AALBORG UNIVERSITET

BACHELOR (BSC) I TEKNISK VIDENSKAB (KEMI OG BIOTEKNOLOGI), 2018

BACHELOR (BSC) I TEKNISK VIDENSKAB
ESBJERG

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KEMISKE OG BIOINDUSTRIELLE PRODUKTER I

2020/2021

MODULETS INDHOLD, FORLØB OG PÆDAGOGIK

LÆRINGSMÅL

VIDEN

Studerende, der gennemfører modulet

- Skal kunne forklare grundlæggende aspekter indenfor kemi, miljø og sundhed

FÆRDIGHEDER

- Formidle projektets problemstilling og resultater skriftligt og mundtligt
- Udarbejde en problemformulering som identificerer en problemstilling og danner grundlag for videre arbejde indenfor projekts fagområde

UNDERVISNINGSFORM

- Projektarbejde

OMFANG OG FORVENTET ARBEJDSINDSATS

150 timer

EKSAMEN

PRØVER

Prøvens navn	Kemiske og bioindustrielle produkter I
Prøveform	Mundtlig pba. projekt
ECTS	5
Bedømmelsesform	Bestået/ikke bestået
Censur	Intern prøve
Vurderingskriterier	Vurderingskriterierne er angivet i Universitetets eksamensordning

FAKTA OM MODULET

Engelsk titel	Chemical and Bio Industrial Products I
Modulkode	K-KT-B1-12
Modultype	Projekt
Varighed	1 semester
Semester	Efterår
ECTS	5
Undervisningssprog	Dansk og engelsk

Tomplads	Ja
Undervisningssted	Campus Esbjerg
Modulansvarlig	Jens Muff

ORGANISATION

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

KEMISKE OG BIOINDUSTRIELLE PRODUKTER II

2020/2021

FORUDSÆTNINGER/ANBEFALEDE FORUDSÆTNINGER FOR AT DELTAGE I MODULET

Modulet bygger videre på viden opnået i Kemiske og bioindustrielle produkter I

MODULETS INDHOLD, FORLØB OG PÆDAGOGIK

LÆRINGSMÅL

VIDEN

Studerende, der gennemfører modulet, skal kunne

- Definere og forklare de i projektet anvendte metoder, teorier og modeller

FÆRDIGHEDER

- Arbejde sikkert i laboratoriet, herunder vurdere og anvende relevante beskyttelsesforanstaltninger, benytte relevante kilder til information, håndtere kemikalier og andet materiale forsvarligt, bortskaffe spild og affald efter forskrifter samt udarbejde arbejdspladsbrugsanvisninger
- Formidle projektets problemstilling og resultater skriftligt, grafisk og mundtligt på en sammenhængende måde

KOMPETENCER

- Varetage planlægning og gennemførsel af et projekt
- Identificere og udvikle egne muligheder for fortsat videreuddannelse indenfor fagområdet

UNDERVISNINGSFORM

- Projektarbejde

OMFANG OG FORVENTET ARBEJDSINDSATS

300 timer

EKSAMEN

FORUDSÆTNING FOR INDSTILLING TIL PRØVEN

- Godkendt prøve i laboratoriesikkerhed er forudsætning for deltagelse i projekteksamen

PRØVER

Prøvens navn	Kemiske og bioindustrielle produkter II
Prøveform	Mundtlig pba. projekt
ECTS	10
Bedømmelsesform	7-trins-skala
Censur	Intern prøve

Vurderingskriterier	Vurderingskriterierne er angivet i Universitetets eksamensordning

FAKTA OM MODULET

Engelsk titel	Chemical and Bio Industrial Products II
Modulkode	K-KT-B1-11
Modultype	Projekt
Varighed	1 semester
Semester	Efterår
ECTS	10
Undervisningssprog	Dansk og engelsk
Tomplads	Ja
Undervisningssted	Campus Esbjerg
Modulansvarlig	Jens Muff

