AALBORG UNIVERSITET

BACHELOR (BSC) I TEKNISK VIDENSKAB (BÆREDYGTIG BIOTEKNOLOGI), 2016, VERSION 2 2018

BACHELOR (BSC) I TEKNISK VIDENSKAB
KØBENHAVN

MODULER SOM INDGÅR I STUDIEORDNINGEN

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LINEAR ALGEBRA

2020/2021

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

- Use of derived functions
- Integrals and integration techniques
- Indefinite, definite and improper integrals
- Use of definite integrals
- Polar coordinates and parametric equations
- Function series
- Ordinary 1st and 2nd order differential equations
- Partial differential equations
- Linear algebra and analytical geometry
- Vectors and vector spaces
- Determinant and linear systems
- Matrices, determinants and linear equation systems

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Understand differentiation and integration of simple mathematical functions
- Understand and interpret simple mathematical problems including solutions to differential equations
- Understand simple problems in linear algebra

SKILLS

- Calculate differentials and integrals of simple functions
- Solve ordinary 1st and 2nd order differential equations
- Solve systems of algebraic equations

TYPE OF INSTRUCTION

Lectures and exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Linear Algebra
Type of exam	Written exam 4 hours
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	Lineær algebra
Module code	K-BBT-B1-19
Module type	Course
Duration	1 semester
Semester	Autumn
ECTS	5
Language of instruction	English
Location of the lecture	Campus Copenhagen
Responsible for the module	Johan Rønby Pedersen

ORGANISATION

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

PROBLEMBASERET LÆRING I VIDENSKAB, TEKNOLOGI OG SAMFUND

2020/2021

MODULETS INDHOLD, FORLØB OG PÆDAGOGIK

LÆRINGSMÅL

VIDEN

- Viden der gør den studerende i stand til at:
  - Redegøre for den grundlæggende læringsteori
  - Redegøre for teknikker til planlægning og styring af projektarbejde
  - Redegøre for forskellige tilgange til problembaseret læring (PBL); herunder Aalborg modellens udgangspunkt i problemer, der indgår i en samfundsmæssig og/eller humanistisk sammenhæng
  - Redegøre for forskellige tilgange til analyse og vurdering af ingeniør, natur og sundhedsvidenskabelige problemstillinger og løsninger i et videnskabsteoretisk, etisk og samfundsmæssigt perspektiv
  - Redegøre for konkrete metoder inden for fagområdet til at udføre denne analyse og vurdering

FÆRDIGHEDER

- Færdigheder der gør de studerende i stand til at:
  - Planlægge og styre et problembaseret studieprojekt
  - Analysere projektgruppens organisering af gruppesamarbejdet med henblik på at identificere stærke og svage sider, og på den baggrund komme med forslag til, hvordan samarbejdet i fremtidige grupper kan forbedres
  - Reflektere over årsager til og anvise mulige løsninger på eventuelle gruppekonflikter
  - Analysere og vurdere egen studieindsats og læring med henblik på at identificere stærke og svage sider, og der ud fra overveje videre studieforløb og studieindsats
  - Reflektere over de anvendte metoder i et videnskabsteoretisk perspektiv
  - Udpege relevante fokusområder, begreber og metoder til at vurdere og udvikle løsninger under hensynstagen til de samfundsmæssige og humanistiske sammenhænge i hvilke løsningen skal indgå

KOMPETENCER

- Kompetencer, som gør den studerende i stand til at:
  - Indgå i et teambaseret projektarbejde
  - Formidle et projektarbejde
  - Reflektere og udvikle egen læring bevidst
  - Indgå i og optimere kollaborative læreprocesser
  - Reflektere over sit professionelle virke i relation til det omgivende samfund

UNDERVISNINGSFORM

Kurset er organiseret som et mix af forelæsninger, seminarer, workshops, gruppekonsultation og selvstudie.

OMFANG OG FORVENTET ARBEJDSINDSATS

Kursusmodulets omfang er 5 ECTS svarende til 150 timers studieindsats.

