Membrane technologies

Outline

1. **Introduction**
   
   Overview on principles, concepts, state-of-the-art and industrial relevance

2. **Membranes**
   
   2.1 Membrane materials, preparation and manufacturing of membranes
   2.2 Characterization of membranes
   2.3 Transport in membranes
   2.4 Polarisation phenomena
   2.5 Membrane fouling

3. **Module and process design principles**
   
   3.1 Modules
   3.2 Membrane systems and operation

4. **Membrane processes**
   
   4.1 Pressure-driven membrane processes
      4.1.1 **Microfiltration**
      4.1.2 **Ultrafiltration**
      4.1.3 **Reverse osmosis**
      4.1.4 **Nanofiltration**
   4.2 Concentration difference as driving force
      4.2.1 Gas separation and vapour permeation
      4.2.2 Pervaporation
      4.2.3 Dialysis
      4.2.4 Carrier-mediated transport

\[1\] underlined are membrane processes with particular relevance for water treatment and purification
4.3 Electrically driven membrane processes
4.3.1 Electrodialysis
4.3.2 Membrane electrolysis

4.4 Thermally driven membrane processes
4.4.1 Membrane distillation

4.5 Membrane contactors
4.5.1 Gas-liquid contactors
4.5.2 Liquid-liquid contactors

4.6 Membrane reactors
4.6.1 Membrane reactor concepts for (bio)chemical synthesis
4.6.2 Fuel cell systems

5. Exemplary membrane technologies for water treatment and purification

5.1 Production of ultrapure water
5.2 Desalination of seawater
5.3 Production of drinking water
5.4 Waste water treatment (MBR)

Main reference books:


Additional books:


Lecture material:

http://duepublico.uni-duisburg-essen.de

Membrane Technologies - Parts 1 to 7