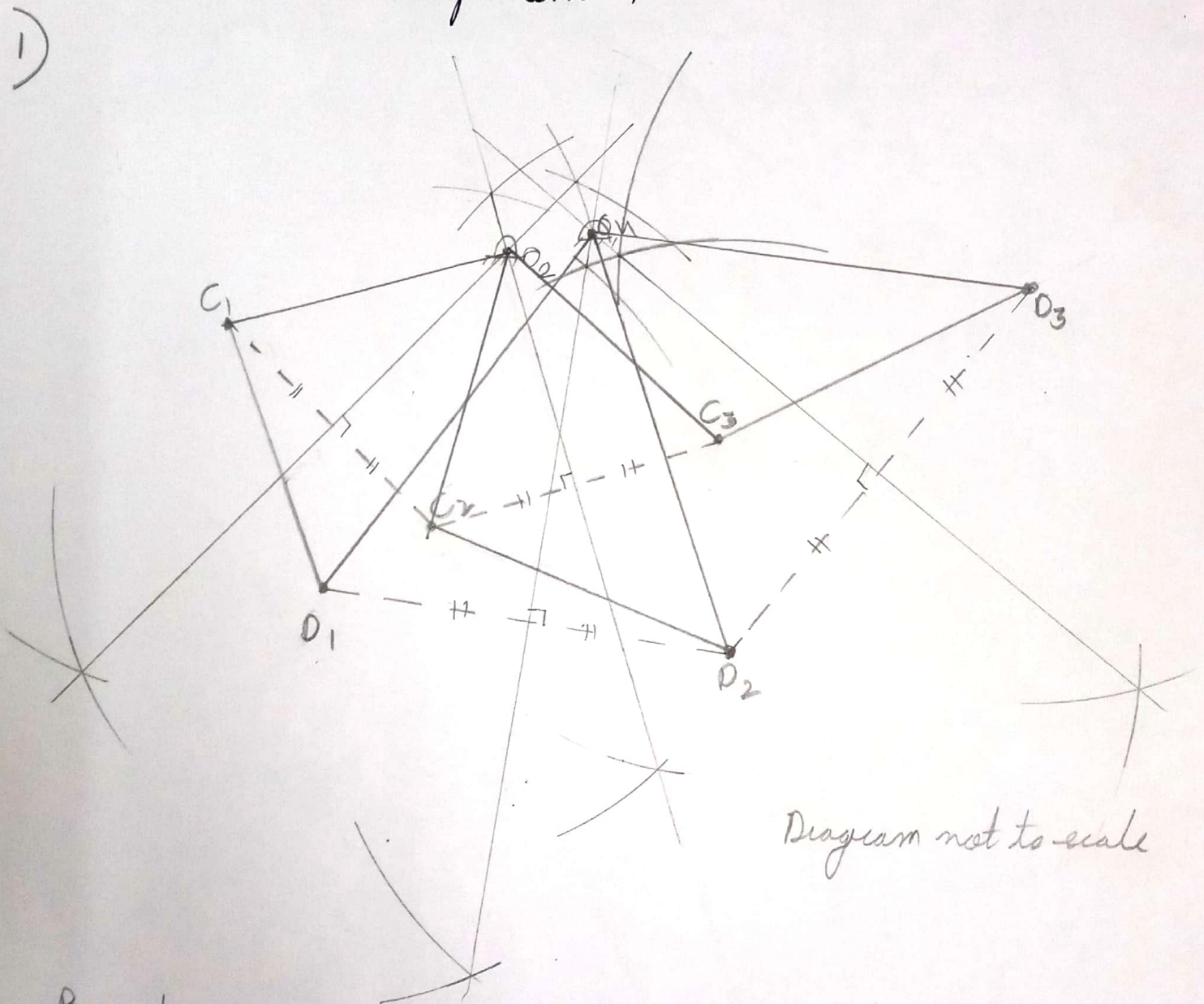


ME322
 Synthesis & Analysis of Mechanisms
 15110049
 Assignment 3
 Assignment 4

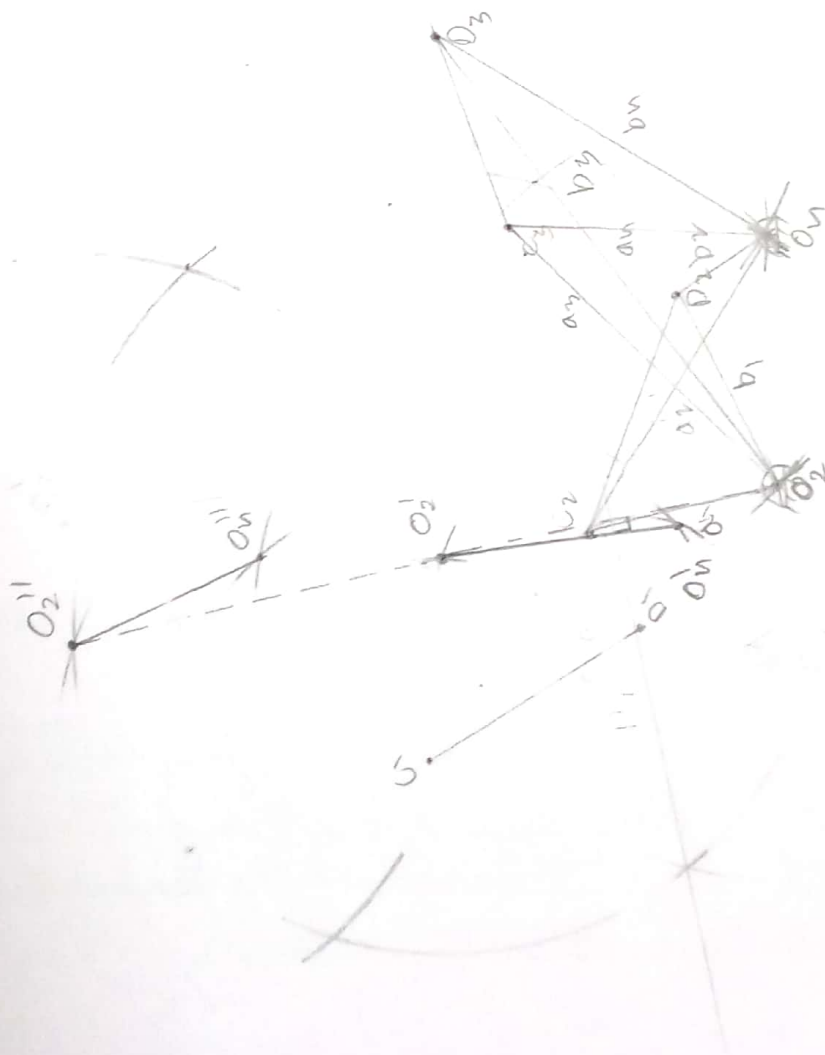


Procedure:

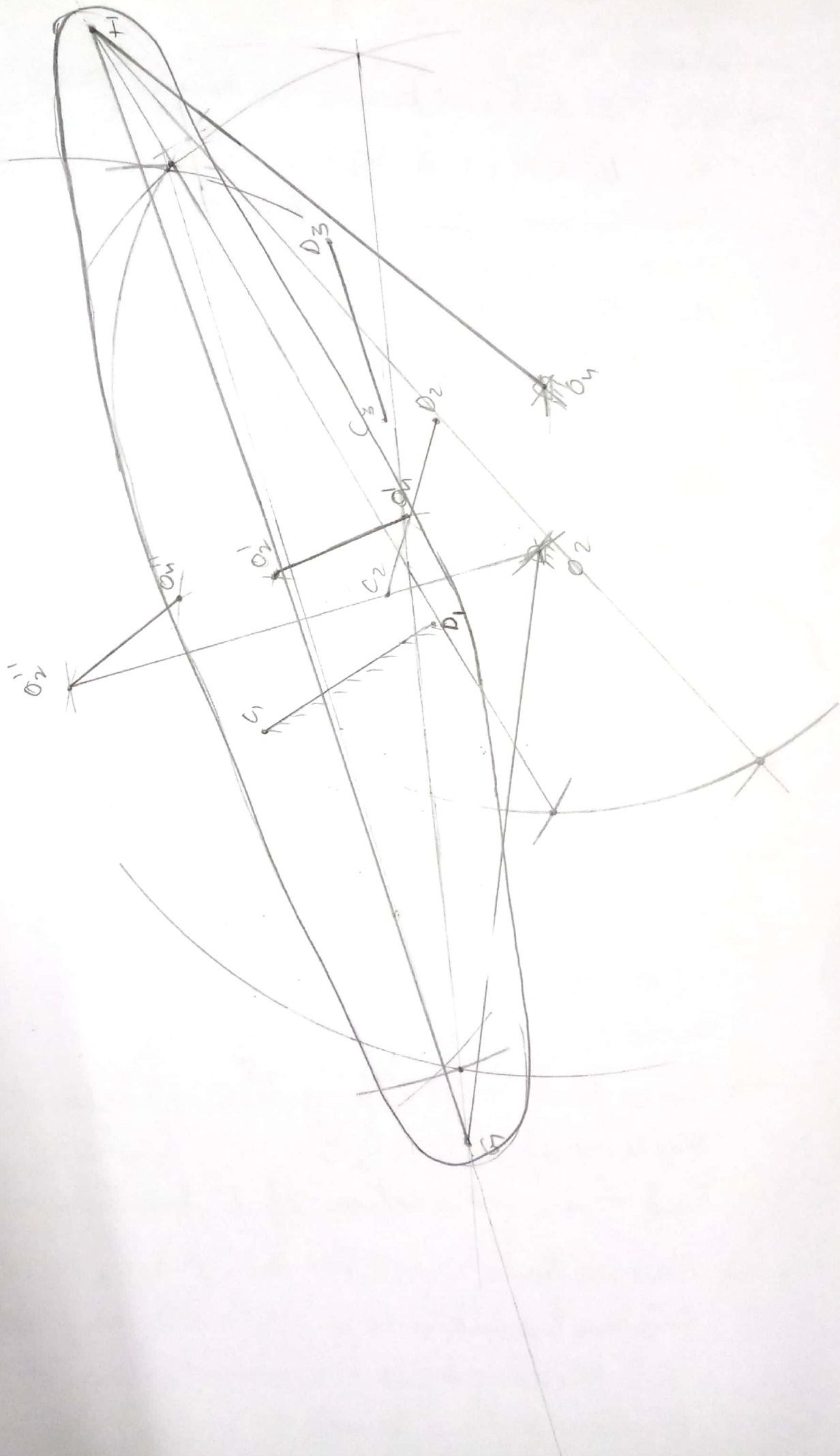
- Produce the diagram such that the link lengths & angles are approximated
- As $O_2C_1 = O_2C_2 = O_2C_3$, we draw line segments C_1C_2 & C_2C_3 . Thereafter draw perpendicular bisectors of C_1C_2 & C_2C_3 using arc method. The point where both the perpendicular bisectors intersect will be O_2 as then $O_2C_1 = O_2C_2 = O_2C_3$ is satisfied