EKSAMEN

PRØVER

Prøvens navn	Problembaseret læring i videnskab, teknologi og samfund

Prøveform	Skriftlig Kurset eksamineres individuelt på baggrund af en skriftlig opgave.
ECTS	5
Bedømmelsesform	Bestået/ikke bestået
Censur	Intern prøve
Vurderingskriterier	Vurderingskriterierne er angivet i Universitetets eksamensordning

FAKTA OM MODULET

Engelsk titel	Problem-based Learning in Science, Technology and Society
Modulkode	N-EN-B1-5
Modultype	Kursus
Varighed	1 semester
Semester	Efterår
ECTS	5
Undervisningssprog	Dansk og engelsk
Tomplads	Ja
Undervisningssted	Campus Aalborg, Campus Esbjerg, Campus København
Modulansvarlig	Annette Grunwald, Søren Rosenlund Frimodt-Møller

ORGANISATION

Studienævn	Studienævn for Energi
Institut	Institut for Energi teknik
Fakultet	Det Ingeniør- og Naturvidenskabelige Fakultet

GENERAL AND ORGANIC CHEMISTRY

2020/2021

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

- The periodic system: atom structure, properties of the elements, the size of atoms and the significance of the size
- Covalent and non-covalent bindings; ionization and ionization energy, electron affinity and electronegativity; charge and mass balances; basic electrochemistry, potentiometry and electrodes
- Separation techniques and chromatography; empirical properties and kinetic theories for gases
- Aliphatic and aromatic carbon compounds; functional groups; stereochemistry and nomenclature
- Acids, bases, buffers, solubility products, equilibria, reaction mechanisms and thermochemistry
- Laboratory safety
- Basic chemical laboratory exercises

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module

- Should know and understand the periodic table
- Should understand chemical equilibria, chemical reactions, and basic thermodynamical principles
- Can account for acid/base and redox properties for important chemical compounds and elements
- Can understand and account for nomenclature in organic chemistry, the structure of organic compounds and reaction mechanisms for organic compounds
- Can understand and account for safe laboratory practice and behavior
- Can understand basic analytical chemistry techniques (i.e. titration, spectrophotometry, chromatography)

SKILLS

- Can address fundamental characters for elements based upon their placement in the periodic system
- Can calculate the relation between ionized and unionized amount of an ionizable compound in water
- Can characterize chemical compounds with respect to acid/base and oxidative/reductive properties
- Can evaluate how a chemical reaction will proceed based upon thermodynamic considerations
- Can read and understand state chart diagrams and calculate the concentration of a compound in the liquid and gas phase based upon gas-liquid equilibrium constants
- Can name organic compounds and account for basic organic reactions, their products and reaction mechanisms

COMPETENCES

- Can use basic chemical and physical principles on biological and process technological problems
- Can move and work safely in a chemical laboratory

TYPE OF INSTRUCTION

- Lectures, calculation exercises, laboratory exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	General and Organic Chemistry

Type of exam	Written or oral exam Approved active participation in the teaching is a prerequisite for participation in the regular 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	Almen og organisk kemi
Module code	K-BBT-B1-1
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	Thorbjørn Terndrup Nielsen

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 – A CASE STUDY

2020/2021

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

The project is a case study where the students should prepare a report and a process analysis, and participate in a seminar where the project team documents are discussed

A biological production technology for the production of food, feed, energy, biochemicals and/or commodities should be selected and its basic elements described

Lectures describing different biological production methods for inspiration

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Account for the working processes in project work
- Describe basic principles in a selected biological production method
- Describe basic principles of different biological production methods.

SKILLS

- Plan a project work
- Use biological and chemical concepts and scientific presentation

COMPETENCES

- Be part of team-based project work.
- Communicate project work
- Reflect upon and develop own learning consciously
- Participate in and optimize collaborative learning processes

TYPE OF INSTRUCTION

- Lectures and project work

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Biological Production – a Case Study
Type of exam	Oral exam based on a project
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	Biologisk produktion – et case studie
Module code	K-BBT-B1-10
Module type	Project
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	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

BIOLOGICAL PRODUCTION

2020/2021

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

This module is based on knowledge gained in "Biological Production - a Case Study"

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

In the project one or more different biological production technologies are selected and analysed for the production of food, feed, energy, biochemicals and commodities

The analyses are carried out from technological, societal, ethical, environmental and economic considerations

Competences are also given within project work, project reporting and project analysis

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Describe techniques for planning and control of project work
- Account for different biological production methods

SKILLS

- Use biological and chemical concepts and scientific presentation
- Carry out analyses of the selected biological production method(s) with respect to principles, sustainability, environment and economy

COMPETENCES

- Be part of team-based project work
- Communicate project work
- Reflect upon and develop own learning consciously
- Participate in and optimize collaborative learning processes

TYPE OF INSTRUCTION

- Project work that may include some laboratory work

EXTENT AND EXPECTED WORKLOAD

300 hours

EXAM

EXAMS

Name of exam	Biological Production
Type of exam	Oral exam based on a project
ECTS	10

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	Biologisk produktion
Module code	K-BBT-B1-11
Module type	Project
Duration	1 semester
Semester	Autumn
ECTS	10
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

CALCULUS

2020/2021

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module builds on knowledge gained in Linear Algebra or similar

