KE-107.3100 Process Simulation **-write your name & student no:**
Examination 28.10.2008; time: 13:00-16:00

Theory (max.1h) : Answer in Finnish, Swedish or English

1. Explain shortly:
a) Rating b) Critical temperature c) Sequential modular simulator

2. Different types of reactor models in Pro/2

3. How to select VLE methods

Simulation part (2h): **(Save each task in *prz and *out files and write your answers on paper)**

1. Simulate a distillation column for separation of 20 t/h of propane and propene solution. Feed containts 50 w-% propane and 50 w-% of propene at 25 bar and 20 °C. 95 w-% propene is separated as distillate and 90 w-% propane is as bottom products. The column has 100 ideal trays.

a) What is the column pressure if condenser temperature is 42 °C
b) Calculate the diameter and height of the column with valve trays (efficiency 80%)

2. Simulate a propene refrigeration system. Propene at 40 °C, saturated liquid (9 t/h) is led to a flash tank F-1. The flash tank is at 400 kPa. Vapor from F-1 is compressed in C-1 to outlet pressure 1600 kPa and totally condensed in a heat exchanger E-1 with pressure drop 50 kPa and the saturated liquid is recycle to the same flash (F-1) via control valve. The saturated liquid from F-1 is feed to cold storage T-1. The cold storage tank contains saturated liquid at 105 kPa and has heat loss 50kW. The vapor vaporized in T-1 is fed via compressor C-2 to the flash tank (F-1) and the liquid from T-1 is taken out as product. (Compressor C-1 and C-2 are polytropic with efficiency 80%)

a) What is the cold storage T-1 temperature?
b) How much cooling water is needed in countercurrent E-1, if inlet and outlet temperature of water is 20 °C and 40 °C

3. Dimethyl ether (DME) can potentially be manufactured by two routes:

i) from methanol: $2CH_3OH \rightarrow CH_3OCH_3+H_2O$ or
ii) from methanol and methane: $CH_3OH + CH_4 \rightarrow CH_3OCH_3+H_2$

a) Calculate which is the more potential route at 1500 kPa and 250 °C
b) If maximum temperature of catalyst is 300 °C, calculate the adiabatic temperature rise for the chosen reaction and choose the reactor type.

Points: **theory:** **2p/each**
simulation: **1). 3p, 2). 4p, 3). 3p and exercise attendance 4p.**