AALBORG UNIVERSITET

CIVILINGENIØR, CAND.POLYT I BÆREDYGTIG BIOTEKNOLOGI, 2020

CIVILINGENIØR
KØBENHAVN

MODULER SOM INDGÅR I STUDIEORDNINGEN

INDHOLDSFORTEGNELSE

ADVANCED MICROBIOLOGICAL PRODUCTION

2021/2022

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

- Demonstrate basic understanding and overview of different biological and biochemical processes that occur in microbiological fermentation and production
- Explain plant cell walls and the structure of plant material in general

SKILLS

- Select relevant enzymes for processing of specific biomasses
- Suggest genetic modifications of microorganisms of relevance to their project
- 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

- 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

EXAMS

Name of exam	Advanced Microbiological Production
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	Avanceret mikrobiel produktion
Module code	K-BBT-K1-16
Module type	Project
Duration	1 semester
Semester	Autumn
ECTS	15
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Mette Lübeck

ORGANISATION

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

BIOREFINERY PRINCIPLES

2021/2022

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

- Account for existing biorefinery concepts and technologies
- Compare different types of biorefineries with each other and oil refineries
- Outline possible technological couplings and combinations with other process industry

SKILLS

- Evaluate biomasses with respect to their applicability in biorefineries and outline which qualities that are associated with applicability
- Identify and analyze the limitations by existing physical-chemical, thermochemical, and biological methods for biomass conversion
- Set up mass and energy balances for different biomass conversions
- Apply one or more of the general calculation models for estimation of costs and energy efficiency in the conversion of different biomasses into different products

COMPETENCES

- Devise a suitable biorefinery technique for the conversion of a given biomass into a specific product
- Evaluate the environmental consequences of biorefinery activities

TYPE OF INSTRUCTION

- Lectures and theoretical exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Biorefinery Principles
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	Bioraffinaderier

Module code	K-BBT-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 Copenhagen
Responsible for the module	Hinrich Wilhelm Uellendahl, Carl Peter Westermann, Mette Lübeck, Morten Lykkegaard Christensen

ORGANISATION

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

SYSTEMS AND SYNTHETIC BIOLOGY

2021/2022

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Explain and process information from “omics” technologies

SKILLS

- Elaborate simple metabolic models and use tools for genome-scale modelling
- Design metabolic and evolutionary engineering strategies
- Apply molecular tools for synthetic biology

COMPETENCES

- Evaluate and address ethical questions in the synthetic biology field

TYPE OF INSTRUCTION

- Lectures and theoretical exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Systems and Synthetic Biology
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	Systembiologi og syntetisk biologi
Module code	K-BBT-K1-8
Module type	Course
Duration	1 semester

Semester	Autumn
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Cesar Simoes da Fonseca

ORGANISATION

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

BIOLOGICAL PRODUCTION PROCESSES

2021/2022

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

SKILLS

Students who have passed the module should be able to

- Use basic molecular biology tools for genetic engineering
- Suggest and apply usable enzymes for biomass degradation
- Differentiate between main groups of microorganisms and their use in a production process

COMPETENCES

- Compare the most important types of bioreactors and suggest the optimal type for a specific production process

TYPE OF INSTRUCTION

- Lectures and theoretical exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Biological Production Processes
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	Biologiske produktionsprocesser
Module code	K-BBT-K1-9
Module type	Course
Duration	1 semester
Semester	Autumn
ECTS	5
Language of instruction	English

Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Mette Lübeck, Peter Stephensen Lübeck, Carl Peter Westermann

ORGANISATION

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

BIOMASS CONVERSION PROCESSES

2021/2022

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- explain how biomass is analyzed, characterized, treated and converted
- explain the possibilities and techniques that are available for process control

SKILLS

- select appropriate analyses for the characterization of a specific biomass considering the subsequent use in a biorefinery
- analyze and quantify the content of relevant components and compounds in a specific biomass
- design and perform experiments to evaluate the potential of a specific biomass in a biorefinery:
- test and evaluate pre-treatment techniques
- perform bench-scale fermentations
- purify intermediate and end products
- 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

- devise the most appropriate process scheme including pre-treatment process, fermentation, purification, and down-stream processing for common types of biomass
- 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

PREREQUISITE FOR ENROLLMENT FOR THE EXAM

- An approved PBL competency profile is a prerequisite for participation in the project exam.