ORGANISATION

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

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

ALMEN KEMI

2020/2021

MODULETS INDHOLD, FORLØB OG PÆDAGOGIK

LÆRINGSMÅL

VIDEN

Studerende, der gennemfører modulet, skal kunne

- redegøre for fundamentale kemiske og fysisk-kemiske principper for kemiske reaktioner og ligevægte
- redegøre for atomers struktur, kemiske bindinger og intermolekylære kræfter
- redegøre for atomers orbitaler, elektronkonfiguration og den fysiske beskrivelse af atomer som giver anledning til deres placering I det periodiske system
- forklare forskellige modeller for molekylorbitaler til beskrivelse af kovalente bindinger og molekylers geometri
- redegøre for fundamentale forskelle på redox reaktioner, syre-base reaktioner, opløselighedsreaktioner og kemisk kompleksdannelse
- redegøre for fundamental termodynamik
- redegøre for fundamental elektrokemi, inklusiv galvaniske elementer og elektrolyse
- redegøre for fundamental reaktionskinetik og kunne forklare reaktionshastigheder og orden for udvalgte reaktioner
- forklare atomers, ioners og molekylers elektronkonfiguration og den tilhørende geometri baseret på orbital og VSEPR teori

FÆRDIGHEDER

- Afstemme kemiske reaktioner og udføre støkiometriske beregninger og massebalancer
- beregne pH og redoxpotentialer for relevante ligevægte
- beregne entalpi, entropi og Gibbs fri energi for kemiske reaktioner
- opstille Nernst ligning for et elektrokemisk system til beregning af cellepotentialet
- beregne udbyttet af elektrolytiske reaktioner
- opstille matematiske modeller til beskrivelse af reaktionshastighed, forklare den overordnede såvel som indgående komponenters reaktionsorden og hvilke parametre der indgår i hastighedskonstanten
- modellere reaktionshastigheden for simple reaktionsmekanismer for at simulere og illustrere forløbet for en kemisk reaktion

KOMPETENCER

- planlægge og udføre simple kemiske forsøg ud fra viden om de kemiske og fysisk-kemiske betingelser, hvorunder sådanne kemiske reaktioner foregår

UNDERVISNINGSFORM

- Forelæsninger samt teoretiske og praktiske øvelser

OMFANG OG FORVENTET ARBEJDSINDSATS

150 timer

EKSAMEN

FORUDSÆTNING FOR INDSTILLING TIL PRØVEN

- Godkendt aktiv deltagelse i undervisningen er forudsætning for deltagelse i den ordinære prøve

PRØVER

Prøvens navn	Almen kemi
Prøveform	Skriftlig eller mundtlig
ECTS	5
Bedømmelsesform	7-trins-skala
Censur	Intern prøve
Vurderingskriterier	Vurderingskriterierne er angivet i Universitetets eksamensordning

FAKTA OM MODULET

Engelsk titel	General Chemistry
Modulkode	K-KT-B1-1
Modultype	Kursus
Varighed	1 semester
Semester	Efterår
ECTS	5
Undervisningssprog	Dansk og engelsk
Tomplads	Ja
Undervisningssted	Campus Esbjerg
Modulansvarlig	Jens Muff

ORGANISATION

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

CALCULUS

2020/2021

MODULETS INDHOLD, FORLØB OG PÆDAGOGIK

LÆRINGSMÅL

VIDEN

• skal have kendskab til definitioner, resultater og teknikker inden for teorien for differentiation og integration af funktioner af to eller flere variable
• skal have kendskab til de trigonometriske funktioner og deres inverse funktioner

• skal have kendskab til beskrivelsen af simple flader i hhv. retvinklede, polære og cylindriske koordinater

• skal have kendskab til de komplekse tal, deres regneregler og deres repræsentationer

• skal have kendskab til faktorisering af polynomier over de komplekse tal

• skal have kendskab til den komplekse eksponentialfunktion, dens egenskaber, og dens forbindelse med trigonometriske funktioner

