



AALBORG UNIVERSITET

CIVILINGENIØR, CAND.POLYT. I KEMI, 2017, VERSION 2 2018

CIVILINGENIØR
AALBORG

MODULER SOM INDGÅR I STUDIEORDNINGEN

INDHOLDSFORTEGNELSE

| | |
|--|----|
| Materialeteknologi 2019/2020 | 3 |
| Materials Chemistry 2019/2020 | 4 |
| Processing of Materials 2019/2020 | 6 |
| Physical Chemistry of Materials 2019/2020 | 8 |
| Industrial Application of Macromolecules 2019/2020 | 10 |
| Polymer Chemistry 2019/2020 | 12 |
| Supramolecular Chemistry 2019/2020 | 14 |
| Carbohydrate Chemistry 2019/2020 | 16 |
| Project work in an external organisation 2019/2020 | 18 |
| Master's thesis in Chemistry 2019/2020 | 20 |
| Extended Master's Thesis in Chemistry 2019/2020 | 22 |

MATERIALETEKNOLOGI

2019/2020

MODULETS INDHOLD, FORLØB OG PÆDAGOGIK

OMFANG OG FORVENTET ARBEJDSINDSAT

450 hours

EKSAMEN

PRØVER

| | |
|---------------------|---|
| Prøvens navn | Materialeteknologi |
| Prøveform | Mundtlig pba. projekt |
| ECTS | 15 |
| Bedømmelsesform | 7-trins-skala |
| Censur | Intern prøve |
| Vurderingskriterier | Vurderingskriterierne er angivet i Universitetets eksamensordning |

FAKTA OM MODULET

| | |
|--------------------|-------------------------------|
| Engelsk titel | Materials Technology |
| Modulkode | K-KEM-K1-48 |
| Modultype | Projekt |
| Varighed | 1 semester |
| Semester | Efterår |
| ECTS | 15 |
| Undervisningssprog | Dansk og engelsk |
| Tomplads | Ja |
| Undervisningssted | Campus Aalborg |
| Modulansvarlig | Yuanzheng Yue |

ORGANISATION

| | |
|------------|---|
| Studienævn | Studienævn for Kemi, Miljø og Bioteknologi |
| Institut | Institut for Kemi og Biovidenskab |
| Fakultet | Det Ingeniør- og Naturvidenskabelige Fakultet |

MATERIALS CHEMISTRY

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module adds to the knowledge obtained in Inorganic Chemistry and Physical Chemistry

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

The purposes of the course are to introduce both fundamental chemical principles of materials and nano-materials, and main methods for developing, optimizing, post-treating and characterizing materials regarding different physical and chemical performances.

The focus will be placed on the relation between chemical composition, structure and properties. The course will introduce the current status of materials and nano-materials technologies.

Materials chemistry focuses on the fundamental principles and applications of both conventional and advanced inorganic materials. The course is divided into the following two parts.

1. General inorganic materials chemistry and characterization of inorganic materials (e.g., glass chemistry, ceramic chemistry, metal chemistry, cement industry)
2. Chemistry of organic and inorganic nano-materials (e.g., thin films, nano-crystals and –particles, nanotubes, mesoporous materials, nano wires, etc.).

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Understand the fundamental principles of materials chemistry and how it relates to practical use
- Explain different application areas of materials and ways to optimize the production process of materials

SKILLS

- Prepare, synthesize and modify materials to reach target properties using theoretical and practical knowledge in materials chemistry
- Design, synthesize, and produce nanostructured materials with given properties.
- Characterize conventional materials and nano-materials

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

| | |
|--------------|-----------------------|
| Name of exam | Materials Chemistry |
| 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 |

FACTS ABOUT THE MODULE

| | |
|----------------------------|---|
| Danish title | Materialekemi |
| Module code | K-KEM-K1-20 |
| Module type | Course |
| Duration | 1 semester |
| Semester | Autumn |
| ECTS | 5 |
| Language of instruction | English |
| Empty-place Scheme | Yes |
| Location of the lecture | Campus Aalborg |
| Responsible for the module | Yuanzheng Yue , Morten Mattrup Smedskjær |

ORGANISATION

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

PROCESSING OF MATERIALS

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module adds to the knowledge obtained in Materials Chemistry, Unit Operations, Modelling of heterogeneous processes

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

The purpose is to introduce students to knowledge about materials manufacturing, post-treatment and the impact of the manufacture conditions on the structure and properties of materials. To introduce students to the analysis of large-scale industrial systems as well as methods and principles of environmental evaluation. To enable students in chemical engineering to collaborate with mechanical engineers

The courses cover the introduction to e.g.:

