GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2019-2020

Process Engineering (O000140)

Course size (nominal values; actual values may depend on programme)

Credits	5.0	Study time	150 h
Contact hrs	60.0 h		

Course offerings and teaching methods in academic year 2019-2020

A (semester 1)	English	lecture	30.0 h
		seminar: practical PC room classes	6.0 h
		lecture: plenary exercises	12.0 h
		seminar: coached exercises	12.0 h

Lecturers in academic year 2019-2020

Heynderickx, Philippe	KR01	lecturer-in-charge

Offered in the following programmes in 2019-2020	crdts	offering
Bachelor of Science in Environmental Technology	5	A
Bachelor of Science in Food Technology	5	A
Bachelor of Science in Molecular Biotechnology	5	A

Teaching languages

English

Keywords

Engineering, unit operations, mass and heat balances

Position of the course

This course continues the education started up in the physics courses, in particular thermodynamics and physical transport phenomena. The course is complementary with the course 'Process Technology'. The course 'Process Engineering' covers the principles of unit operations, whereas the course 'Process Technology' focuses on the technical realization of these unit operations. The purpose of the course is double. First, the set-up of processes, being based on (mass or heat) transport phenomena, is covered. Second, a selection of typical unit operations from the chemical industry and industrial activities with respect to e.g. food processing are discussed, where the selection comprises calculations concerning momentum, mass and heat transfer operations.

Contents

1. Introduction to engineering principles and units
2. Heat transfer processes
2.1. Forced convection heat transfer inside pipes
2.2. Heat exchangers
2.3. Special heat-transfer coefficients
3. Evaporation
3.1. Introduction
3.2. Types of Evaporation equipment and operation methods
3.3. Overall heat-transfer coefficients in evaporators
3.4. Calculation methods for single-effect evaporators
3.5. Evaporation of biological materials
4. Drying of process materials
4.1. Introduction and methods of drying
4.2. Equipment for drying
4.3. Vapor pressure of water and humidity
4.4. Equilibrium moisture content of materials

4.5. Rate-of-drying curves
4.6. Calculation methods for constant-rate drying period
4.7. Calculation methods for falling-rate drying period
5. Stage and continuous gas-liquid separation processes
5.1. Types of separation processes and methods
5.2. Equilibrium relations between phases
5.3. Single and multiple contact stages
5.4. Mass transfer between phases
5.5. Absorption in plate and packed towers
5.6. Estimation of mass-transfer coefficients for packed towers
6. Liquid-liquid and fluid-solid separation processes
6.1. Introduction to adsorption processes
6.2. Batch adsorption
6.3. Design of fixed-bed adsorption columns
6.4. Single-stage liquid-liquid extraction processes
6.5. Types of equipment and design for liquid-liquid extraction
6.6. Continuous multistage countercurrent extraction
7. Membrane separation processes
7.1. Introduction and types of membrane separation processes
7.2. Liquid permeation membrane processes
7.3. Gas permeation membrane processes
7.4. Ultrafiltration membrane processes
7.5. Microfiltration membrane processes
8. Mechanical-physical separation processes
8.1. Introduction and classification of mechanical-physical separation processes
8.2. Filtration in solid-liquid separation
8.3. Centrifugal separation processes
9.0. Gas-liquid reactions
10.0. Dealing with Fermi problems - back-of-the-envelope calculations

Initial competences

Inorganic Chemistry 1: Structure of Matter; Inorganic Chemistry 2: Reactivity of Matter; Mathematics 1: Engineering Mathematics; Physics 1 and 2: Mechanics, Vibration, Waves and Thermodynamics

Final competences

The student will have a profound view on the principles of unit operations. The covered unit operations should be understood, both qualitatively and quantitatively from an engineering point of view.

Conditions for credit contract

Access to this course unit via a credit contract is unrestricted: the student takes into consideration the conditions mentioned in 'Starting Competences'

Conditions for exam contract

Access to this course unit via an exam contract is unrestricted

Teaching methods

Lecture, lecture: plenary exercises, seminar: coached exercises, seminar: practical PC room classes

Learning materials and price

Course notes (theory and exercises) and slides are available on Minerva platform
Syllabus 'Environmental Chemistry' by Prof. Heynderickx and the references within.

References

Syllabus 'Environmental Chemistry' by Prof. Heynderickx and the references within.

Course content-related study coaching

Professor and assistants have office hours to give a possibility for extra input/explanation/... after the scheduled course hours.

Evaluation methods

end-of-term evaluation and continuous assessment

Examination methods in case of periodic evaluation during the first examination period

Written examination with open questions, open book examination

Examination methods in case of periodic evaluation during the second examination period

Written examination with open questions, open book examination

Examination methods in case of permanent evaluation

Participation

Possibilities of retake in case of permanent evaluation

examination during the second examination period is not possible

Extra information on the examination methods

During the first and second examination period, the periodic evaluation accounts for 80% (16/20) for the final score. The written examination with open questions consists of a part 'theory', which is closed book (maximally 8/20). The second part is an open book examination for the exercises (maximally 8/20). Time consumption on the whole examination (maximal 4 hrs) is maximal 2 hrs for the theory part and the remaining time (minimal 2 hrs) for the exercise part.
The non-periodic evaluation takes up 20% (4/20). This non-periodic evaluation corresponds to the presence and attitude (participation) during lectures, lectures for plenary exercises and seminars for coached exercises (maximally 1/20). Some assignments (as homework with deadline) can be given, counting for maximally 3/20. During the second examination period, this non-periodic evaluation (maximal 4 pts) cannot be retaken.
To qualify for passing, the total score needs to be at least 10/20. Regarding the assignments as non-periodic evaluation (maximal 3/20), there are deadlines: in case the deadline is not met, the corresponding score will be 0 for that assignment. No excuse can be invoked whatsoever.

Calculation of the examination mark

5% participation (presence and attitude)
15% assignments (type exercises)
*80% w*ritten exam with open questions for theory (maximal 8 pts) and open book examination for exercises (maximal 8 pts)