

CIVILINGENIØR, CAND.POLYT. I KEMITEKNIK, 2017

CIVILINGENIØR ESBJERG

MODULER SOM INDGÅR I STUDIEORDNINGEN

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PROCESS ANALYSIS

2021/2022

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Account for which theoretical, numerical and experimental tools are available to solve the selected problem in process analysis
- · Explain the physical, chemical and mathematical theory behind the selected tools

SKILLS

- Apply instruments, equipment, data sampling systems and instrumental chemical analysis to solve the problem
- · Evaluate which kind of theory and or equipment gives the fastest and most robust answer to the questions raised
- Write a project report following the standards of the field of study, include relevant original scientific literature, use the correct terminology, and communicate the research-based foundation, problem and results of the project in writing, graphically and orally in a coherent way
- Assess and select relevant original scientific literature and current scientific methods, models and other tools used in the project and asses the problem of the project and results in relevant scientific contexts and social conditions

COMPETENCES

- · Transfer the obtained theory and methodology to other problems involving process analysis
- Handle the planning, implementation and management of complex and unpredictable research and/or developmental tasks and take professional responsibility for implementing academic assignments and interdisciplinary collaborations
- · Take responsibility for own professional development and specialization

TYPE OF INSTRUCTION

Project work

EXTENT AND EXPECTED WORKLOAD

450 hours

EXAM

Name of exam	Process Analysis
Type of exam	Oral exam based on a project
ECTS	15
Assessment	7-point grading scale
Type of grading	Internal examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

Danish title	Procesanalyse
Module code	К-КТ-К1-18
Module type	Project
Duration	1 semester
Semester	Autumn
ECTS	15
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Esbjerg
Responsible for the module	Sergey Kucheryavskiy

Study Board	Study Board of Biotechnology, Chemistry and Environmental Engineering	
Department	Department of Chemistry and Bioscience	
Faculty	Faculty of Engineering and Science	

FLUID MECHANICS

2021/2022

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- · Explain fundamental basis for the formulation and analysis of the statics and dynamics of the flow of viscous fluids
- · Account for fluid kinematics
- Explain stresses in fluids, equation of motion, constitutive models and Navier-Stokes equations
- · Account for Reynolds averaging and turbulence models
- Describe turbulent and laminar boundary layers including understanding of momentum equation for boundary layers
- · Explain the basic phenomena involved in multiphase flows

SKILLS

- · Plan, design and make experiments and choose measurements methods suitable to the characteristics of the fluid
- Determine and apply appropriate experimental methods to fluid flows
- Apply appropriate analytical, semi-empirical and numerical methods for mathematical description of fluid dynamic problems
- Use multiphase flow models

COMPETENCES

- · Independently define and analyse scientific problems within the area of fluid dynamics
- · Independently be a part of professional and interdisciplinary development work within the area of fluid dynamics

TYPE OF INSTRUCTION

· Lectures, workshops, exercises, mini-projects and self-studies

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

Name of exam	Fluid Mechanics
Type of exam	Written or oral exam
ECTS	5
Assessment	7-point grading scale
Type of grading	Internal examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

Danish title	Strømningslære
Module code	K-KT-K1-7
Module type	Course
Duration	1 semester
Semester	Autumn
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Esbjerg
Responsible for the module	Matthias Mandø

Study Board	Study Board of Biotechnology, Chemistry and Environmental Engineering	
Department	Department of Chemistry and Bioscience	
Faculty	Faculty of Engineering and Science	

COLLOID AND INTERFACE SCIENCE

2021/2022

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- · Account for different types of colloids and their stability
- · Acount for adsorption at interfaces
- · Account for surfactants, wettability and emulsions
- · Account for different scattering techniques, X-ray methods and electron microscopy
- Account for different disciplines in which the theory of colloid and interface science are beneficial for understanding details of products or processes
- · Explain the importance of size and interparticle forces that result in macroscopic properties of substances
- Explain models of colloids and interfaces that can be used for the description and understanding of different colloid systems. This involves physical equations, diagrams, drawings and images

