Course Specifications
Valid as from the academic year 2018-2019

Reaction Kinetics and Reactor Design (I000745)

Course
 Specifications

Lecturers in academic year 2018-2019
Van der Meeren, Paul LA24 lecturer-in-charge

Course offerings and teaching methods in academic year 2018-2019
A (semester 2) Dutch seminar: practical PC room classes 25.0 h
lecture 16.25 h guided self-study 11.25 h
seminar: coached exercises 7.5 h

Offered in the following programmes in 2018-2019
Bachelor of Science in Bioscience Engineering (main subject Chemistry and Food Technology) 5 credits A
Master of Science in Bioscience Engineering: Cell and Gene Biotechnology 5 credits A
Master of Science in Bioscience Engineering: Environmental Technology 5 credits A

Teaching languages
Dutch

Keywords
Reaction kinetics, residence time distribution, reactor design

Position of the course
This course aims to provide the student with a better understanding of various aspects of the rate of transformation processes, such as (bio)chemical reactions and thermal processes (e.g. sterilisation). It discusses unit operations that include changes in chemical structure and hence is complementary to 'process engineering' where unit operations are discussed that do not change the chemical structure.

Contents
First of all, thermodynamics aspects, such as heat exchange and position of the equilibrium, are considered. In addition, different ways to numerically indicate transformation rates are discussed. Besides, the rate-determining factors are discussed. In addition to batch processes, continuous reactors are considered as well. In the latter case, the flow-through characteristics are of primary importance.

Part 1: Thermodynamic aspects
· thermochemistry
· calorimetry
· entropy change upon chemical reaction
· Gibbs free energy
· chemical equilibrium

Part 2: Kinetics
· vocabularium
· influence of concentration on reaction rate
· rate equations of simple and complex reactions
· homogenous and heterogenous catalysis
· reaction rate theories

Contact hrs
Study time 135 h
Credits 5.0

Course size (nominal values; actual values may depend on programme)
Credits 5.0
Study time 135 h
Contact hrs 60.0 h

(Approved)
· collision theory of Arrhenius and collision kinetics
· transition theory of Eyring and derived equations

Part 3: Reactor design
· types of reactors (batch reactor, plug-flow reactor, CFSTR)
· residence time distribution in flow-through reactor
· mixing time versus residence time
· E- and F-curves
· concentration profiles in reactors:
  · physical aspect: wash-out behaviour
  · chemical aspect: (bio)chemical transformations
· heat transfer in reactors

Initial competences
  Profound knowledge about thermodynamics.

Final competences
  1. Numerical description of the rate of discontinuous and continuous transformation processes
  2. Simulation of time-dependent behaviour of reactant and product concentrations
  3. Elementary knowledge of flow through continuous reactors

Conditions for credit contract
  Access to this course unit via a credit contract is determined after successful competences assessment.

Conditions for exam contract
  This course unit cannot be taken via an exam contract.

Teaching methods
  Guided self-study, lecture, seminar: coached exercises, seminar: practical PC room classes

Extra information on the teaching methods
  Theory: oral presentations
  Exercises: guided calculation and simulation exercises

Learning materials and price
  Course material is available

References
  Included in the lecturing material

Course content-related study coaching
  The study coaching will be taken care of by the teaching assistants of the department.

Evaluation methods
  end-of-term evaluation

Examination methods in case of periodic evaluation during the first examination period
  Written examination, open book examination

Examination methods in case of periodic evaluation during the second examination period
  Written examination, open book examination

Examination methods in case of permanent evaluation

Possibilities of retake in case of permanent evaluation
  not applicable

Extra information on the examination methods
  Theory: period aligned evaluation
  Exercises: period aligned evaluation

  Students who eschew period aligned and/or non-period aligned evaluations for this course unit may be failed by the examiner.
  Theory: written (open book) examination
  Exercises: written (open book) examination

Calculation of the examination mark

(Approved)