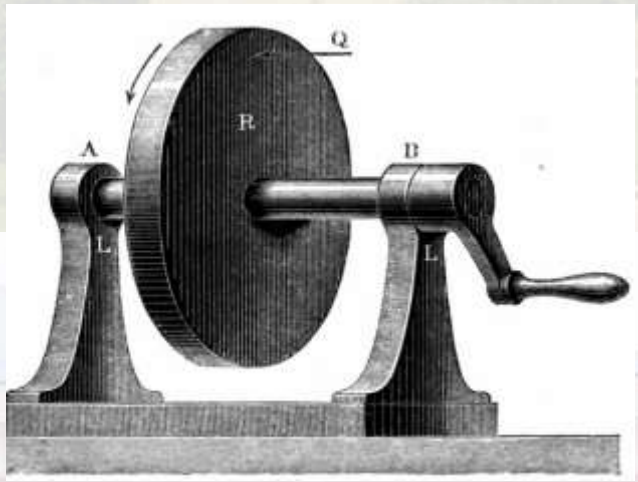
19MET302 - THEORY OF MACHINES

UNIT – I

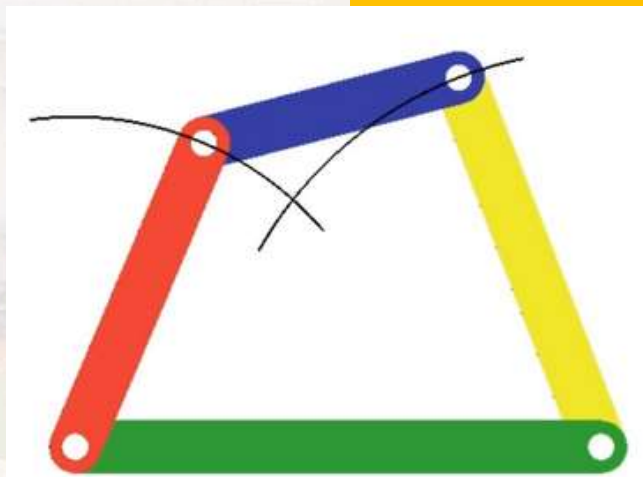
BASICS OF MECHANISMS

TOPIC-1

FUNDAMENTALS OF MECHANISM(FOM)



SOURCE: Khurmi R S



SOURCE: Khurmi R S

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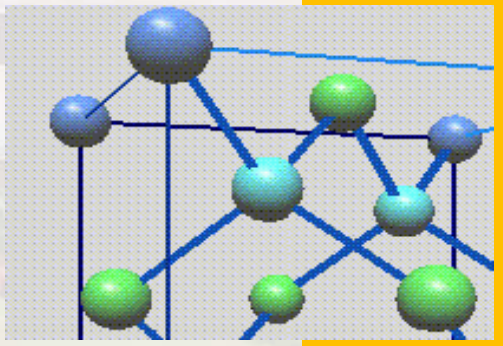
DIVISIONS OF DYNAMICS

KINEMATICS – Deals with Motion and Time

(**Kinema** – Greek Word – **Motion**)

KINETICS – Deals with Motion, Time and Forces.

Statics	Kinematics	Kinetics
STRUCTURE	MECHANISM	MACHINE



SOURCE: Chemol

STRUCTURE

SOURCE: Rtskin

MACHINE

SOURCE: Bllmnk

MECHANISM

LINK / ELEMENT

A single resistant body / combination of resistant bodies having relative motion with another resistant body / combination of resistant bodies.

SOLID LINK

SOURCES: TItch

FLEXIBLE LINK

FLUID LINK

MACHINE

Each part of a machine, which moves relative to some other part, is known as a *kinematic link* (simply link) or *element*.

SOURCE: Bharat

LATHE MACHINE

COMPONENTS OF MECHANISMS

- Link / element
- Kinematic pairs / joints
- Kinematic chain

SOURCE: VELINO

BUILDING TOP LOOPS

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 (i.e. completely or successfully constrained motion), it is called a kinematic chain.