SKILLS

- · Apply general theory of colloid science in combination with experimental tools
- Evaluate which kinds of experimental tools that preferable can be used to enhance the physico-chemical understanding of a given process or product

COMPETENCES

· Select and apply models to describe different colloidal systems and interfaces

TYPE OF INSTRUCTION

· Lectures laboratory problems and theoretical exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

Name of exam	Colloid and Interface Science
Type of exam	Oral exam
ECTS	5
Assessment	7-point grading scale
Type of grading	Internal examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

Danish title	Kolloid- og grænsefladekemi
Module code	К-КТ-К1-8
Module type	Course
Duration	1 semester
Semester	Autumn
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Esbjerg
Responsible for the module	Erik Gydesen Søgaard

Study Board	Study Board of Biotechnology, Chemistry and Environmental Engineering	
Department	Department of Chemistry and Bioscience	
Faculty	Faculty of Engineering and Science	

CHEMOMETRICS

2021/2022

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Account for general methods for multivariate data analysis (principal component analysis, multiple linear regression, principal component regression, projection on latent structures, soft independent modelling of class analogy)
- Account for methods for data preprocessing (centering, scaling, non-linear and spectroscopic preprocessing, orthogonal signal correction)
- Explain basic methods for variable selection (Selectivity ratio, VIP, interval PLS, jack-knife)
- Explain the theoretical background of these methods, their advantages and limitations as well as possible applications
- · Explain how multivariate methods complement traditional statistical methods

SKILLS

- Explore multivariate data, find groups and trends, detect and remove outliers
- · Calibrate and do proper validation of multivariate regression models, use these models for prediction
- Evaluate if data need a preprocessing and which method to apply
- · Calibrate and evaluate models for data classification
- · Compare different regression and classification models and find which is the best
- Use multivariate methods for analysis of real data from different applications

TYPE OF INSTRUCTION

· Lectures, classroom instruction and mini-projects

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

Name of exam	Chemometrics
Type of exam	Written exam
ECTS	5
Assessment	Passed/Not Passed
Type of grading	Internal examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

Danish title	Kemometri
Module code	К-КТ-К1-9
Module type	Course
Duration	1 semester
Semester	Autumn
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Esbjerg
Responsible for the module	Sergey Kucheryavskiy

Study Board	Study Board of Biotechnology, Chemistry and Environmental Engineering	
Department	Department of Chemistry and Bioscience	
Faculty	Faculty of Engineering and Science	

PROCESS MODELLING

2021/2022

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- · Describe one or more advanced programmes for numerical calculations of complex and/or big amounts of data
- · Explain the theory behind the programmes

SKILLS

- · Apply one of the programmes for numerical calculation of a selected process in the laboratory or at pilot scale
- · Evaluate the results of simulations and find and correct any wrong input data
- Write a project report following the standards of the field of study, include relevant original scientific literature, use the correct terminology and communicate the research-based foundation, problem and results of the project in writing, graphically and orally in a coherent way
- Assess and select relevant original scientific literature and current scientific methods, models and other tools used in the project and asses the problem of the project and results in relevant scientific contexts and social conditions

COMPETENCES

- Present the setup of the model, the calculations and estimations of the results and to propose further work based on the results of calculation
- Handle the planning, implementation and management of complex and unpredictable research and/or developmental tasks and take professional responsibility for implementing academic assignments and interdisciplinary collaborations
- · Take responsibility for own professional development and specialization

TYPE OF INSTRUCTION

Project work

EXTENT AND EXPECTED WORKLOAD

450 hours

EXAM

Name of exam	Process Modelling
Type of exam	Oral exam based on a project
ECTS	15
Assessment	7-point grading scale
Type of grading	External examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

Danish title	Procesmodellering
Module code	K-KT-K2-15
Module type	Project
Duration	1 semester
Semester	Spring
ECTS	15
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Esbjerg
Responsible for the module	Rudi P. Nielsen
Time allocation for external examiners	В

