# DRONACHARYA GROUP OF INSTITUTIONS, GREATER NOIDA

Mechanical Engineering Department

## Unit 1

Q-1 Define the following terms. (i) Kinematic Pair (ii) Kinematic link. Deduce an expression relating the number of links (L) and the number of joints (J) for a kinematic chain.

*Q-2 Distinguish between a kinematic chain, a mechanism and a machine. What are the most commonly used kinematic chains consisting of lower pairs? Draw a neat sketch of slider crank mechanism and give the classification of pairs used in it.*

Q-3 Define instantaneous centre of Rotation. Give the types of instantaneous centers. With the help of neat sketch of a four bar mechanism, show all the types of instantaneous centers.

*Q-4 Define a kinematic link or element "Kinematic link may be a machine component, but machine component may not be a kinematic link" Explain the statement.*

Q-5 What do you mean by constrained motion? What are the different types of constrained motions? Explain with examples and neat sketches.

Q-6 Define inversion of mechanism. Explain the inversion of quadric cycle chain mechanism, single slider crank mechanism and double slider crank mechanism

*Q-7 For a planer mechanism, derive an expression for Grubler's equation and find the degree of freedom for the mechanism for the mechanism shown in figure 1.*

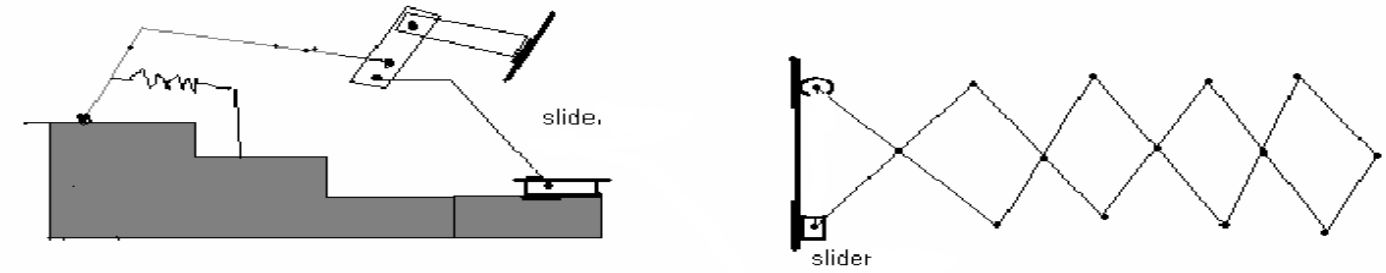



Figure 1

Q-8 Derive an expression for the degree of freedom of a mechanism. Prove that the mechanism shown in figure 2 is a constrained kinematic chain.

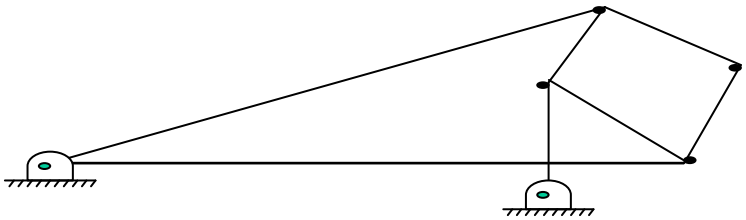


*Figure 2*

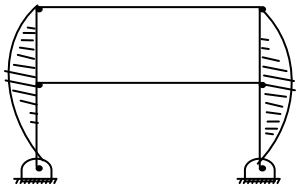
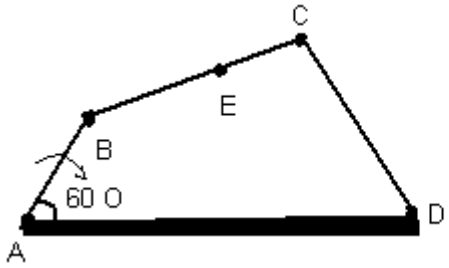


*Figure 1*

Q-9 A pin jointed 4 bar mechanism is shown in fig. The link AB rotates at 20 rpm and angle BAD = 60 °

Find: Angular velocities of links CD and BC, Linear velocity of point E on link BC at a distance of 2.25 m from end B.




AB = 0.5 M
BC = 3.0 M
CD = 1.5 M
AD = 3.5 M
BE = 2.25 M

Q-10 Prove that if three bodies are in relative motion with respect to one another, the three relative instantaneous centers are collinear.

Q-11 Locate all the instantaneous centers of the mechanism shown in figure 6.

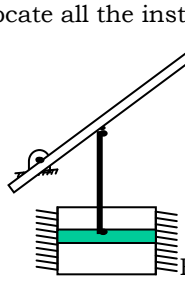


Fig 6

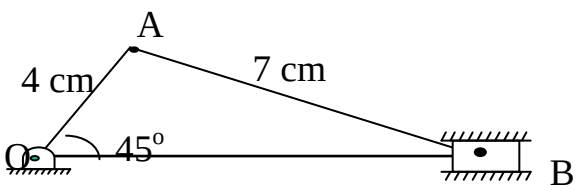



Fig 7

Q-12 Determine all the centers of the slider crank mechanism shown in figure and find angular velocity of connecting rod and the velocity of piston. Angular speed of link OA is w = 10 rad / sec. (Clockwise) Fig 7

*Q-13 State and prove the angular velocity ratio theorem for direct contact of links.*

Q-14 Locate all the instantaneous centers for the mechanism shown in figure 4. Determine the ratio of velocities of points D and B and Points C and B. Find the angular velocity of link BC. The crank speed is 500 rpm.

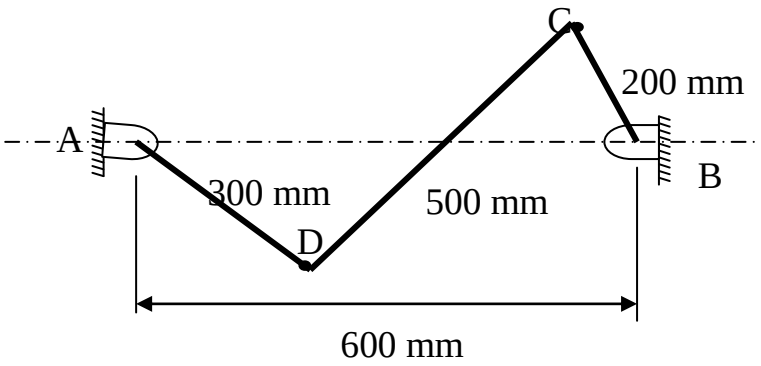



Fig 5

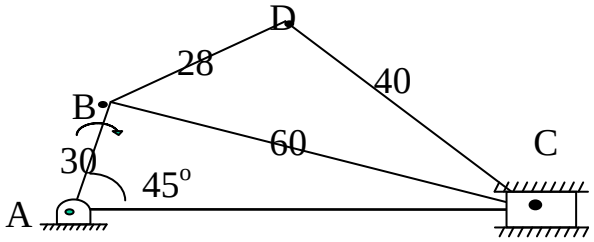



Fig 4

Q-15 Find the angular velocity of connecting link CD and that of link AD shown in fig 5 when link BC has a constant angular velocity of 2 rad/ sec.