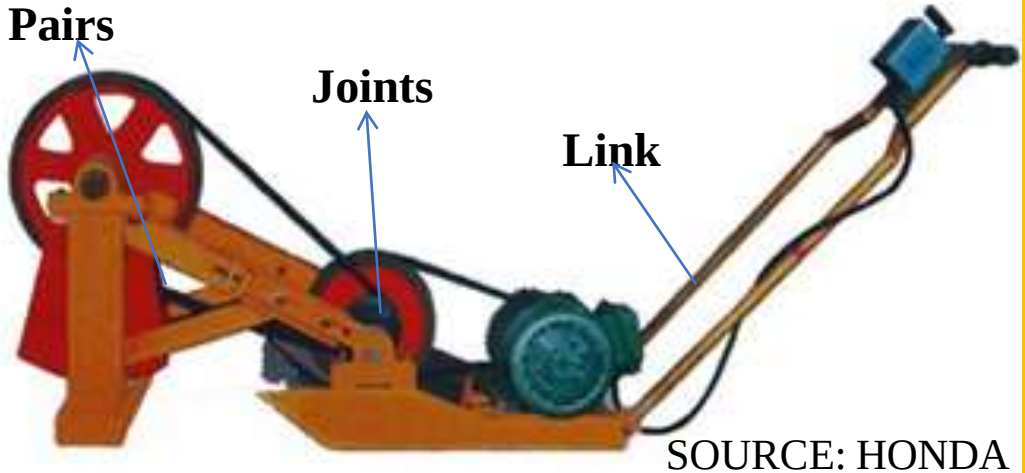
$$l = 2P - 4$$

Where, l = no of links

P = no of Pairs

$$J = 3/2\ l - 2$$

J = No of Joints



SOURCE: HONDA

LAWN-MOVER- MACHINE

PROBLEMS ON ARRANGEMENT OF THREE LINKS

Consider the arrangement of three links AB, BC and CA with pin joints at A, B and C as shown in Figure.