Study Board	Study Board of Biotechnology, Chemistry and Environmental Engineering	
Department	Department of Chemistry and Bioscience	
Faculty	Faculty of Engineering and Science	

PROCESS SIMULATION AND INSTRUMENTATION 2021/2022

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- · Account for the principles of process simulation
- Explain process optimization using process simulation
- · Account for computational aspects of phase equilibria
- · Account for instrumentation and PFD & PID's
- Describe commercial process simulators

SKILLS

- Illustrate an actual process in a PFD
- Convert a PFD into a working process simulation
- · Perform both steady-state and dynamic simulations

COMPETENCES

- Investigate a given case using simulation tools
- · Select an appropriate thermodynamic model for a given case

TYPE OF INSTRUCTION

Lectures, practical exercises, group and individual instructions

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Process Simulation and Instrumentation	
Type of exam	Written or oral exam	
ECTS	5	
Assessment	Passed/Not Passed	
Type of grading	Internal examination	
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures	

FACTS ABOUT THE MODULE

Danish title Processimulering og instrumentering

Module code	К-КТ-К2-8
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Esbjerg
Responsible for the module	Rudi P. Nielsen

Study Board	Study Board of Biotechnology, Chemistry and Environmental Engineering	
Department	Department of Chemistry and Bioscience	
Faculty	Faculty of Engineering and Science	

WATER TREATMENT

2021/2022

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- · Describe different water bodies in the society and its surroundings and their interaction with atmosphere
- · Describe natural and antropogenic pollutants, their origin and some ways to eliminate them
- Explain which chemical compounds are normally present in groundwater, surface water, sea water, brine and at which levels based on original water and weathering processes
- · Describe a normal Danish drinking water treatment system and a Danish waste water treatment system

SKILLS

- Select a methodology from an array of advanced oxidative and reductive processes that separately or in common can solve a given recalcitrant water pollution problem
- · Select unit operations and purification methods for produced water and other industrial water types

COMPETENCES

• Use proper terminology in oral, written and graphical communication and documentation within water treatment technology

TYPE OF INSTRUCTION

Lectures supplemented with project work, workshops, presentation seminars, laboratory tests and cases

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Water Treatment
Type of exam	Oral exam
ECTS	5
Assessment	7-point grading scale
Type of grading	Internal examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

FACTS ABOUT THE MODULE

Danish title	Teknisk vandbehandling
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Module code	K-KT-K2-9
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Esbjerg
Responsible for the module	Jens Muff

Study Board	Study Board of Biotechnology, Chemistry and Environmental Engineering	
Department	Department of Chemistry and Bioscience	
Faculty	Faculty of Engineering and Science	

POLYMERS AND PROPERTIES OF POLYMERS 2021/2022

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Explain polymerisation processes
- · Describe the influence of segments in polymers on the properties
- · Account for viscosity and solubility parameters for polymers
- · Account for degradation of polymers
- · Account for permeability and migration in polymers
- · Describe additives and their influence on the properties
- · Describe a polymer system

SKILLS

- Analyze and describe analytical methods to receive the knowledge about the polymer system and of the properties for the system
- Describe the properties of a polymer system

COMPETENCES

 Apply proper terminology in oral, written and graphical communication and documentation within polymers and properties of polymer systems

TYPE OF INSTRUCTION

Lectures and theoretical exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

Name of exam	Polymers and Properties of Polymers
Type of exam	Written or oral exam
ECTS	5
Assessment	7-point grading scale
Type of grading	Internal examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

Danish title	Polymerer og polymeres egenskaber
Module code	К-КТ-К2-10
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Esbjerg
Responsible for the module	Jesper de Claville Christiansen

Study Board	Study Board of Biotechnology, Chemistry and Environmental Engineering	
Department	Department of Chemistry and Bioscience	
Faculty	Faculty of Engineering and Science	