- Application areas and development tendencies of plastics
- Chemical performances of materials
- Manufacturing technology of polymers
- Manufacturing technology of ceramics, cements and glasses
- Environmental analysis and management
- Industrial processes by visiting relevant industries

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Clarify the relationship among chemical composition, structure, properties and manufacturing

SKILLS

- Conduct calculations of manufacture parameters and mechanical, physical and chemical properties
- Apply materials manufacturing technologies and their engineering applications
- Predict certain properties of materials based on their manufacturing parameters
- Design manufacturing and post-treatment processes that can improve physical and chemical performances of materials
- Carry out analysis of large-scale production processes

COMPETENCES

- Use principles and methods for environmental management

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

| | |
|--------------|-------------------------|
| Name of exam | Processing of Materials |
| 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 |

FACTS ABOUT THE MODULE

| | |
|----------------------------|---|
| Danish title | Materialeforarbejdning |
| Module code | K-KEM-K1-19 |
| Module type | Course |
| Duration | 1 semester |
| Semester | Autumn |
| ECTS | 5 |
| Language of instruction | English |
| Empty-place Scheme | Yes |
| Location of the lecture | Campus Aalborg |
| Responsible for the module | Yuanzheng Yue , Morten Mattrup Smedskjær |

ORGANISATION

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

PHYSICAL CHEMISTRY OF MATERIALS

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module adds to knowledge obtained in Physical Chemistry and Analytical Chemistry

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

- Materials thermodynamics
- Chemical reaction kinetics and dynamics in materials
- Phase equilibrium in materials
- Order and disorder in solid
- Experimental methods for collecting thermodynamic and kinetic data of materials, e.g., viscometric and calorimetric methods
- General electrochemistry
- Analytical electrochemistry
- Application of electrochemistry in materials science
- Description of electron-ion conductor junction as electrochemical electrode
- Electrolytes and their properties, redox reactions, conductivity and determination
- Links between electrochemical potentials, thermodynamic parameters and concentrations
- Electrochemical methods: Impedance spectroscopy, voltammetry, and other analytical methods and its instrumentation
- Type of electrodes, electrode kinetics and electrode related effects
- Description of the different type of batteries, accumulators and fuel cells

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Understand and apply the link between electrochemistry and thermodynamics
- Explain and utilize phase diagram of materials
- Clarify mechanisms behind the phase transitions

SKILLS

- Solve physical chemical problems in the fields of materials science and chemical processes
- Collect and evaluate physical-chemical data by doing experiments such as the viscometric and calorimetric measurements
- Apply different types of electron-ion conductor junction to understand their electrodynamic, thermodynamic and kinetic backgrounds
- Apply different analytical methods based on electrochemical reactions
- Apply the knowledge about chemistry, technology and economy of electrochemical processes in materials industry
- Design the processes in batteries, accumulators and fuel cells

COMPETENCES

- Design experimental routes for synthesis and treatment of new materials based on physical chemistry and electrochemical principles

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

| | |
|------------------------|--|
| Name of exam | Physical Chemistry of Materials |
| 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 |

FACTS ABOUT THE MODULE

| | |
|----------------------------|--|
| Danish title | Materialers fysiske kemi |
| Module code | K-KEM-K1-21 |
| Module type | Course |
| Duration | 1 semester |
| Semester | Autumn |
| ECTS | 5 |
| Language of instruction | English |
| Empty-place Scheme | Yes |
| Location of the lecture | Campus Aalborg |
| Responsible for the module | Yuanzheng Yue , Jens Muff |

ORGANISATION

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

INDUSTRIAL APPLICATION OF MACROMOLECULES

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module adds to the knowledge obtained in Organic Chemistry, Physical Chemistry, Unit Operations

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

To give the students an extensive knowledge and competences in molecular applications of natural and synthetic macromolecules, principles of their production and characterisation of polymers from molecular architecture to properties in relation to their industrial use.

Projects will deal with industrial problems related to the chemistry and application of macromolecules. Projects could cover macromolecule synthesis, modification and/or characterization as well as applications of macromolecules.