In this case,

Number of links, l = 3

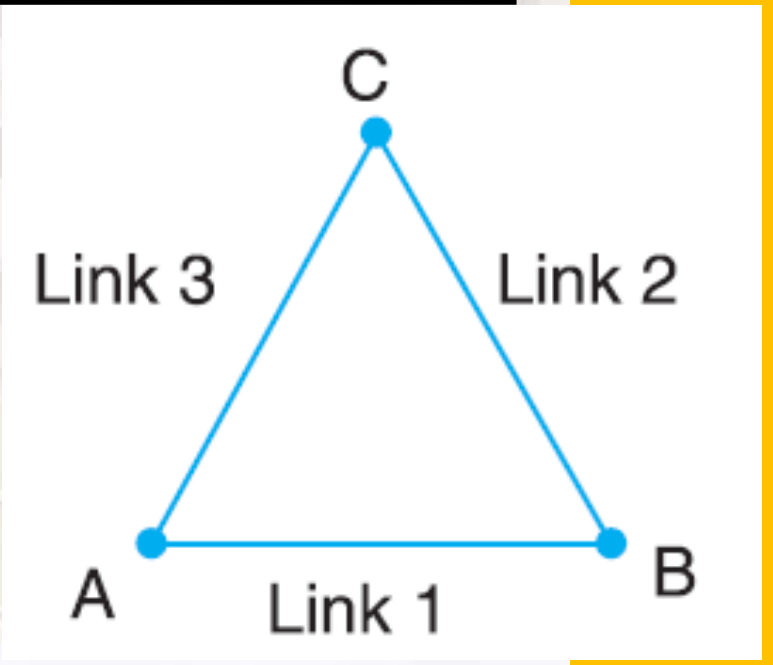
Number of pairs, p = 3

Number of joints, j = 3

From equation (i), l = 2p – 4

or 3 = 2 × 3 – 4 = 2

L.H.S. > R.H.S. ***Locked chain***



SOURCE: Khurmi R S

THREE BAR LINKS

BOARD USAGE ALSO

PROBLEMS ON ARRANGEMENT OF FOUR LINKS

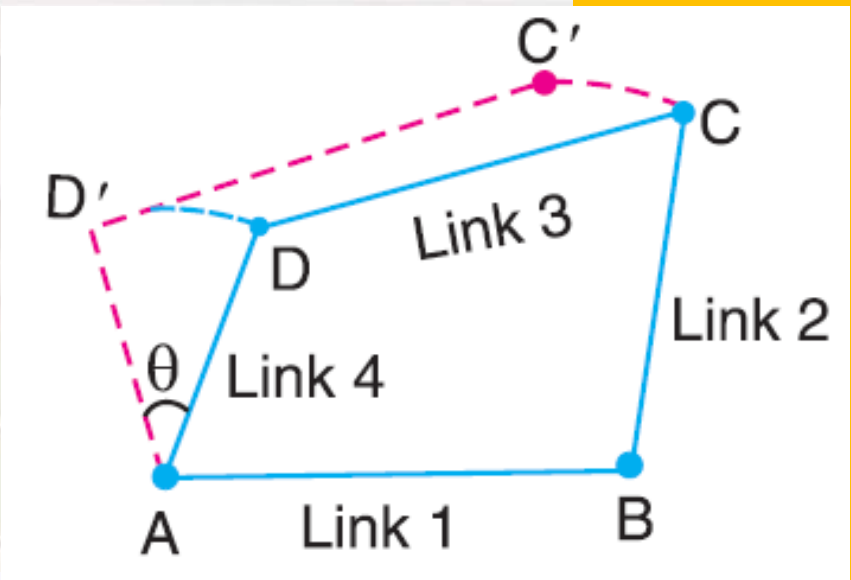
Consider the arrangement of four links AB, BC, CD and DA as shown in Figure. In this case

l = 4, p = 4, and j = 4

From equation (i), $l = 2p - 4$

$4 = 2 \times 4 - 4 = 4$

i.e. L.H.S. = R.H.S.



SOURCE: Khurmi R S

L.H.S. = R.H.S. constrained kinematic chain

FOUR BAR LINKS

BOARD USAGE ALSO

PROBLEMS ON ARRANGEMENT OF FIVE LINKS

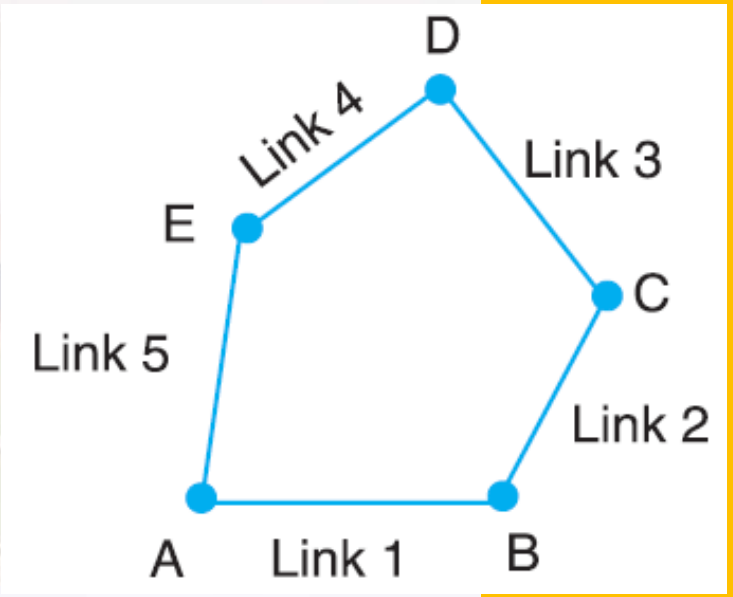
Consider an arrangement of five links, as shown in Figure. In this case,

l = 5, p = 5, and j = 5

From equation (i),

$l = 2p - 4$ or $5 = 2 \times 5 - 4 = 6$

i.e. L.H.S. < R.H.S.



