PROBLEM 1

Consider the mechanism shown in the figure. The dimensions of the mechanism are,

\[ |AC| = 80 \text{ mm}, \quad |AF| = 150 \text{ mm}, \quad |BC| = |CD| = |DB| = 50 \text{ mm}, \quad |DE| = 90 \text{ mm} \]

a) If the input is \( \theta_{12} = 30^\circ \), find all possible solutions (corresponding to all closures of the mechanism) for the unknown joint variables using a graphical approach and present your results in a tabulated form. (You are expected to use a drawing tool)

b) Write down the loop closure equations and find the values of the unknown joint variables analytically if the input is \( \theta_{12} = 30^\circ \).
PROBLEM 2
Consider the inverted slider crank mechanism shown in the figure.

The dimensions of the mechanism are given as
|AC| = b_1 = 18 cm  |AB| = b_2 = 8 cm  |BE| = b_3 = 30 cm  |CD| = b_4 = 5 cm

a) Using an analytical approach, obtain the equations for the joint variables in terms of input $\theta_{12}$ and the link lengths.

For the closure given in the figure,

b) implement the expressions found in part (a) into a computer program (Matlab, MathCAD, etc.) and perform full cycle position analysis for input $\theta_{12}$ changing from 0 to 360 degrees with increments of at most 5 degrees.

c) plot the variations of $s_{43}$ and $\theta_{14}$ with respect to $\theta_{12}$ for full crank rotation.

d) plot the curve traced by coupler point E.

Note: Make sure to submit the source code of your programs, explain the procedure using comments etc and fully annotate the plots. There is no need to submit the print-out of the tabulated results.

Hint: An example about using MATLAB for mechanism analysis is posted on the website.