

## **PROCESS ENGINEERING AND CHEMICAL EQUIPMENT TOPICS**

### **ex. 1/10 – Draining a tank and friction factors**

- calculation of gas density at arbitrary temperature and pressure
- Bernoulli equation
- draining time for a tank
- fluid flow criterion; Reynolds number
- equivalent diameter for tubes with a non-circular cross-section
- pressure drop for the fluid flow through a straight tube, Darcy-Weisbach equation
- pressure drop due to local resistance
- pressure drop for the fluid flow through a packed bed, Leva equation
- equivalent diameter for non-spherical elements, porosity, form factor

### **ex. 4 – Heat exchanger**

- conduction, convection, heat transfer (equations, units of coefficients, driving forces)
- calculation of convective heat transfer coefficients for forced convection – criterial numbers and equations
- heat transfer in heat exchangers:
  - heat balance, driving force – mean temperature difference
  - types of currents in shell-and-tube heat exchangers (co-current and counter-current)
  - heat transfer with a phase change

### **ex. 6 – Extraction**

- Gibbs triangle – drawing, reading out of ternary solution compositions
- equilibrium curve, equilibrium tie lines
  - lever-arm principle and material balance
  - single-stage extraction
  - minimum and maximum amount of solvent

### **ex. 5 – Filtration – a rotary drum filter**

- filtration at constant pressure
- time of filtration, rate of filtration
- time of washing, rate of washing
- determination of filtration constants – a graphical method
- filter press and rotary drum filter

### **ex. 9 - Absorption**

- mass transfer rate and overall mass transfer rate
- definitions and units of mass transfer coefficient in the gas and liquid phases
- concentrations for the description of absorption - relative mass fractions
- a scheme of a counter-current absorption column
- a mass balance of a counter-current absorption
- absorption equilibrium and operating line for counter-current absorption process
- a minimum amount of absorbent in a counter-current absorption
- a number of mass transfer units in the liquid and gas phases, idea and calculation
- determination of the number of theoretical plates
- a height of the packed bed in the absorption column

### **ex. 15 – Fluidization**

- units of the fluid flow rate and related recalculations
- units of pressure and related recalculations
- principle of operation of an u-tube manometer
- critical velocity of fluidization
- velocity of a particle removal from an apparatus
- a dependence of  $\log \Delta p = f(\log u)$  through a fixed bed and during the fluidization