ME5243: Advanced Mechanism Design

Mechanism Classification

1. Below are link lengths for a 4-bar. In a group of 2 or 3, discuss and answer the following for one of the linkages:

<table>
<thead>
<tr>
<th>Linkage 1</th>
<th>Linkage 2</th>
<th>Linkage 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground Link: 2 cm</td>
<td>Ground Link: 3.5 cm</td>
<td>Ground Link: 3.5 cm</td>
</tr>
<tr>
<td>Input Link: 3.5 cm</td>
<td>Input Link: 4 cm</td>
<td>Input Link: 4 cm</td>
</tr>
<tr>
<td>Coupler Link: 4 cm</td>
<td>Coupler Link: 2 cm</td>
<td>Coupler Link: 5 cm</td>
</tr>
<tr>
<td>Output Link: 5 cm</td>
<td>Output Link: 5 cm</td>
<td>Output Link: 2 cm</td>
</tr>
</tbody>
</table>

a) What is the range-of-motion classification of this linkage? How do you know?
b) Sketch the mechanism at multiple positions (at least 6) through the range of motion. Consider drawing the ground link horizontally for simplicity. Does the motion agree with your classification?
2. Identify the task classification and discuss your reasoning

a) Locking pliar  d) Crane Linkage  g) Window Opening Mechanism
b) Robot arm & manipulator
c) Oar linkage  e) Rooftop Kayak Loader  h) Robot Leg Mechanism
f) Aircraft Wing Mechanism

3. Draw all of the inversions of the Stephenson and Watt six bar chains. Identify what tasks each inversion is best suited.
4. Shown below is a power hacksaw. Link 5 pivots at O₅ and its weight forces the sawblade against the workpiece while the linkage moves the blade (link 4) back and forth within link 5 to cut the part.
   a. Sketch the kinematic diagram.
   b. What type of mechanism is it?
   c. Draw a second diagram of the kinematic equivalent mechanism containing only revolute joints.

Source: Norton, Design of Machinery.
5. Determine what type of sixbar linkage is shown in each figure below

a) Hart inversor linkage

Figure source: Norton, Design of Machinery.

c) Chebyschev straight-line mechanism

d) Drum brake mechanism

e) Entertainment cabinet