• skal have kendskab til kurver i planen (både i rektangulære og polære koordinater) og rummet, parametrisering, tangentvektor og krumning for disse

• skal have kendskab til teorien for anden ordens lineære differentialligninger med konstante koefficienter

FÆRDIGHEDER

• skal kunne visualisere funktioner af to og tre variable ved hjælp af grafer, niveaukurver og niveauflader
• skal kunne foretage bestemmelse af lokale og globale ekstrema for funktioner af to og tre variable

• skal kunne bestemme areal, volumen, inertimoment og lignende ved anvendelse af integrationsteori

• skal kunne approksimere funktioner af en variabel ved hjælp af Taylors formel, og kunne anvende lineær approksimation for funktioner af to eller flere variable

• skal have færdighed i regning med komplekse tal

• skal kunne finde rødder i den komplekse andengradsligning og udføre faktorisering af polynomier i simple tilfælde

• skal kunne løse lineære andenordens differentialligninger med konstante koefficienter, generelt, og med begyndelsesbetingelser

• skal kunne ræsonnere med kursets begreber, resultater og teorier, i simple konkrete og abstrakte problemstillinger

KOMPETENCER

• skal udvikle og styrke sit kendskab til, forståelse af, og anvendelse af matematiske teorier og metoder inden for andre fagområder

• skal ud fra givne forudsætninger kunne ræsonnere og argumentere med matematiske begreber fra calculus

UNDERVISNINGSFORM

Forelæsninger med tilhørende opgaveregning.

OMFANG OG FORVENTET ARBEJDSINDSATS

Kursusmodulets omfang er 5 ECTS svarende til 150 timers studieindsats.

EKSAMEN

PRØVER

Prøvens navn	Calculus
Prøveform	Skriftlig eller mundtlig
ECTS	5
Bedømmelsesform	7-trins-skala
Censur	Intern prøve
Vurderingskriterier	Vurderingskriterierne er angivet i Universitetets eksamensordning

FAKTA OM MODULET

Engelsk titel	Calculus
Modulkode	F-MAT-B1-3
Modultype	Kursus
Varighed	1 semester
Semester	Efterår
ECTS	5
Undervisningssprog	Dansk og engelsk
Tomplads	Ja
Undervisningssted	Campus Aalborg, Campus Esbjerg, Campus København
Modulansvarlig	Morten Grud Rasmussen

ORGANISATION

Studienævn	Studienævn for Matematik, Fysik og Nanoteknologi
Institut	Institut for Matematiske Fag
Fakultet	Det Ingeniør- og Naturvidenskabelige Fakultet

KEMISKE REAKTIONER I NATURLIGE OG TEKNISKE SYSTEMER

2020/2021

FORUDSÆTNINGER/ANBEFALEDE FORUDSÆTNINGER FOR AT DELTAGE I MODULET

Modulet bygger videre på viden opnået i Kemiske og bioindustrielle produkter II

MODULETS INDHOLD, FORLØB OG PÆDAGOGIK

LÆRINGSMÅL

VIDEN

Studerende, der gennemfører modulet, skal kunne

- Beskrive grundlæggende begreber, modeller, teorier og metoder anvendt i projektet

FÆRDIGHEDER

- Vælge og anvende relevante modeller, teorier og metoder indenfor projektarbejdets område
- Planlægge og udføre kemiske forsøg i laboratoriet på sikkerhedsmæssig forsvarlig måde, føre journal over forsøgsgangen og drage relevante konklusioner af de opnåede resultater
- Opbygge en projektrapport efter fagområdets normer og formidle projektets problemstilling og resultater skriftligt, grafisk og mundtligt på en sammenhængende måde, herunder sammenhæng mellem problemformulering, projektets udførsel og væsentligste konklusioner
- Sætte projektets problemstilling og resultater i relevant faglig og samfundsmæssig kontekst og identificere relevante interessenter