SOURCE: Khurmi R S

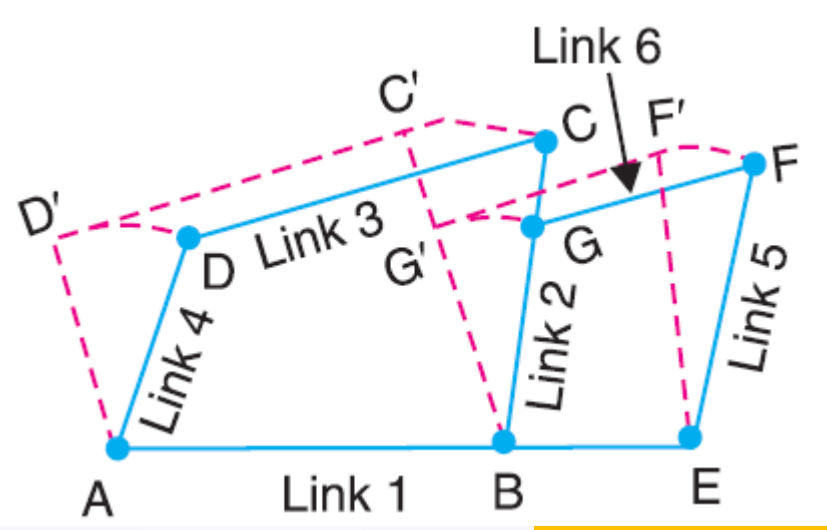
L.H.S. < R.H.S. unconstrained chain

FIVE BAR LINKS

BOARD USAGE ALSO

PROBLEMS ON ARRANGEMENT OF SIX LINKS

Consider an arrangement of six links, as shown in Figure. This chain is formed by adding two more links in such a way that these two links form a pair with the existing links as well as form themselves a pair. In this case, $l = 6$, p = 5, and j = 7



SOURCE: Khurmi R S

From equation (i),

$l = 2p - 4$ or $6 = 2 \times 5 - 4 = 6$

i.e. L.H.S. = R.H.S. kinematic chain

SIX BAR LINKS

BOARD USAGE ALSO

ASSESMENT QUESTIONS

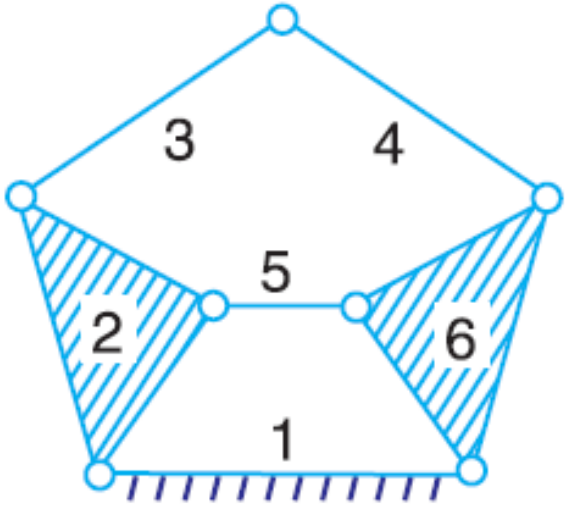
Multiple Choice Questions

1. The coefficient of restitution for inelastic bodies is
   (a) zero (b) between zero and one
   (c) one (d) more than one
2. In a reciprocating steam engine, which of the following is a kinematic link ?
   (a) cylinder and piston (b) piston rod and connecting rod
   (c) crank shaft and flywheel (d) flywheel and engine frame
3. The relation between the number of pairs (p) forming a kinematic chain and the number of links (l) is
   (a) $l = 2p - 2$ (b) $l = 2p - 3$
   (c) $l = 2p - 4$ (d) $l = 2p - 5$

ASSESMENT QUESTIONS

TWO MARKS QUESTIONS

1. Find out the links arrangement and at what constraint does the below Figure is



SOURCE: Khurmi R S

NO OF LINKS IN IT ?

SEOURC: FREEPIK