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module

- Should have knowledge about definitions, results and techniques within the theory of differentiation and integration of functions of two or more variables
- Should know trigonometric functions and their inverse functions
- Should have knowledge about simple surfaces in right-angled, polar and spherical coordinates
- Should have knowledge about complex numbers their calculation rules and representations
- Should have knowledge about factorization of polynomia of complex numbers
- Should have knowledge about the complex exponential function, its properties and its connection with trigonometric functions
- Should have knowledge about the theory for second order linear differential equations with constant coefficients

SKILLS

- Can visualize functions of two and three variables by means of graphs, level curves and level planes
- Can determine local and global extremes for functions of two and three variables
- Can determine area, volume, inertia moment by use of integration theory
- Can approximate functions of a variable by means of Taylor's equation and use linear approximation for functions with two or three variables
- Are capable of calculations using complex numbers
- Can find the roots of the complex quadratic equation and perform factorization of polynomia in simple cases
- Can solve linear second order differential equations with constant coefficients, generally and with starting conditions
- Can reason with the concepts, results and theories of the course in simple concrete and abstract problems

COMPETENCES

- Can develop and strengthen the knowledge, understanding and application of mathematical theories and methods within other fields
- Can reason and argue using mathematical concepts from given prerequisites

TYPE OF INSTRUCTION

Lectures and calculation exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Calculus
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	Calculus
Module code	K-BBT-B2-14
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	Bedia Akyar Møller

ORGANISATION

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

BIOMOLECULES AND BIOCHEMISTRY I

2020/2021

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module

- Can explain the properties of a broad diversity of biological molecules
- Can account for the basic synthesis of biological macromolecules (DNA/RNA, protein/sugars, polysaccharides and lignin)
- Can account for degradation of lignocellulosic material
- Can account for the structure of biomolecules
- Can account for the structure and reproduction of prokaryote and eukaryote cells

SKILLS

- Can distinguish between anaerobic and aerobic organisms and basic metabolism
- Can outline basic properties of enzymes
- Has a basic understanding of DNA replication, RNA and protein synthesis
- Knows about prokaryote and eukaryote cell components, functions and division
- Can use the gained knowledge in the project "Biomass conversion"

COMPETENCES

- Can evaluate whether processes are aerobic or anaerobic
- Can understand which biochemical processes that are important in connection with the complex biotechnological processes in connection with biomass conversion e.g. in a biorefinery

TYPE OF INSTRUCTION

Lectures, group work and seminar calculation exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Biomolecules and Biochemistry I
Type of exam	Written or oral exam Approved active participation in the teaching is a prerequisite for participation in the regular 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	Biomolekyler og Biokemi I
Module code	K-BBT-B2-1
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	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

SUSTAINABILITY

2020/2021

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

The purpose of the course is to give an overview of sustainability principles and a number of principles and methods that are parts of sustainability considerations.

The course is arranged as 2 weekly theoretical exercises where each theme is initiated by a lecture given by staff members or by invited lecturers

The different themes (sustainability concepts; thermodynamics and sustainability; sustainability and life cycle analyses; sustainability and energy, nutrients, water, and greenhouse gases; bioethics and sustainability; economics, development, and sustainability) are treated in case studies as a basis for discussions in groups

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Outline sustainability concepts related to energy, thermodynamics, nutrients, water and greenhouse gases

SKILLS

- Perform sustainability estimations and simple life cycle analyses
- Relate sustainability to societal perspectives
- Analyze biotechnological processes with respect to sustainability

COMPETENCES

- Include ethical considerations in sustainability analyses
- Outline the relationships between sustainability and development and understand projections of resource and environmental issues including global and local models
- Include economic considerations in sustainability analyses

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Sustainability
Type of exam	Written exam 4 hours
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	Bæredygtighed
Module code	K-BBT-B2-2
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	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

2020/2021

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module builds on knowledge gained in Biological production, Biomolecules and Biochemistry I or similar

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

In the project, the students work with individually chosen biomasses which should be analyzed with respect to main composition. The biomass can be pretreated or, if possible, already pretreated by others and enzymes should be applied for conversion of the biomass into a sugar stream. This can be used for production of food, feed, energy, biochemicals and commodities.

The analyses are carried out both from technological and sustainable considerations. Since plant biomass constitute the major resource for biological production, an introduction to algal, plant cells and plant cell walls will also be given. Competences are given within laboratory based work and writing of a report based on experimental data.