KOMPETENCER

- Organisere gruppesamarbejde og samarbejde med vejledere samt varetage planlægning, gennemførsel og styring af et projekt under hensyntagen til tidligere erfaringer
- Identificere og udvikle egne muligheder for fortsat videreuddannelse indenfor fagområdet

UNDERVISNINGSFORM

- Projektarbejde

OMFANG OG FORVENTET ARBEJDSINDSATS

450 timer

EKSAMEN

PRØVER

Prøvens navn	Kemiske reaktioner i naturlige og tekniske systemer
Prøveform	Mundtlig pba. projekt
ECTS	15
Bedømmelsesform	7-trins-skala

Censur	Ekstern prøve
Vurderingskriterier	Vurderingskriterierne er angivet i Universitetets eksamensordning

FAKTA OM MODULET

Engelsk titel	Chemical Reactions in Natural and Technical Systems
Modulkode	K-KT-D2-4
Modultype	Projekt
Varighed	1 semester
Semester	Forår
ECTS	15
Undervisningssprog	Dansk og engelsk
Tomplads	Ja
Undervisningssted	Campus Esbjerg
Modulansvarlig	Jens Muff
Censornorm	B

ORGANISATION

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

GRUNDLÆGGENDE KEMISK PROCESTEKNIK OG TERMODYNAMIK

2020/2021

MODULETS INDHOLD, FORLØB OG PÆDAGOGIK

LÆRINGSMÅL

VIDEN

Studerende, der gennemfører modulet, skal kunne

- redegøre for grundlæggende procestekniske begreber, herunder systemer, systemgrænser, procestyper, procesenheder og procesvariable
- redegøre for begreberne energi, energioverførsel og effekt
- redegøre for systematikken for opstilling og beregning af balanceligninger
- forklare termodynamikkens hovedsætninger
- redegøre for ideale gasser
- redegøre for varme, arbejde og indre energi
- redegøre for termodynamiske materialeegenskaber
- redegøre for Boltzmann-fordelingen
- forklare entropi
- forklare enthalpi og kunne definere standard enthalpiændringer ved fysiske processer og kemiske reaktioner
- redegøre for Gibbs fri energi, faseligevægte for rene stoffer samt fasediagrammer
- redegøre for kemisk potentiale og termodynamisk ligevægt for kemiske reaktioner

FÆRDIGHEDER

- læse procesdiagrammer
- foretage en relevant afgrænsning og/eller opdeling af en given teknisk, kemisk eller biologisk proces og udfærdige et blok- eller procesdiagram herfor
- omregne mellem enheder
- opstille og løse massebalancer for stationære ikke-reaktive systemer og reaktive systemer
- regne på ideale gasser og ideale gasblandinger
- estimere kompressibilitetsfaktoren for en real gas ved givne procesbetingelser
- Anvende fasediagrammer og damptabeller
- foretage termokemiske beregninger
- beregne ligevægtsforhold på baggrund af termodynamiske data
- opstille og løse energibalancer for stationære systemer
- anvende metoder og teorier inden for kemisk procesteknik og termodynamik på simple modelsystemer

KOMPETENCER

- anvende den termodynamiske teori og de procestekniske metoder til at forstå, beskrive og løse problematikker inden for fagområder som analytisk kemi, materialelære, separationsteknik, kemisk reaktionsteknik og procesdesign

UNDERVISNINGSFORM

Forelæsninger og teoretiske øvelser

OMFANG OG FORVENTET ARBEJDSINDSATS

150 timer

EKSAMEN

PRØVER

Prøvens navn	Grundlæggende kemisk procesteknik og termodynamik
Prøveform	Skriftlig eller mundtlig
ECTS	5
Bedømmelsesform	7-trins-skala
Censur	Intern prøve
Vurderingskriterier	Vurderingskriterierne er angivet i Universitetets eksamensordning