SPECIALISATION IN CHEMICAL ENGINEERING 2021/2022

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- · Account for at least one of the following areas
 - ^o Bio energy
 - Ceramics and photocatalysis
 - ° Chemicals in oil and gas industry
 - Environmental technology
 - ° Fossil fuels and enhanced oil recovery
 - Fungal Technology
 - Natural products
 - Polymer technology
 - Spectroscopy and data analysis

SKILLS

- · Demonstrate skills in at least one of the following areas:
 - ^o Execution of laboratory experiments
 - ° Application of physico-chemical models to chemical engineering products
 - Processes or process units, application of process simulators to chemical engineering related processes (e.g. separation, kinetics)
- · Analysis of experimental data
- Write a project report following the standards of the field of study, include relevant original scientific literature, use the correct terminology and communicate the research-based foundation, problem and results of the project in writing, graphically and orally in a coherent way
- Assess and select relevant original scientific literature and current scientific methods, models and other tools used in the project and asses the problem of the project and results in relevant scientific contexts and social conditions

COMPETENCES

- · Identify key aspects of the problem/process under investigation
- Select and combine experimental and theoretical methods, as appropriate, in order to solve complex problems in chemical engineering
- · Critical review of the methods used and the results obtained on the project work
- Handle the planning, implementation and management of complex and unpredictable research and/or developmental tasks and take professional responsibility for implementing academic assignments and interdisciplinary collaborations
- · Take responsibility for own professional development and specialization

TYPE OF INSTRUCTION

Project work

EXTENT AND EXPECTED WORKLOAD

900 hours

EXAM

EXAMS

Name of exam	Specialisation in Chemical Engineering	
Type of exam	Oral exam based on a project	
ECTS	30	
Assessment	7-point grading scale	
Type of grading	External examination	
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures	

FACTS ABOUT THE MODULE

Danish title	Specialisering i kemiteknologi
Module code	K-KT-K3-19
Module type	Project
Duration	1 semester
Semester	Autumn
ECTS	30
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Esbjerg
Responsible for the module	Jens Muff
Time allocation for external examiners	В

Study Board	Study Board of Biotechnology, Chemistry and Environmental Engineering	
Department	t Department of Chemistry and Bioscience	
Faculty	Faculty of Engineering and Science	

MASTER'S THESIS IN CHEMICAL ENGINEERING 2021/2022

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- · Explain the scientific basis and scientific issues in chemical engineering
- · Explain the highest international research within the thesis subject area

SKILLS

- · Master the scientific methods and general skills related to the thesis subject area
- Write a project report following the standards of the field of study, use the correct terminology and document extensive use of relevant and original scientific literature, and communicate and discuss the project's research-based foundation, problem and results in writing, graphically and verbally in a coherent way
- Critically assess and select relevant original scientific literature and current scientific methods, models and other tools used in the project and asses and discuss the problem of the project and results in relevant scientific contexts and social conditions
- Evaluate the potential of the project for further development, assessing and incorporating relevant economic, ethical, environmental and other socially relevant factors

COMPETENCES

- Participate in and independently implement technological and scientific development and research, develop and implement experimental work and solve complex tasks using scientific methods
- Handle the planning, implementation and management of complex and unpredictable research and/or developmental tasks and take professional responsibility to implement independent academic assignments and interdisciplinary collaborations
- · Independently take responsibility for own professional development and specialization

TYPE OF INSTRUCTION

- · Project work
- A long Master's thesis of more than 30 ECTS must include work of experimental nature to an extend that corresponds to the ECTS load of the thesis

EXTENT AND EXPECTED WORKLOAD

900 hours

EXAM

Name of exam	Master's Thesis in Chemical Engineering	
Type of exam	Oral exam based on a project	
ECTS	30	
Assessment	7-point grading scale	

Type of grading	External examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

Danish title	Kandidatspeciale i kemiteknik
Module code	К-КТ-К4-20
Module type	Project
Duration	1 semester
Semester	Spring
ECTS	30
Language of instruction	English
Location of the lecture	Campus Esbjerg
Responsible for the module	Jens Muff
Time allocation for external examiners	D