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module can

- Present an overview of plant or algae biomass as a resource
- Understand the basic structure of plants or algae and their cell walls
- Give an overview of plant or algae biomass conversion, including the need for pretreatment

SKILLS

- Carry out simple analyses of plant or algae biomass with respect to its composition of main components (e.g. cellulose, hemi-cellulose, lignin etc.)
- Apply enzymes to degrade plant or algae biomass
- Be able to calculate the hydrolysis efficiency
- Be able to calculate theoretical yield of a biological production (e.g. conversion of the biomass into bioethanol)

COMPETENCES

- Define a biorefinery concept
- Apply sustainability criteria in the development of biorefinery concepts
- Estimate the environmental impact
- Understand the basis of carrying out experimental work

TYPE OF INSTRUCTION

Lectures and project work including laboratory work

EXTENT AND EXPECTED WORKLOAD

450 hours

EXAM

EXAMS

Name of exam	Biomass Conversion
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

FACTS ABOUT THE MODULE

Danish title	Omdannelse af biomasse
Module code	K-BBT-B2-10
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	Zsófia Kádár
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

ENERGY AND RESOURCES

2020/2021

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module builds on knowledge gained in General and organic chemistry or similar

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

Sustainable and non-sustainable raw material and energy ressources; thermodynamics of chemical and biological reactions and systems; quality of different energy forms; storage and transport of energy

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module

- Can distinguish between fossil and renewable energy resources
- Have an overview of accessibility and sustainability related to different energy sources and their conversion processes
- Have fundamental knowledge about the different energy forms (fuels, electricity, heat) and their energy quality
- Can understand advantages and disadvantages of the different energy forms with respect to storage and transport

SKILLS

- Can calculate the energy content of a specific resource
- Can use thermodynamics in chemical and biological reactions for the calculation of energy loss by transformation to a specific energy form and the final energy content by conversion to mechanical energy, electricity and heat

COMPETENCES

- Can evaluate the sustainability and efficiency of the production of a specific raw material and its conversion into energy

TYPE OF INSTRUCTION

- Lectures and calculation exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Energy and Resources
Type of exam	Written exam 4 hours

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	Energi og ressourcer
Module code	K-BBT-B3-2
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, Henrik Tækker Madsen

ORGANISATION

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

APPLIED BIODIVERSITY

2020/2021

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module builds on knowledge gained in Biomolecules and Biochemistry I or similar

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

The general microbial diversity of fungi, bacteria and archaea is presented in this course

The actual and potential organisms that are used in biotechnology are discussed in detail and their ecology and growth characteristics are worked through together with the different laboratory techniques that are used for isolation and handling of the organisms

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module

- Can account for microbial diversity
- Can account for the problems associated to classification and species concepts of microorganisms
- Can describe commercially important microorganisms
- Can evaluate conventions regulating commercial exploitation of microorganisms
- Can describe different screening methods for new microorganisms
- Can describe how genes with interesting properties can be isolated from natural environmental samples
- Can account for basic bioinformatics needed to handle microbial diversity

SKILLS

- Can give an overview of bioinformatic tools associated to the handling of microbial biodiversity
- Have an overview of the different laboratory techniques used for isolation and handling of different types of microorganisms

TYPE OF INSTRUCTION

- Lectures and classroom exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Applied Biodiversity
Type of exam	Written exam 4 hours
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	Anvendt biodiversitet
Module code	K-BBT-B3-3
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

KINETICS AND MODELLING OF BIOPROCESSES

2020/2021

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module builds on knowledge gained in Linear algebra, Calculus, Biomolecules and Biochemistry or similar

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

- Introduction to mathematical modeling and bioprocesses, applications and approach
- The kinetics of enzymatic reactions, kinetics of cell growth, metabolism and inhibition, the effect of temperature and pH
- Mass balances and modeling of ideal bioreactors at steady-state and non-steady-state
- Examples of model development; manual estimation of process parameters based upon experimental data

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module

- Can account for the kinetics of biochemical reactions
- Understand how mathematic models are constructed for different processes and bioreactors

SKILLS

- Can determine the kinetics and calculate the relevant kinetic parameters for the processes in a bioreactor
- Can define the most important variables and make sufficient assumptions to be able to derive the mathematic model of a bioprocess
- Can apply a mathematical model on a bioreactor

COMPETENCES

- Can use mathematical modeling for the design of biotechnological processes

TYPE OF INSTRUCTION

- Lectures and calculation exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Kinetics and Modelling of Bioprocesses
Type of exam	Written exam 4 hours
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	Kinetik og modellering af bioprocesser
Module code	K-BBT-B3-4
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	Morten Lykkegaard Christensen, Mads Koustrup Jørgensen

ORGANISATION

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

SUSTAINABLE PRODUCTION OF BIOENERGY

2020/2021

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module builds on knowledge gained in Biomass conversion, Biomolecules and Biochemistry I or similar