FAKTA OM MODULET

Engelsk titel	Fundamental Chemical Engineering and Thermodynamics
Modulkode	K-KT-D2-2
Modultype	Kursus
Varighed	1 semester
Semester	Forår
ECTS	5
Undervisningssprog	Dansk og engelsk
Tomplads	Ja
Undervisningssted	Campus Esbjerg
Modulansvarlig	Marco Maschietti

ORGANISATION

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

BIOLOGISK AKTIVE MOLEKYLER – INTRODUKTION TIL CELLEBIOLOGI OG BIOLOGISK KEMI

2020/2021

FORUDSÆTNINGER/ANBEFALEDE FORUDSÆTNINGER FOR AT DELTAGE I MODULET

Modulet bygger videre på viden opnået i Almen kemi

MODULETS INDHOLD, FORLØB OG PÆDAGOGIK

LÆRINGSMÅL

VIDEN

- Redegøre for cellers opbygning
- Redegøre for biologisk aktive molekylers strukturer, egenskaber og funktion
- Forklare den cellulære energiomsætning
- Redegøre for DNA opbygning og replikation
- Redegøre for bioteknologiske teknologier
- Redegøre for proteins opbygning og funktion
- Redegøre for lipider og membraners opbygning og funktion
- Beskrive cellen, dens organeller og indholdsstoffer
- Redegøre for metabolisme
- Redegøre for energiomsætningen i celler
- Redegøre for enzymers virkemåde og regulering
- Redegøre for hvordan DNA kan bruges i moderne rekombinante teknologier
- Redegøre for samspillet mellem kemi og biologi på celleniveau

FÆRDIGHEDER

- Anvende faglitteratur om cellebiologiske emner

UNDERVISNINGSFORM

Forelæsninger samt teoretiske og praktiske øvelser

OMFANG OG FORVENTET ARBEJDSINDSATS

150 timer

EKSAMEN

FORUDSÆTNING FOR INDSTILLING TIL PRØVEN

- Godkendt aktiv deltagelse i undervisningen er forudsætning for deltagelse i den ordinære prøve

PRØVER

Prøvens navn	Biologisk aktive molekyler – introduktion til cellebiologi og biologisk kemi
Prøveform	Skriftlig eller mundtlig
ECTS	5

Bedømmelsesform	Bestået/ikke bestået
Censur	Intern prøve
Vurderingskriterier	Vurderingskriterierne er angivet i Universitetets eksamensordning

FAKTA OM MODULET

Engelsk titel	Biological Active Molecules – Introduction to Cell Biology and Biological Chemistry
Modulkode	K-KT-D2-1
Modultype	Kursus
Varighed	1 semester
Semester	Forår
ECTS	5
Undervisningssprog	Dansk og engelsk
Tomplads	Ja
Undervisningssted	Campus Esbjerg
Modulansvarlig	Jens Laurids Sørensen

ORGANISATION

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

LINEÆR ALGEBRA

2020/2021

FORUDSÆTNINGER/ANBEFALEDE FORUDSÆTNINGER FOR AT DELTAGE I MODULET

Modulet bygger på viden opnået i modulet Calculus.

MODULETS INDHOLD, FORLØB OG PÆDAGOGIK

LÆRINGSMÅL

VIDEN

• skal have viden om definitioner, resultater og teknikker inden for teorien for lineære ligningssystemer
• skal have kendskab til lineære transformationer og deres sammenhæng med matricer

• skal have viden om computerværktøjet Matlab og dets anvendelse inden for lineær algebra

• skal have kendskab til simple matrixoperationer

• skal have kendskab til invertibel matrix og invertibel lineær afbildning

• skal have kendskab til vektorrummet Rn og underrum deraf

• skal have kendskab til lineær afhængighed og uafhængighed af vektorer, samt dimension og basis for underrum

• skal have kendskab til determinant for matricer

• skal have kendskab til egenværdier og egenvektorer for matricer og deres anvendelse

