CL-402: Chemical Process Technology

July-November Session, 2018

7th semester, Department of Chemical Engineering

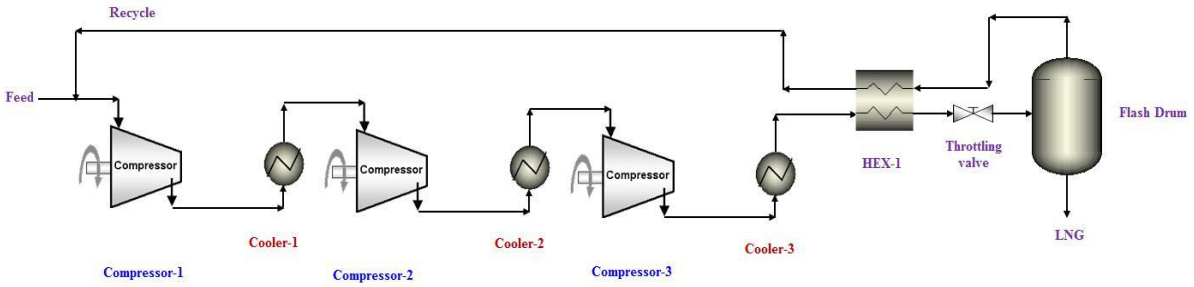
Indian Institute of Technology Guwahati, Guwahati

Assignment-1

Use Aspen Plus V8.8 for process design

Total Marks: 30

1: Consider the three-stage recycle Linde process for the liquefaction of natural gas. The flow sheet is:



Natural gas can be considered to be pure methane which is available at 1 bar and 280 K at the inlet of compressor-1. The first stage (compressor-1) compresses the gas from 1 bar to 5 bar, the second stage (compressor-2) from 5 bar to 25 bar and the third stage (compressor-3) from 25 bar to 100 bar. Between stages the gas is isobarically cooled to 280 K. Methane leaves the cooler-3 at 100 bar and 210 K which is further cooled in heat exchanger (HEX-1) by the cold vapour leaving the separator (flash drum). Methane is further expanded through an adiabatic valve to 1 bar and then the resulting gaseous and liquid streams are separated in separator. The flash drum is adiabatic and operates at 1 bar and the compressor can be assumed to operate reversibly and adiabatically.

a) Determine the work required in each compressor and total work needed for each kilogram of liquid methane produced.

b) Find the diameter and height of flash drum.

Use Peng-Robinson equation of state as the thermodynamic model.