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

- Introduction to energy and material use and resources, environmental aspects and biomass as energy
- Definition, types, accessibility and characteristics of raw materials for biofuels production
- Microbial conversion of biomass and microbial metabolism related to specific biofuels production
- Different pretreatment methods in relation to biomass and biofuels production
- Laboratory scale experiments on microbial production of biofuels
- Analyses of substrates, intermediate and end products, calculation of yields and productivity of biofuels production

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Have knowledge about current and potential possibilities to replace fossil-based energy by bioenergy through sustainable biotechnological processes
- Can account for the potential of biomass as a renewable resource for energy production
- Can explain how different biofuels can be produced by microorganisms
- Can account for different pretreatment methods in relation to different types of biomass and biofuels

SKILLS

- Can suggest a suitable pretreatment and microbial process for the production of biofuels from a specific biomass
- Can design and perform simple laboratory-scale fermentations with pure or mixed microbial cultures
- Can analyze substrates, intermediates and end products, derive significant information from experimental data and calculate yields and production rates for the production of biofuels

COMPETENCES

- Can evaluate the efficiency of the production of a specific biofuel based upon experimental data

TYPE OF INSTRUCTION

- Project work

EXTENT AND EXPECTED WORKLOAD

450 hours

EXAM

EXAMS

Name of exam	Sustainable Production of Bioenergy
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	Bæredygtig produktion af bioenergi
Module code	K-BBT-B3-12
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	Hinrich Wilhelm Uellendahl

ORGANISATION

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

SUSTAINABLE PRODUCTION OF BIOCHEMICALS

2020/2021

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module builds on knowledge gained in Biomass conversion, Biomolecules and Biochemistry I or similar

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

- Introduction to material use and resources, environmental aspects and biomass as material resources
- Definition, types, accessibility and characteristics of raw materials for biochemicals production
- Microbial conversion of biomass and microbial metabolism related to specific biochemicals production
- Different pretreatment methods in relation to biomass and biochemicals production
- Laboratory scale experiments on microbial production of biochemicals
- Analyses of substrates, intermediate and end products and calculation of yields and productivity of biochemicals production

LEARNING OBJECTIVES

KNOWLEDGE

- Have knowledge about current and potential possibilities to replace fossil-based chemicals by biochemicals through sustainable biotechnological processes
- Can account for the potential of biomass as a renewable resource for chemical production
- Can explain how different biochemicals can be produced by microorganisms
- Can account for different pretreatment methods in relation to different types of biomass and bioproducts

SKILLS

- Can suggest a suitable pretreatment and microbial process for the production of biochemicals from a specific biomass
- Can design and perform simple laboratory-scale fermentations with a pure microbial culture
- Can analyze substrates, intermediates and end products, derive significant information from experimental data and calculate yields and production rates for the production of biochemicals

COMPETENCES

- Can evaluate the efficiency of the production of a specific biochemical based upon experimental data

TYPE OF INSTRUCTION

- Project work

EXTENT AND EXPECTED WORKLOAD

450 hours

EXAM

EXAMS

Name of exam	Sustainable Production of Biochemicals
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	Bæredygtig produktion af biokemikalier
Module code	K-BBT-B3-13
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	Hinrich Wilhelm Uellendahl

ORGANISATION

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

MICROBIOLOGICAL PROCESSES

2020/2021

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module builds on knowledge gained in Biomolecules and Biochemistry I, Applied Biodiversity or similar

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

Modern biotechnology is to a large degree based upon the huge metabolic diversity of the microbial world. The most important of the microbial pathway types are presented and compared across the organismal groups. Also interesting pathways that so far are not exploited will be presented. Special metabolic pathways, energy metabolism and production of secondary metabolites will be discussed

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module

- Can present an overview over microbial physiological diversity
- Can describe the differences between prokaryotes and eukaryotes, archaea, fungi and algae
- Can account for microbial interactions
- Can explain how different types of fermentative, respiring and photosynthetic microorganisms produce energy
- Can describe microbial turnover of different compounds including nutrient and carbon cycles
- Can account for industrial use of microorganisms

SKILLS

- Can establish mass and energy balances for microbial conversion
- Has an overview of important microbial interactions
- Can evaluate potential risks and safety measures when handling microorganisms

TYPE OF INSTRUCTION

- Lectures
- Calculation exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Microbiological Processes
Type of exam	Written exam 4 hours
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	Mikrobiologiske processer
Module code	K-BBT-B4-3
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	Teis Søndergaard