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Understand and account for the chemical properties of selected natural and synthetic macromolecules on molecular and macroscopic level
- Relate the chemical properties to the production of natural and synthetic macromolecules

SKILLS

- Select relevant techniques for the characterization of macromolecules and the study of their applications
- Synthesize, modify and characterize macromolecules with selected physical and chemical functionalities
- Apply separation principles for manufacturing, purification and characterization of macromolecules

COMPETENCES

- Analyze and solve problems related to industrial use of macromolecules, implementing knowledge of molecular and macroscopic properties of macromolecules

EXTENT AND EXPECTED WORKLOAD

450 hours

EXAM

EXAMS

| | |
|------------------------|--|
| Name of exam | Industrial Application of Macromolecules |
| 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 |

FACTS ABOUT THE MODULE

| | |
|----------------------------|--|
| Danish title | Industriell anvendelse af makromolekyler |
| Module code | K-KEM-K2-48 |
| Module type | Project |
| Duration | 1 semester |
| Semester | Spring |
| ECTS | 15 |
| Language of instruction | Danish and English |
| Empty-place Scheme | Yes |
| Location of the lecture | Campus Aalborg |
| Responsible for the module | Donghong Yu |

ORGANISATION

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

POLYMER CHEMISTRY

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module adds to the knowledge obtained in Fundamental Organic Chemistry, Experimental Organic Chemistry

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

To introduce the students majoring in chemistry or engineering a broad knowledge of polymer chemistry, such as principles of polymerization, polymer morphologies, polymer properties and so on. Meanwhile, some basic experimental techniques will be included in the lab course.

- Basic Principles: Molecular weight and polymer solutions
- Chemical Structure and Polymer Properties
- Polymer Morphology
- Step-reaction and ring opening polymerization and its lab course
- Free radical polymerization and its lab course
- Ionic Polymerization and its lab course
- Vinyl polymerization with complex coordination catalysts
- Characterization of polymers, Polyethers, -sulfides, and related polymers, Polyamides and related polymers. Heterocyclic polymers. Miscellaneous organic polymers, Inorganic and partially inorganic polymers. Natural Polymers.
- Recent developments in the frontier research for novel polymerization technique of new materials
- Basic experimental techniques will be included in laboratory exercises

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Account for different categories of polymers and their use in selected applications
- Characterize and categorize polymers
- Explain different polymerization and modification principles

SKILLS

- Design synthetic routes of functional monomers
- Perform polymerization under various conditions
- Modify polymer surfaces

COMPETENCES

- Characterize macromolecules: from chemical structure to molecular weights and distributions

TYPE OF INSTRUCTION

The program is based on a combination of academic, problem-oriented and interdisciplinary approaches and organized based on the following work and evaluation methods that combine skills and reflection:

- Lectures
- Workshop exercises (individually and in groups)
- Project work and exercises in labs
- Teacher feedback

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

| | |
|------------------------|--|
| Name of exam | Polymer Chemistry |
| 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 |

FACTS ABOUT THE MODULE

| | |
|--|-----------------------------|
| Danish title | Polymerkemi |
| Module code | K-KEM-K2-19 |
| Module type | Course |
| Duration | 1 semester |
| Semester | Spring |
| ECTS | 5 |
| Language of instruction | English |
| Empty-place Scheme | Yes |
| Location of the lecture | Campus Aalborg |
| Responsible for the module | Donghong Yu |
| Time allocation for external examiners | F |

ORGANISATION

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

SUPRAMOLECULAR CHEMISTRY

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module adds to the knowledge obtained in Organic Chemistry and Physical Chemistry

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

To introduce the students to supramolecular chemistry with focus on the physical chemistry of molecular interactions.

The course includes lectures and theoretical assignments, including

- The basic concepts of supramolecular chemistry
- Intermolecular forces and equilibrium considerations
- Thermodynamics and solvent effects
- Cation- and anion-specific ligands
- The supramolecular chemistry of biological systems
- The self-organization of molecules
- Self-assembly of macromolecules and polymers
- Experimental assessment and computational modelling of molecular interactions

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Explain the principles of design of artificial ligands
- Relate similarities and differences of intra- and intermolecular forces of large molecules and aggregates
- Describe the thermodynamics of molecular interactions and account for the importance of solvents and additives on the strength of molecular interactions

SKILLS

- Apply theories and methods for analysis of molecular interactions
- Apply experimental and computational models in the study of molecular interactions

COMPETENCES

- Predict the molecular interactions of macromolecules and their implications on macroscopic behaviour

TYPE OF INSTRUCTION

The program is based on a combination of academic, problem-oriented and interdisciplinary approaches and organized based on the following work and evaluation methods that combine skills and reflection:

- Lectures
- Workshop exercises (individually and in groups)
- Project work and exercises in labs
- Teacher feedback

EXTENT AND EXPECTED WORKLOAD

150 timer

EXAM

EXAMS

| | |
|------------------------|--|
| Name of exam | Supramolecular Chemistry |
| 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 |

FACTS ABOUT THE MODULE

| | |
|--|---------------------------------------|
| Danish title | Supramolekylær kemi |
| Module code | K-KEM-K2-22 |
| Module type | Course |
| Duration | 1 semester |
| Semester | Spring |
| ECTS | 5 |
| Language of instruction | English |
| Empty-place Scheme | Yes |
| Location of the lecture | Campus Aalborg |
| Responsible for the module | Kim Lambertsen Larsen |
| Time allocation for external examiners | F |