• skal have kendskab til projektioner og ortonormale baser

• skal have viden om første ordens differentialligninger, samt om systemer af lineære differentialligninger

FÆRDIGHEDER

• skal kunne anvende teori og regneteknik for lineære ligningssystemer til at afgøre løsbarhed, og til at bestemme fuldstændige løsninger og deres struktur
• skal kunne repræsentere lineære ligningssystemer ved hjælp af matrixligninger, og omvendt

• skal kunne bestemme og anvende reduceret echelonform af en matrix

• skal kunne anvende elementære matricer i forbindelse med Gauss-elimination og inversion af matricer

• skal kunne afgøre lineær afhængighed eller lineær uafhængighed af små systemer af vektorer

• skal kunne bestemme dimension af og basis for underrum
• skal kunne bestemme matrix for en givet lineær afbildning, og omvendt

• skal kunne løse simple matrixligninger

• skal kunne beregne invers af små matricer

• skal kunne bestemme dimension af og basis for nulrum og søjlerum

• skal kunne beregne determinanter og kunne anvende resultatet af beregningen

• skal kunne beregne egenværdier og egenvektorer for simple matricer

• skal kunne afgøre, om en matrix er diagonaliserbar, og i bekræftende fald gennemføre en diagonalisering, for simple matricer

• skal kunne beregne den ortogonale projektion på et underrum af Rn

• skal kunne løse separable og lineære første ordens differentialligninger, generelt, og med begyndelsesbetingelser

KOMPETENCER

• skal udvikle og styrke sit kendskab til, forståelse af, og anvendelse af matematiske teorier og metoder inden for andre fagområder
• skal ud fra givne forudsætninger kunne ræsonnere og argumentere med matematiske begreber inden for lineær algebra

UNDERVISNINGSFORM

Forelæsninger med tilhørende opgaveregning.

OMFANG OG FORVENTET ARBEJDSINDSATS

Kursusmodulets omfang er 5 ECTS svarende til 150 timers studieindsats.

EKSAMEN

PRØVER

Prøvens navn	Lineær algebra
Prøveform	Skriftlig eller mundtlig
ECTS	5
Bedømmelsesform	7-trins-skala
Censur	Intern prøve
Vurderingskriterier	Vurderingskriterierne er angivet i Universitetets eksamensordning

FAKTA OM MODULET

Engelsk titel	Linear Algebra

Modulkode	F-MAT-B2-2
Modultype	Kursus
Varighed	1 semester
Semester	Forår
ECTS	5
Undervisningssprog	Dansk og engelsk
Tomplads	Ja
Undervisningssted	Campus Aalborg, Campus Esbjerg
Modulansvarlig	Morten Grud Rasmussen

ORGANISATION

Studienævn	Studienævn for Matematik, Fysik og Nanoteknologi
Institut	Institut for Matematiske Fag
Fakultet	Det Ingeniør- og Naturvidenskabelige Fakultet

ANALYSIS OF CHEMICAL SYSTEMS

2020/2021

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- explain the fundamental physical principles that underlie the chemical analysis apparatus used in the project
- explain the fundamental physical principles underlying alternatives to the selected instrumental chemical analysis techniques
- explain the chemistry that underlies sample preparation to the instrumental chemical analysis techniques that are selected above
- describe standard statistical methods used in analytical chemistry

SKILLS

- perform stoichiometric calculations and use ordinary glassware in the laboratory
- perform analytical chemical experiments in accordance with the regulatory and achieve a reproducible result
- write down and reconcile all chemical reaction schemes that underlie the analysis regulatory
- calculate the thermodynamic affinity for reactions
- perform relevant statistical calculations and select analytical methods for validation
- perform general uncertainty calculations on the results obtained
- explain safety rules and phrases for the analysis and the chemicals used
- write a project report following the standards of the field of study, include relevant literature, use the correct terminology and communicate the problem and results in writing, graphically and orally in a coherent way
- justify the choice of methods, models and other tools used in the project and asses the problem of the project and results in relevant professional contexts