ORGANISATION

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

BIOCHEMISTRY II

2020/2021

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module builds on knowledge gained in General and organic chemistry, Biomolecules and Biochemistry I or similar

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module

- Can account for the synthesis of biological macromolecules (DNA/RNA and protein)
- Can account for the structure, function and regulation of biomolecules
- Can account for Michaelis-Menten enzyme kinetics
- Can account for the energy metabolism of cellular systems
- Can account for basic metabolic pathways

SKILLS

- Can describe the structure and function of lipids, cell membranes and membrane proteins
- Can give an overview of important metabolic pathways; glycolysis, citric acid cyclus, oxidative phosphorylation, glyconeogenesis, photosynthesis, Calvin cyclus, pentose phosphate synthesis, protein metabolism, amino acid catabolism and fatty acid metabolism
- Has an understanding of DNA replication, RNA and protein synthesis
- Can use the gained knowledge in the project "The cell as a factory"

COMPETENCES

- Can evaluate whether processes are anabolic or catabolic and whether processes are primary metabolic or secondary metabolic
- Can understand which biochemical processes that are important in connection with the complex biotechnological processes in e.g. a biorefinery

TYPE OF INSTRUCTION

Lectures, group work and seminar calculation exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Biochemistry II
Type of exam	Written exam 4 hours
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	Biokemi II
Module code	K-BBT-B4-4
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	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

PROCESS TECHNOLOGY

2020/2021

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module builds on knowledge gained in Linear algebra, Calculus, General and organic chemistry or similar

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

- Introduction to chemical and biochemical processes
- Basic engineer calculations
- Set up of process diagrams
- Matter and energy balances at steady and non-steady state
- Liquid flow and mixing
- Heat and mass transfer
- Unit operations
- Homogeneous and heterogeneous reactions
- Thermodynamic analyses of chemical reactions and equilibria

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module

- Know the most common physical variables and their dimensions and units
- Can understand unit conversion between physical variables
- Can interpret process diagrams and flow sheets
- Knows the principles of the most common unit operations
- Can understand the stoichiometry in chemical processes

SKILLS

- Can construct diagrams and flow sheets or simple processes
- Can define system boundaries
- Can set up mass and/or energy balances for single step or multistep processes in which chemical reactions are a part
- Can solve algebraic or differential equations from a mass or energy balance and define the operative conditions of the system
- Can use thermodynamic functions to calculate enthalpy changes and equilibria in chemical processes

COMPETENCES

- Can analyze and design simple chemical processes

TYPE OF INSTRUCTION

Lectures and calculation exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Process Technology
Type of exam	Written exam 4 hours
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	Procesteknologi
Module code	K-BBT-B4-5
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

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

THE CELL AS A FACTORY

2020/2021

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module builds on knowledge gained in Biological production, Biomass conversion, Biomolecules, Biochemistry I or similar

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

The purpose of the module is to give a fundamental insight into the organization of the biochemistry on the cellular level and how and when this can be exploited in microbial fermentations.

The project is partially practical including work with one or more cell types (prokaryotic or eukaryotic) in fermentation experiments, where the dynamics and regulation of the cells are investigated.

The project is closely associated to the parallel course in biochemistry, and the fermentation experiments are analyzed based upon the metabolism and known pathways of the cells

An introduction to analytical chemistry relevant to the project (HPLC, GC, etc.) is given.

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module

- Can account for biochemical synthesis pathways that can lead to the production of defined products in the project
- Can account for how biochemical synthesis pathways can be up-regulated for an efficient production of selected products
- Have an overview of the significance of pathway engineering on energy balances in cells designed to produce selected products
- Understand bioinformatic and modeling tools for the development of cell factories
- Can account for microbial growth conditions, microbial growth and how this is affected by temperature and pH and how this can be exploited for microbial production
- Can account for the structure, biological function and use of enzymes and enzyme-catalyzed processes

SKILLS

- Can plan and perform experiments relevant to the project of the course
- Can account for production, development and harvest of microbial metabolites and industrial enzymes in bacteria, yeast and filamentous fungi and the development of recombinant production strains

COMPETENCES

- Can use the project work as a study form including the presented methods for organization of the group collaboration and solving of group conflicts
- Can analyze own learning process
- Can organize group work and collaborate with supervisors
- Can communicate the results and processes of the project in a structured and understandable way, in writing, graphically and orally

TYPE OF INSTRUCTION

Project work

EXTENT AND EXPECTED WORKLOAD

450 hours

EXAM

EXAMS

Name of exam	The Cell as a Factory
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

FACTS ABOUT THE MODULE

Danish title	Cellen som fabrik
Module code	K-BBT-B4-11
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
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

