



## LABORATORY PLANNING GUIDE

### L56 v3 Chemical Reaction Engineering Laboratory

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Covered subjects according to the curriculum

Major topics of learning content:

- conversion of substances depending on
  - \* reactor type
  - \* residence time in the reactor
  - \* temperature
- fundamentals of a saponification reaction
- fundamentals of chemical catalysis
- fundamentals of enzymatic catalysis
- continuous stirred tank reactor
- discontinuous stirred tank reactor
- stirred tanks in series
- tubular reactor
- plug-flow reactor
- laminar-flow reactor
- use of a photometric analyser
- using the flow injection analysis (FIA)
- heterogeneous catalysis in the fixed bed
- corrosion behaviour of different metallic materials (rust / passivation)
  - \* influence of pH value of the electrolyte solution
  - \* influence of salt concentration in the electrolyte solution
  - \* oxygen corrosion
  - \* corrosion protection by external voltage, sacrificial anodes and protective layers
- gas absorption
  - \* investigation of the absorption process when separating gas mixtures in a packed column
  - \* investigation of the variables influencing the effectiveness of absorption
- continuous adsorptive air drying
  - \* fundamental principle of adsorption and desorption
  - \* investigation of the variables influencing adsorption and desorption
- adsorption
  - \* determining the mass transfer zone
  - \* an absorber's mass balance and efficiency
  - \* predicting breakthrough curves
  - \* detection of the influencing factors contact time, temperature and mode of operation
- fundamentals of diffusion: Fick's law
- determination of the diffusion coefficient for the mass transport in gas and in liquid
- advanced oxidation with hydrogen peroxide and UV light
- fundamental principle of reverse osmosis
  - \* Van't Hoff's law
  - \* permeate flow rate and retention dependent on pressure, salt concentration in raw water and yield
  - \* assembly, cleaning and conservation of membrane modules

### Main concept

The laboratory is designed for accommodation of 24 students + 2 laboratory staff:

- 2 - 4 students form a team and work together at a workstation / training system
- 11 different workstations
- All workstations are floor standing or on a laboratory table
- 3 of the workstations are equipped with a PC
- Each workstation is equipped with a manual containing technical information, basic theory, experiment instructions, evaluation help and safety advice.
- Student teams are scheduled to change workstations from lab session to lab session in order to perform the entire range of experiments within the course duration.
- Average time per experiment: 90 to 120 minutes.
- 2 workstations for laboratory staff (with PC and internet access)
- 1 printer for common use
- 1 cupboard for small parts, consumables, tools, paper etc.

### Initial training provided for laboratory personnel

Trainer: Specialized engineer of G.U.N.T. Gerätebau GmbH, Germany.

To be conducted immediately after installation and commissioning of the equipment.

General topics to be covered for any of the educational systems:

- Basic familiarization with the system.
- Functions and components.
- Overall system configuration aspects.
- Start-up and operational aspects.
- Conduction experiments, including evaluation and calculation.
- Using the system with and without the software (where applicable).
- Trouble shooting and maintenance aspects.
- Hands-on, practical familiarization aspects.
- Seminar participants with the delivered system.
- Details of the manuals.
- Safe operation and preventive maintenance.

### Requirements / Utilities

Power supply:

- 230 V / 50 Hz / 1 phase – at least 20 power sockets

Water:

- 4 x cold water
- 4 x drain

Others:

- CO<sub>2</sub>

Laboratory computer network:

- 2 internet connections for staff
- 2 internet connections for students

Location:

- Laboratory space min 72 m<sup>2</sup>
- This laboratory could be installed on any floor (e.g. ground floor or 1<sup>st</sup> floor)

Schedule of requirements

Item No.	Description	Quantity
Item 1	Supply unit for chemical reactors	1 pcs.
Item 1.1	Continuous stirred tank reactor	1 pcs.
Item 1.2	Tubular reactor	1 pcs.
Item 1.3	Stirred tanks in series	1 pcs.
Item 1.4	Discontinuous stirred tank reactor	1 pcs.
Item 1.5	Plug-flow reactor	1 pcs.
Item 1.6	Laminar-flow reactor	1 pcs.
Item 2	Fixed bed catalysis	1 pcs.
Item 2.1	Flow injection analysis	1 pcs.
Item 3	Corrosion experimental unit	1 pcs.
Item 4	Gas absorption	1 pcs.
Item 5	Adsorptive air drying	1 pcs.
Item 6	Adsorption	1 pcs.
Item 7	Diffusion in liquids and gases	1 pcs.
Item 8	Tubular reactor	1 pcs.
Item 9	Advanced oxidation	1 pcs.
Item 10	Reverse osmosis	1 pcs.

Laboratory drawing

