GHENT UNIVERSITY

Course Specifications

Valid in the academic year 2024-2025

Digitalisation for Resource Recovery (I002599)

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

Credits 6.0 **Study time 180 h**

Course offerings in academic year 2024-2025

Lecturers in academic year 2024-2025

Offered in the following programmes in 2024-2025	**crdts**	**offering**

Teaching languages

English

Keywords

Modelling, bioprocesses, physical chemical processes, data acquisition and sensoring, control, process optimisation

Position of the course

The student is trained in modelling of unit processes and process trains in the area of resource recovery. This allows to optimize the complex processes with different objectives in mind. The importance of acquisition and treatment of input data is highlighted among which new developments on IoT approaches. Fundamentals of process control are introduced and finally applied to process trains to make them disturbance proof. Concepts of digital twins at different scales are introduced. Some topics are introduced through guest lectures by people from practice.

Contents

Items with * are offered in reduced form for offering session B

1 *Introduction to digitalisation*
2 *Data acquisition*
  1 *Traditional monitoring*
  2 *Sensoring and IoT*
  3 *Design of sampling and sensor networks*
  4 *Maintenance and operator training*
3 *Data modeling and standardization*
  1 *Data models*
  2 *Context data and metadata*
  3 *Data standards and interoperability*
4 *Data provisioning and brokerage*
  1 *Data requirements*
  2 *Data brokerage*
5 *Data verification*
    1.Quality control
    2.On-line and offline data verification approaches
6. *Modelling of unit operations**
    1. Mixing, gas-liquid mass transfer
    2. Bioprocesses (ASM, ADM)
    3. Physical chemical processes (settling, precipitation, flotation, filtration,...)
7. *Modelling of process flowsheets*
    1. Example of BSM1&2 layouts
    2. Resource recovery train(s)

3. Drinking water treatment train

8. *Operational process optimization (scenario analysis)*
9. *Introduction to control**
10. *Application of control in process flowsheets*
11. *Introduction to a digital twin example*

Initial competences

Introduction to Environmental Modeling and Simulation or Modelling and simulation of bioprocesses; Environmental Technology - Water

Final competences

1 The student knows how to build a model of a given unit process
2 The student is able to build a model of a resource recovery process train
3 The student is able to optimise a process train for several objectives
4 The student understands the fundamentals of data acquisition and reconciliation and knows how to apply them.
5 The student understands master the fundamentals of control and knows how to apply them to a resource recovery process flow sheet

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

Seminar, Lecture, Independent work, Peer teaching

Extra information on the teaching methods

The theoretical aspects are treated by independent work supported by oral lectures. The practical exercises are taught in seminars and practical PC-room classes. 2 scientific papers in the field of digitalization of resource recovery need to be critically analysed and peer-assessed.

Study material

None

References

Henze, M., Gujer, W., Mino T. and van Loosdrecht, M. (2000) Activated Sludge Models ASM1, ASM2, ASM2D and ASM3. Scientific and Technical Report No. 9, IWAPublishing, London

Course content-related study coaching

Assessment moments

end-of-term and continuous assessment

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

Peer and/or self assessment

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

Peer and/or self assessment

Examination methods in case of permanent assessment

Peer and/or self assessment, Assignment

Possibilities of retake in case of permanent assessment

examination during the second examination period is possible

Extra information on the examination methods

The exam (open book) checks whether the student is able to solve a practical problem effectively using the methodologies learned in order to answer questions about a system. The paper analysis checks the correct interpretation and critical assessment of scientific literature on the course topic.

Calculation of the examination mark

Practical exercises: 70%
Assignment: 30%
Students who eschew period aligned and/or non-period aligned evaluations for this course unit may be failed by the examiner.