Study Board	Study Board of Biotechnology, Chemistry and Environmental Engineering	
Department	Department of Chemistry and Bioscience	
Faculty	Faculty of Engineering and Science	

PROJECT WORK IN AN EXTERNAL ORGANISATION 2021/2022

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

· Explain the scientific basis of the work carried out by the external organisation

SKILLS

- Master the scientific methods and general skills related to the project work in the external organisation
- Write a report following the standards of the field of study, use the correct terminology and document extensive use of relevant and original scientific literature, communicate and discuss the project's foundation, problem and results in writing, graphically and verbally in a coherent way
- Critically assess and select relevant original scientific literature and current scientific methods, models and other tools used in the project and asses and discuss the problem of the project and results in relevant scientific contexts and social conditions
- Evaluate the potential of the project for further development, assessing and incorporating relevant economic, ethical, environmental and other socially relevant factors

COMPETENCES

- Participate in development, innovation and research and use scientific methods to solve complex tasks
- Take professional responsibility to implement independent assignments and interdisciplinary collaborations
- Independently take responsibility for own professional development and specialization

TYPE OF INSTRUCTION

- · Project work, supervised by an external supervisor in collaboration with an internal supervisor at Aalborg University
- Project work in an external organisation must be in areas of relevance to the competence profile of the program

EXTENT AND EXPECTED WORKLOAD

900 hours

EXAM

Name of exam	Project Work in an External Organisation	
Type of exam	Oral exam based on a project	
ECTS	30	
Assessment	Passed/Not Passed	
Type of grading	Internal examination	
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures	

Danish title	Projektarbejde i en ekstern organisation
Module code	К-КТ-КЗ-20
Module type	Project
Duration	1 semester
Semester	Autumn
ECTS	30
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Esbjerg
Responsible for the module	Erik Gydesen Søgaard

Study Board	Study Board of Biotechnology, Chemistry and Environmental Engineering	
Department	Department of Chemistry and Bioscience	
Faculty	Faculty of Engineering and Science	

MASTER'S THESIS IN CHEMICAL ENGINEERING 2021/2022

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- · Explain the scientific basis and scientific issues in chemical engineering
- · Explain the highest international research within the thesis subject area

SKILLS

- · Master the scientific methods and general skills related to the thesis subject area
- Write a project report following the standards of the field of study, use the correct terminology and document extensive use of relevant and original scientific literature, communicate and discuss the project's research-based foundation, problem and results in writing, graphically and verbally in a coherent way
- Critically assess and select relevant original scientific literature and current scientific methods, models and other tools used in the project, asses and discuss the problem of the project and results in relevant scientific contexts and social conditions
- Evaluate the potential of the project for further development, assessing and incorporating relevant economic, ethical, environmental and other socially relevant factors

COMPETENCES

- Participate in and independently implement technological and scientific development and research, develop and implement experimental work and solve complex tasks using scientific methods
- Handle the planning, implementation and management of complex and unpredictable research and/or developmental tasks and take professional responsibility to implement independent academic assignments and interdisciplinary collaborations
- · Independently take responsibility for own professional development and specialization

TYPE OF INSTRUCTION

- · Project work
- A long Master's thesis of more than 30 ECTS must include work of experimental nature to an extend that corresponds to the ECTS load of the thesis

EXTENT AND EXPECTED WORKLOAD

1800 hours

EXAM

Name of exam	Master's Thesis in Chemical Engineering
Type of exam	Master's thesis/final project
ECTS	60
Assessment	7-point grading scale

Type of grading	External examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

Danish title	Kandidatspeciale i kemiteknik
Module code	К-КТ-КЗ-24
Module type	Project
Duration	2 semesters
Semester	Autumn
ECTS	60
Language of instruction	English
Location of the lecture	Campus Esbjerg
Responsible for the module	Jens Muff
Time allocation for external examiners	D

Study Board	Study Board of Biotechnology, Chemistry and Environmental Engineering	
Department	Department of Chemistry and Bioscience	
Faculty	Faculty of Engineering and Science	