APPLIED STATISTICS

2020/2021

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module adds to the knowledge obtained in Linear Algebra and Calculus

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Describe basic concepts of probability theory, statistics and quality control
- Account for relevant statistical software for solving problems in statistics and quality control

SKILLS

- Choose the right probability model and perform calculations according to the model. This applies to both discrete and continuous distributions
- Handle both one-dimensional as well as multi-dimensional random variables and the related distributions, discrete and continuous
- Calculate the mean, standard deviation for one-dimensional random variables and also be introduced into the calculation and understanding of covariance for multi-dimensional random variables
- Select the right statistical method and make calculations of confidence intervals and do hypothesis testing for one and two random samples, make analysis of variance and regression analysis in terms of continuous as well as discrete probability distributions
- Establish and solve problems in process control and product control, this applies both within continuous as an alternative variation
- Handle both traditional solution techniques as well as software based solutions
- Interpret the results obtained from the correct statistical method including their application
- Set up and use non-parametric tests on qualitative data

COMPETENCES

- Engage in a dialogue regarding the optimal choice of method within probability theory, statistics and quality control
- Disseminate the results of the calculations to others, including colleagues, public authorities, etc.

TYPE OF INSTRUCTION

- Lectures and theoretical exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Applied Statistics
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	Anvendt statistik
Module code	K-KT-B3-30
Module type	Course
Duration	1 semester
Semester	Autumn
ECTS	5
Language of instruction	Danish and English
Empty-place Scheme	Yes
Location of the lecture	Campus Esbjerg
Responsible for the module	Svante Eriksen

ORGANISATION

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

MOLECULAR BIOLOGY

2020/2021

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module builds on knowledge gained in Biomolecuels and Biochemistry I, Biochemistry II or similar

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

- The structure and organization of the genetic material including DNA, RNA, the bacterial genome and plasmids
- Replication of DNA including segregation and mitosis
- Genetic variation, mutation, repair mechanisms, recombination, mobile genetic elements and transcription factors
- Transcription and translation, operons, RNA synthesis, mRNA splicing, protein synthesis and the genetic code
- Molecular biological methods in theory and practice focusing on methods for genetic modification of microorganisms for production and other biotechnological purposes
- Genomics, transcriptomics and proteomics
- Introduction to simple molecular biology phylogenetical tools

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module

- Can account for the central dogma and its implicationscan, account for the nature, organization and replication of the genetic material in prokaryotes as well as in eukaryotes
- Can account for the structure and regulation of genes including *cis*-and *trans*-regulatory elements
- Can account for transcription and translation in prokaryotes as well as in eukaryotes including the operon model, protein synthesis and the genetic code
- Can account for the theory behind central molecular biological methods - especially methods that can be used for modification and monitoring of biotechnologically relevant organisms
- Can understand the principles behind the so-called "omics" technologies
- Can understand the most simple bioinformatics tools

SKILLS

- Can use selected molecular biological methods
- Can plan a series of experiments to modify an organism from the methods learned during the course
- Can describe the applications of genetically engineered organisms in biotechnology including considerations related to ethics and safety
- Can use blast and elementary algorithms for molecular biological phylogeny

TYPE OF INSTRUCTION

- Lectures and laboratory exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Molecular Biology

Type of exam	Written exam 4 hours
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	Molekylærbiologi
Module code	K-BBT-B5-5
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

CELL BIOLOGY AND GENETICS

2020/2021

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module builds on knowledge gained in Biomolecules and Biochemistry I, Biochemistry II or similar

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

- Classical genetics
- Chromosomes and heridity
- The structure and organization of the genetic material
- Genetic variation, mutations, conjugation, transfection, transformation, mitosis, meiosis and mobile genetic elements
- The prokaryotic and eukaryotic cells
- The eukaryotic organelles and their function

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module

- Can understand the central principles within classical genetics
- Can describe how genetic variation can arise, including mutations, recombination of DNA and exchange of genetic material between individuals/species
- Can account for the background of heredity
- Can describe the construction of prokaryotic cells
- Can describe the construction of eukaryotic cells and their organelles
- Can account for communication between cells

SKILLS

- Can describe the classical and the modern genetics
- Can describe the differences between prokaryotic and eukaryotic cells

TYPE OF INSTRUCTION

- Lectures and calculation exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Cell Biology and Genetics
Type of exam	Written exam 4 hours
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	Cellebiologi og genetik
Module code	K-BBT-B5-6
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

DEVELOPMENT OF RECOMBINANT BIOCATALYSTS

2020/2021

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module builds on knowledge gained in Biomolecules and Biochemistry I, Biochemistry II, Microbiological processes or similar