COMPETENCES

- select the best possible analytical equipment for chemical analysis of a given product or process, taking economic and temporal factors into account
- handle the planning, implementation and management of a project and handle complex and development-oriented tasks during the project work and contribute to the project group's work and results
- identify own learning needs for continued development and education in the field of study

TYPE OF INSTRUCTION

- Project work

EXTENT AND EXPECTED WORKLOAD

450 hours

EXAM

EXAMS

Name of exam	Analysis of Chemical Systems
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	Analyse af kemiske systemer
Module code	K-KT-B3-13
Module type	Project
Duration	1 semester
Semester	Autumn
ECTS	15
Language of instruction	Danish and English
Empty-place Scheme	Yes
Location of the lecture	Campus Esbjerg
Responsible for the module	Morten Enggrob Simonsen
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

METHODS IN QUANTITATIVE CHEMICAL ANALYSIS 2020/2021

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Explain the fundamental physical principles governing selected apparatus for instrumental chemical analysis, including chromatographic and spectroscopic techniques
- Explain the fundamental physical principles forming the basis for alternatives to the selected instrumental chemical analysis methods
- Account for the chemistry that forms the basis of sample preparation for the above selected instrumental chemical analysis techniques
- Account for spectroscopic methods that may be utilized for qualitative analysis of various organic, inorganic or organometallic substances

SKILLS

- Perform relevant stoichiometric calculations and use common glassware in the laboratory
- Perform analytical chemical experiments based on written instructions and achieve a reproducible result
- Write and balance any and all chemical reaction schemes forming the foundation of the instructions for the analysis
- Calculate the thermodynamic affinity for the applied reactions from the point of reference
- Perform relevant statistical calculations on the results of a series of analysis on selected instruments
- Perform general calculations of the uncertainty in the measurements based on the obtained results
- Identify appropriate experimental methods for qualitative determination of substance properties

COMPETENCES

- Select and evalaute imaginable analysis equipment in the laboratory for a chemical analysis of a product or a given process under consideration of time and economical aspects

TYPE OF INSTRUCTION

- Lectures, laboratory exercises and theoretical exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Methods in Quantitative Chemical Analysis
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	Metoder til kvantitativ kemisk analyse
Module code	K-KT-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 Esbjerg
Responsible for the module	Morten Enggrob Simonsen

ORGANISATION

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

INORGANIC AND ORGANIC CHEMISTRY

2020/2021

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- explain the concept of activity and activity coefficients of ions in solution
- explain the fundamental thermodynamics underlying the calculation of equilibrium constants of coupled equilibria systems
- describe properties of solids that rely on the atomic structure of metals and ionic compounds
- describe stereochemistry and coordination chemistry of chemical complexation
- explain bonding of organic carbon-based compounds and stereochemistry
- account for functional groups, nomenclature, common trivial names and physical properties
- account for reactive intermediates (radicals, carbocat-ions, and anions)
- describe reaction mechanisms of organic reactions
- explain product distribution and synthesis strategy
- account for methods for the purification and isolation of organic chemicals
- account for the influence of ionic strength (non-ideality) when doing calculations on chemical reactions in solution
- explain the models for the structure of chemical complexation based on electron configuration

SKILLS

- couple several chemical equilibria of both homogeneous and heterogeneous nature and to perform the necessary calculations for determination of the equilibrium state of the coupled system
- explain various equilibrium diagrams with a particular focus on redox reactions
- deduce important properties of chemical compounds using the periodic table of elements
- apply the knowledge achieved in the course for analysis of the chemistry of a main group and other trends in the periodic table
- apply the fundamental concepts of isotope and nuclear chemistry
- use the nomenclature rules to read, interpret and disseminate information related to organic chemicals
- write reaction mechanisms, stereochemistry and product distributions for selected ionic, organometallic and radical reactions
- based on synthesis protocols, draw a block diagram showing all steps in the synthesis and the subsequent purification procedure

