GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2018-2019

Industrial Biotechnology (I001749)

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

Credits	5.0	Study time	135 h	Contact hrs	60.0 h

Course offerings and teaching methods in academic year 2018-2019

A (semester 1)	Dutch	lecture	30.0 h
		guided self-study	12.5 h
		excursion	10.0 h
		seminar: practical PC room classes	7.5 h

Lecturers in academic year 2018-2019

Soetaert, Wim	LA25	lecturer-in-charge

Offered in the following programmes in 2018-2019	crdts	offering
Master of Science in Bioinformatics (main subject Bioscience Engineering)	5	A
Master of Science in Bioscience Engineering: Cell and Gene Biotechnology	5	A
Master of Science in Bioscience Engineering: Chemistry and Bioprocess Technology	5	A
Master of Science in Bioscience Engineering: Food Science and Nutrition	5	A

Teaching languages

Dutch

Keywords

Screening, growth kinetics, fermentors, bioreactors, aeration, substrates, genetics, mutations, recombination, enzyme technology, biocatalysis, bioconversion, bioreactors in solvents

Position of the course

This course deals with the underlying principles of the industrial exploitation of fermentation and bioconversion processes. Kinetical, physiological, genetical as well as processtechnological aspects are discussed. These principles are then exemplified with some industrial case-studies.

The principles of biocatalytic processes and enzyme technology and its industrial applications are also widely discussed.

The practical training includes the computing of fermentation and biocatalysis parameters and visits to fermentation industries

Contents

1. General introduction to industrial microbiology and biotechnology
° Production of microbial biomass, enzymes, primary and secondary metabolites

2. Microbial nutrition and substrates for industrial fermentation
° Carbon sources
° Nitrogen sources
° Minerals, vitamins and growth factors
° Chelators and buffers
° Medium optimisation
° Medium sterilisation

3. Growing micro-organisms on an industrial scale
° General introduction to microbial growth kinetics
° Inoculum preparation and fermentation build-up
° Measurement of microbial growth and microbial metabolites
° Agitation and aeration
° Foam and pH control
° Batch fermentation
° Scale-up of industrial fermentation
° Continuous culture
° Fed batch fermentation
° High cell density fermentation
° Solid state fermentation

4. Development of industrial micro-organisms
° Safekeeping of industrial strains
° Microbial culture collections
° Screening in nature and metagenomics
° Mutation, genetic engineering and selection of industrial micro-organisms
  a.Techniques for random mutation of micro-organisms
  b.Transformation
  c.In-vivo recombination
  d.In-vitro recombination and rDNA technology
  e.Selection and screening techniques

5. Metabolic deregulation and metabolic engineering of industrial micro-organisms
° Metabolic control and regulation of microbial flux
° Metabolic deregulation for overproduction of microbial metabolites
° Metabolic engineering and modelling
° Synthetic biology

6. Down-stream processing: product recovery from fermentation broths
° Biomass separation
  a. Centrifugation
  b. Microfiltration
  c. Filtration
° Product recovery
  a. Extraction
  b. Crystallisation
  c. Precipitation
  d. Evaporation
  e. Membrane processes
  f. Chromatography

Initial competences

Industrial Biotechnology builds on the learning outcomes of course units Chemistry 1: Structure of Matter, Chemistry 2: Reactivity of Matter, Chemistry 3: Organic Chemistry - structure, Chemistry 3: Organic Chemistry - reactivity, Biochemistry and Molecular Biology, Microbiology ; or the learning outcomes have been achieved differently.

Final competences

1 Have insight in the microbial nutrition and media
2 Have insight in the basic principles of microbial fermentation technology
3 Have insight in the directed metabolic and genetic engineering of microorganisms
4 Have insight in the downstream processing technology for the recovery and purification of microbial products

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, excursion, lecture, seminar: practical PC room classes

Learning materials and price

A written course is available; a few reference books are recommended. Cost: 15 EUR

References

SIKYTA, B., 1995

Techniques in Applied Microbiology
Progress in Industrial Microbiology, vol 31,
Elsevier (ISBN 0444-98666-9)

DEMAIN, A.L. and DAVIES, J.E. (Eds.) 1999
Manual of Industrial Microbiology and Biotechnology
ASM-Press, USA (ISBN -1-55581-128-OC)

RATLEDGE, C. and KRISTIANSEN, B. (Eds.) 2001
Basic Biotechnology (2nd ed.)
Cambridge University Press (ISNB -0521-77917-0)

STRAATHOF, A.J.J. and ADLERCREUTZ, P. 2000
Applied Biocatalysis (2nd ed.)
Harwood Academic Publ. (ISBN -90-5823-023-6)

WAITES, M. J., MORGAN, N., L, ROCKEY, J. S. and HIGTON, G., 2001
Industrial Microbiology: an introduction
Blackwell Science (ISBN 0632-05307-0)

Course content-related study coaching

Evaluation methods

end-of-term evaluation

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

Written examination with open questions, oral examination

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

Written examination with open questions, oral examination

Examination methods in case of permanent evaluation

Possibilities of retake in case of permanent evaluation

not applicable

Extra information on the examination methods

Theoretic exam: written and oral
Practical exam: PC exercise (closed book)

Calculation of the examination mark

Theoretical exam: 80%
Practical exam: 20%

Students who eschew period aligned and/or non-period aligned evaluations for this course unit may be failed by the examinator.