- Repeat the previous procedure to find O_4 by the intersection of perpendicular bisectors of $\overline{D_1D_2}$ & $\overline{D_2D_3}$.
- Hence we obtain O_2 & O_4 which are fixed pivots. By joining $\overline{O_2C}$ & $\overline{O_4D}$ we get 4 bar mechanism at a particular position of C&D.

~~X~~



2)

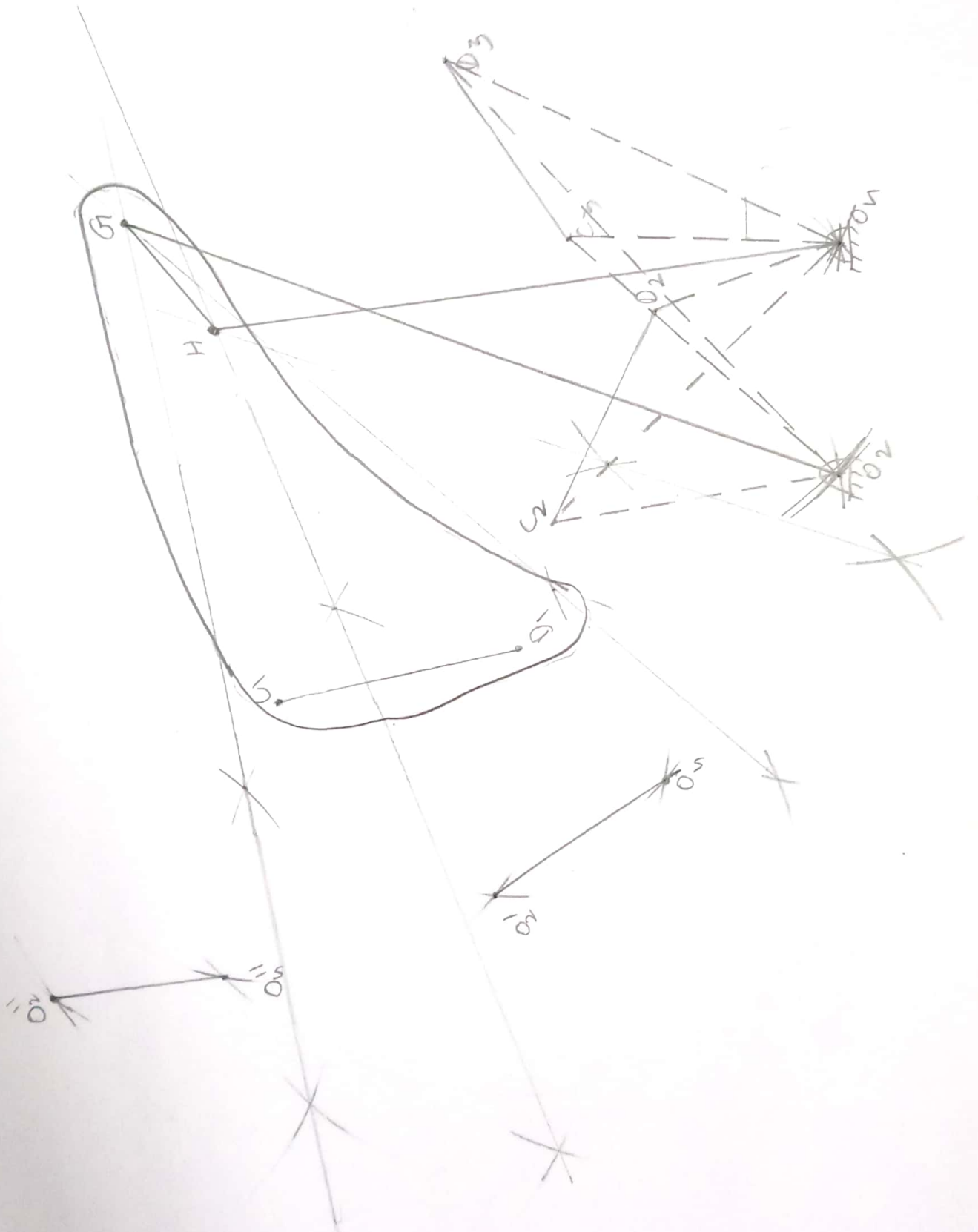


Case 1

Procedure:

- For C_1, D_1 link and free O_2 & O_4 pivoted joints
- Now let $O_2 D_2 = b_2$ & $O_2 C_2 = a_2$
Draw an arc of radius a_2 from C_1
Draw an arc of radius b_2 from O_1
Mark the intersection as point O_2'
- Similarly let $O_4 D_4 = b_4$ & $O_4 C_4 = a_4$
Draw an arc of radius a_4 from C_1
Draw an arc of radius b_4 from O_1
Mark the intersection as point O_4'
- Repeat the above 2 steps for $C_3 D_3$ link i.e.
let $C_3 O_2 = a_1$ & $D_3 O_2 = b_1 \Rightarrow$ intersection of a_1 from C_1 & b_1 from O_1
let $C_3 O_4 = a_3$ & $D_3 O_4 = b_3 \Rightarrow$ intersection of a_3 from C_1 & b_3 from $O_1 = O_4''$
 $O_1 = O_2''$
- Now we have $O_2', O_2'', O_4' & O_4''$
We need to find G & H such that
 $O_2 G = O_2' G = O_2'' G$ &
 $O_4 H = O_4' H = O_4'' H$
- Hence find G as intersection of perpendicular bisectors of $\overline{O_2 O_2'}$ & $\overline{O_2 O_2''}$