ORGANISATION

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

CARBOHYDRATE CHEMISTRY

2019/2020

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Explain and show in depth understanding of the structure and chemical properties of mono- and disaccharides as well as oligo- and polysaccharides
- Demonstrate knowledge of industrially important carbohydrates including hydrocolloids and their gelation properties
- Explain essential aspects of glycobiology
- Demonstrate in depth knowledge of the substrate specificity, regio- and anomeric selectivity as well as the function and catalytic mechanisms of carbohydrate active enzymes
- Demonstrate knowledge of the enzymology related to degradation and modification of plant based biomass including starch, cellulose and pectin

SKILLS

- Apply and suggest methods of carbohydrate synthesis and modifications to solve problems in industrial processes and applications
- Apply knowledge to evaluate structure in relation to functional properties of carbohydrates
- Carry out calculations on basic carbohydrate chemical concepts
- Perform theoretical analyses of chemical and physical methods in carbohydrate chemistry
- Suggest relevant chemical and enzyme catalysts for chemical reactions in carbohydrate chemistry

TYPE OF INSTRUCTION

- Lectures
- Theoretical exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

| | |
|------------------------|--|
| Name of exam | Carbohydrate Chemistry |
| 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 |

FACTS ABOUT THE MODULE

| | |
|----------------------------|---|
| Danish title | Kulhydratkemi |
| Module code | K-BT-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 Aalborg |
| Responsible for the module | Lars Haastrup Pedersen , Kim Lambertsen Larsen |

ORGANISATION

| | |
|-------------|---|
| 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

2019/2020

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, and 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 assess 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

EXAMS

| | |
|------------------------|--|
| 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 | External examination |
| Criteria of assessment | The criteria of assessment are stated in the Examination Policies and Procedures |

FACTS ABOUT THE MODULE

| | |
|--|--|
| Danish title | Projektarbejde i en ekstern organisation |
| Module code | K-KEM-K3-64 |
| Module type | Project |
| Duration | 1 semester |
| Semester | Autumn |
| ECTS | 30 |
| Language of instruction | English |
| Empty-place Scheme | Yes |
| Location of the lecture | Campus Aalborg |
| Responsible for the module | Kim Lambertsen Larsen |
| Time allocation for external examiners | B |

ORGANISATION

| | |
|-------------|---|
| 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 CHEMISTRY

2019/2020

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

The master thesis can be conducted as a long master thesis. If choosing to do a long master thesis, it has to include experimental work and has to be approved by the study board. The amount of experimental work must reflect the allotted ECTS

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Explain the scientific basis and scientific issues in chemistry and 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 assess 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 extent that corresponds to the thesis ECTS load

EXTENT AND EXPECTED WORKLOAD

900 hours

EXAM

EXAMS

| | |
|--------------|------------------------------|
| Name of exam | Master's thesis in Chemistry |
|--------------|------------------------------|

| | |
|------------------------|--|
| Type of exam | Master's thesis/final 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 | Kandidatspeciale i kemi |
| Module code | K-KEM-K4-70 |
| Module type | Project |
| Duration | 1 semester |
| Semester | Spring |
| ECTS | 30 |
| Language of instruction | English |
| Location of the lecture | Campus Aalborg |
| Responsible for the module | Kim Lambertsen Larsen |
| Time allocation for external examiners | D |

ORGANISATION

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

EXTENDED MASTER'S THESIS IN CHEMISTRY

2019/2020

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 chemistry and 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 assess 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 extent that corresponds to the thesis ECTS load

EXTENT AND EXPECTED WORKLOAD

1800 hours

EXAM

EXAMS

| | |
|--------------|---------------------------------------|
| Name of exam | Extended Master's Thesis in Chemistry |
| 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 |

ADDITIONAL INFORMATION

The master thesis can be conducted as a long master thesis. If choosing to do a long master thesis, it has to include experimental work and has to be approved by the study board. The amount of experimental work must reflect the allotted ECTS.

FACTS ABOUT THE MODULE

| | |
|--|---------------------------------------|
| Danish title | Langt kandidatspeciale i kemi |
| Module code | K-KEM-K3-65 |
| Module type | Project |
| Duration | 2 semesters |
| Semester | Autumn and Spring |
| ECTS | 60 |
| Language of instruction | English |
| Location of the lecture | Campus Aalborg |
| Responsible for the module | Kim Lambertsen Larsen |
| Time allocation for external examiners | D |

ORGANISATION

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