EXAMS

Name of exam	Biomass Conversion Processes

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	Processering og omsætning af biomasse
Module code	K-BBT-K2-13A
Module type	Project
Duration	1 semester
Semester	Spring
ECTS	15
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Hinrich Wilhelm Uellendahl

ORGANISATION

Study Board	Study Board of Biotechnology, Chemistry and Environmental Engineering
Department	Department of Chemistry and Bioscience
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MICROBIOLOGICAL DISCOVERY

2021/2022

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Describe different screening strategies and their benefits and limitations
- Devise and describe relevant classical screening strategies for microorganisms with specific capabilities
- Devise and describe relevant advanced molecular screening strategies for identification of specific genes or gene products

TYPE OF INSTRUCTION

Lectures and theoretical exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Microbiological Discovery
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	Mikrobiel 'discovery'
Module code	K-BBT-K2-7
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen

Responsible for the module	Mette Lübeck

ORGANISATION

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

ADVANCED KINETICS AND MODELLING OF BIOPROCESSES

2021/2022

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

SKILLS

Students who have passed the module should be able to

- Estimate the kinetic parameters of a biological process and choose the key process variables for the development of a suitable process model
- Derive the mathematical model of a bioprocess
- Apply mathematical and kinetic models for different types of bioreactors
- Interpret and evaluate modelling data from bioreactors

TYPE OF INSTRUCTION

Lectures and theoretical exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Advanced Kinetics and Modelling of Bioprocesses
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	Avanceret kinetik og modellering af bioprocesser
Module code	K-BBT-K2-8
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English

Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Hinrich Wilhelm Uellendahl

ORGANISATION

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SUSTAINABLE BIOTECHNOLOGICAL COMPANIES – FROM INNOVATION TO INDUSTRY

2021/2022

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module adds to the knowledge obtained in the modules Biorefinery Principles and Biological Production Processes

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

- Describe the principles of the transfer from innovation to production of new bioproducts
- Account for patent issues
- Describe how to establish a business plan and a budget for expenditure and establishment
- Describe a biotechnological production company with respect to substrates, organisms and processes

SKILLS

- Work out a simple life-cycle analysis and technoeconomical assesment for the production in a biotechnological company
- Establish a plant description, process diagrams, mass balances and energy balance of a biotechnological production
- Calculate a budget for the establishment and operation of a biotechnological production
- Evaluate the sustainability of the biotechnological production by means of a life-cycle analysis
- Set principles for a business plan

COMPETENCES

- Utilize the competences gained during the education to establish a complete business plan of a sustainable biotechnological company.
- Participate in team-based project work

TYPE OF INSTRUCTION

Lectures and project work

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Sustainable biotechnological companies – from innovation to industry
Type of exam	Oral exam based on a project Oral examination based upon a business plan worded out during the course and a presentation of the business plan
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	Bæredygtige bioteknologiske virksomheder - fra innovation til industri
Module code	K-BT-M2-82
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Peter Stephensen Lübeck

ORGANISATION

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

PROJECT-ORIENTED STUDY IN AN EXTERNAL ORGANISATION

2021/2022

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

- 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 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. The Project-oriented study in an external organization must have a scope that correspond the ECTS load.

EXAM

EXAMS

Name of exam	Project-oriented Study 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	Projektorienteret forløb i en virksomhed
Module code	K-BBT-K3-17
Module type	Project
Duration	1 semester
Semester	Autumn
ECTS	30
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Mette Lübeck, Peter Stephensen Lübeck

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

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 within the competence profile of the program
- explain the highest international research within the thesis subject area

SKILLS

- master the scientific methods and general skills related to the competence profile of the program
- 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 and problem and results in writing, graphically and verbally in a professionally reasoned and 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 societal 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

EXTENT AND EXPECTED WORKLOAD

900 hours

EXAM

EXAMS

Name of exam	Master's Thesis
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
Module code	K-KMB-K4-5
Module type	Project
Duration	1 semester
Semester	Spring
ECTS	30
Language of instruction	English
Responsible for the module	Lars Haastrup Pedersen
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

MASTER'S THESIS

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 within the competence profile of the program
- explain the highest international research within the thesis subject area

SKILLS

- master the scientific methods and general skills related to the competence profile of the program
- 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 and problem and results in writing, graphically and verbally in a professionally reasoned and 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 societal 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 and has to be approved by the Head of Studies. The amount of experimental work must reflect the allotted ECTS.

EXTENT AND EXPECTED WORKLOAD

1800 hours

EXAM

EXAMS

Name of exam	Master's Thesis
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

FACTS ABOUT THE MODULE

Danish title	Kandidatspeciale
Module code	K-KMB-K4-4
Module type	Project
Duration	2 semesters
Semester	Autumn
ECTS	60
Language of instruction	English
Responsible for the module	Lars Haastrup Pedersen
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