Find H as intersection of \perp bisectors of $\overline{O_4 O_4'}$ & $\overline{O_4 O_4''}$
- Now we have G & H too. Join G & O_2 and H & O_4
Construct a link with G, H, C_1 & D_1 as points on the link. Hence we have 4 bar mechanism for the desired positions & fixed pivots.

Case 2



3) Procedure:

- Draw the frame
- Draw the extreme positions of rocker arm
- Join C_1, C_2 . Draw a \perp bisector of $\overline{C_1 C_2}$
- Measure $(\overline{C_2 C}) = r$
- Extend C_1, C_2 in horizontal direction
- Now at a some distance from right leg of frame mark O_2
- Draw a circle of radius $(\overline{O_2 C}) = r$ with O_2 as center as in one full rotation of crank, rocker should translate $2r$ in horizontal direction
- Now join O_1 & C_1 with a link #2
- Join O_2 & O_1 to get link #4

Consider dimensions in figure as the real ones
i.e. scale ratios = 1

then

$$s + l = 11.55 \text{ cm} \quad L_4 = 9.75 \text{ cm} = l$$

$$p + q = 12.04 \text{ cm} \quad L_2 = 9.6 \text{ cm} = q$$

$$L_3 = 1.6 \text{ cm} = s$$

$$s + l < p + q \quad L_1 = 2.8 \text{ cm} = p$$

\Rightarrow Gruen's linkage

#4 ground link
comprising of O_2 & O_1

