Assignment - 1

• Determine the number of theoretical plates required to yield **95% N₂** at top and **96% O₂** at bottom. Feed stream is **70% N₂** and **30% O₂**. The operating pressure is 1 atm. Molar fraction of liquid in feed stream is **0.5** mole liquid/mole mixture. The desired flow rate at the bottom product is **30** mole/sec and the heat removed in the condenser at top of the column is **2000 kW**.

• Also, calculate the maximum and minimum number of plates for the extreme cases of \( Q_D \).
Answers

- OP line for enriching section:
  \[ y_n = 0.77x_{n+1} + 0.22 \]

- OP line for stripping section:
  \[ y_m = 1.11x_{m+1} - 0.001 \]

- \( q \) line:
  \[ y = -1.0x + 1.4 \]

- The total number of vertical lines are 8.

**McCabe – Thiele Method**

<table>
<thead>
<tr>
<th>Section</th>
<th>Number of Steps</th>
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</thead>
<tbody>
<tr>
<td>Enriching Section</td>
<td>2 + 1 (Condenser)</td>
</tr>
<tr>
<td>Stripping Section</td>
<td>6 + 1 (Boiler)</td>
</tr>
</tbody>
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Prof. M D Atrey, Department of Mechanical Engineering, IIT Bombay