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

In the project, a selected biocatalyst is designed and developed

The work includes design and construction of plasmids using different molecular techniques (e.g restriction enzyme based cloning and/or PCR based cloning), selection of relevant selection markers, transformation of E. coli, selection of correct E. coli clones, plasmid preparation and transformation of relevant host (if another host than E. coli is chosen) and selection and use of assays for testing and evaluation of the heterologous expressed gene(s)

The project report should include a theoretical part and an experimental part with results and conclusion of the laboratory work

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module

- Can describe the different steps in development of a selected biocatalysis with respect to cloning and transformation technologies as well as specific assays for testing the recombinant biocatalysts
- Has knowledge on molecular biological techniques and basic bioinformatic tools

SKILLS

- Hands on experience with common good laboratory practices (GLP) for working with recombinant microorganisms
- Hands on experience with sterile techniques
- Experience with basic microbial and molecular biological methods

COMPETENCES

- Can design a molecular project
- Is able to work independently in a laboratory environment
- Can reflect upon and develop own learning processes

TYPE OF INSTRUCTION

- Project work

EXTENT AND EXPECTED WORKLOAD

450 hours

EXAM

EXAMS

Name of exam	Development of Recombinant Biocatalysts

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

FACTS ABOUT THE MODULE

Danish title	Udvikling af rekombinante biokatalysatorer
Module code	K-BBT-B5-15
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	Peter Stephensen Lübeck
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

BIOTECHNOLOGY, ETHICS AND SOCIETY

2020/2021

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

Ethical issues presented through cases and discussions of complex dilemmas; presentation of central concepts on scientific argumentation and method; the history of civil engineering and its placement in society and science

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module

- Can understand basic theory of science concepts, theories and methods related to civil engineering emphasizing biotechnological issues
- Can use theory of science and ethical considerations in a societal context

SKILLS

- Can account for ethical considerations in connection with biotechnological issues

TYPE OF INSTRUCTION

Lectures and discussions

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Biotechnology, Ethics and Society
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	Bioteknologi, etik og samfund
Module code	K-BBT-B6-6
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	Christian Baron

ORGANISATION

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

BSC PROJECT

2020/2021

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

- The final project can take a starting point in one of the projects produced at an earlier semester or can be a new project
- The project can be carried out within or in collaboration with a company or as an independent project on the university
- The project can be theoretical or experimental but has to include sustainability and application considerations

LEARNING OBJECTIVES

SKILLS

Students who have passed the module

- Can carry out and report an independent experimental and/or theoretical project work within sustainable biotechnology

COMPETENCES

- Have gained the skill of critical independent reflection within a biotechnological topic related to existing knowledge
- Can include sustainability and application considerations in the evaluation of a project
- Can elaborate a precise well-balanced written and oral communication of the results and conclusions of a project

TYPE OF INSTRUCTION

Project work

EXTENT AND EXPECTED WORKLOAD

600 hours

EXAM

EXAMS

Name of exam	BSc Project
Type of exam	Oral exam based on a project
ECTS	20
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	Bachelorprojekt
Module code	K-BBT-B6-12
Module type	Project

Duration	1 semester
Semester	Spring
ECTS	20
Language of instruction	English
Location of the lecture	Campus Copenhagen
Responsible for the module	Cristiano Varrone
Time allocation for external examiners	C

ORGANISATION

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

CASES IN BIOPROCESS TECHNOLOGY

2020/2021

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module builds on knowledge gained in Linear algebra, General and Organic Chemistry, Process Technology or similar

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

- Unit processes needed for the conversion of biomass into biobased products
- pretreatment of substrate and biomass
- sterilization of substrates and installations
- design of fermentation processes
- transferring biochemical reactions, their stoichiometry, rates and yields into production processes
- bioreactor types - design and function
- up scaling of biotechnological production
- bioprocesses using GMO´s
- cases for different industrial process schemes including wastewater treatment, energy production and production of bio-based chemicals

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module

- Can account for how to transfer knowledge of microbial processes and their kinetics into large-scale production processes
- Have knowledge about special fermentation processes and the use of gene modified organisms (GMO)
- Have knowledge about bioreactor types, their design and possibility for up scaling
- Can account for substrate preparation and handling and operation of production facilities
- Can account for different unit processes needed for the conversion of biomass into industrial products

SKILLS

- Can set up, design, and compose different unit processes for the conversion of biomass into specific products

TYPE OF INSTRUCTION

Lectures, laboratory exercises and calculation exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Cases in Bioprocess Technology
Type of exam	Written exam 4 hours
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	Cases i bioproces teknologi
Module code	K-BBT-B6-15
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

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