COMPETENCES

- alter reaction pathways in order to achieve a preferred or particular outcome of a process
- apply own knowledge of organic chemistry in technical, biological and ecological contexts

TYPE OF INSTRUCTION

- Lectures, laboratory exercises, theoretical exercises and workshops

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Inorganic and Organic 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	Uorganisk og organisk kemi
Module code	K-KT-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 Esbjerg
Responsible for the module	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

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

CHEMICAL THERMODYNAMICS AND SEPARATION PROCESS ENGINEERING

2020/2021

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module adds to the knowledge obtained in:

Chemical and Bio Industrial Products II

Fundamental Chemical Engineering and Thermodynamics

Inorganic and Organic Chemistry

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Account for models for non-ideal gasses
- Explain theoretical and empirical models for phase equilibrium of pure species
- Account for mixtures, including partial properties, chemical potentials, fugacity, activity, coefficient of activity and must know models for phase equilibrium in mixtures
- Explain the theory and design of industrial separation processes, especially staged equilibrium processes as distillation, absorption and extraction
- Explain the functioning of separation process equipment used in chemical equilibrium processes

SKILLS

- Differentiate between ideal and non-ideal gasses and to use simple models of non-ideal gasses
- Write equation for thermodynamic equilibrium in ideal and in non-ideal mixtures and solutions
- Evaluate if a given chemical mixture can be separated and which methods could be applicable
- Use thermodynamic data to dimension simple equilibrium processes
- Write and use mass, energy and equilibrium relations to find the required number of equilibrium stages for a given separation of a binary mixture

COMPETENCES

- Describe, model and solve problems in separation process engineering

TYPE OF INSTRUCTION

Lectures and theoretical exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Chemical Thermodynamics and Separation Process Engineering
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	Fysisk-kemiske separationsprocesser
Module code	K-KT-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 Esbjerg
Responsible for the module	Rudi P. Nielsen

ORGANISATION

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

MICROBIAL BIOTECHNOLOGY

2020/2021

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module adds to the knowledge obtained in:

Biological Active Molecules – Introduction to Cell Biology and Biological Chemistry

General Chemistry

Inorganic and Organic Chemistry

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Describe the cell as a biological entity
- Account for prokaryotic and eukaryotic cell structures
- Account for energy conversion in microorganisms
- Describe biochemical analysis methods
- Describe technically important microorganisms, their nutrition, metabolism and growth
- Account for microbial genetics
- Describe microbiological analysis methods
- Explain good microbiological practice

SKILLS

- Establish and calculate growth curves for microbiological growth
- Perform biochemical and microbiological tests in the laboratory in a safe way
- Handle experimental work with microorganisms, evaluate and use appropriate protective measures, work with sterile techniques, use relevant sources of information, and dispose of waste according to regulations

COMPETENCES

- Utilize knowledge on biochemical molecules, processes and systems, for projects in technical microbiology, food technology or for biotechnology development or production

TYPE OF INSTRUCTION

Lectures and theoretical exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Microbial Biotechnology
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 bioteknologi
Module code	K-KT-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 Esbjerg
Responsible for the module	Jens Laurids Sørensen

ORGANISATION

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

MATERIAL SCIENCE AND MATERIAL SELECTION

2020/2021

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module adds to the knowledge obtained in:

Linear Algebra

Calculus

Fundamental Chemical Engineering and Thermodynamics

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Explain the fundamental structure and properties of metals, polymers, ceramics and composites
- Account for equilibrium and non-equilibrium diagrams
- Account for the selection of materials
- Account for material processing, including joining and surface treatment
- Explain the fundamental mechanisms in corrosion and wear/abrasion
- Describe material testing and the applicability of results gained from testing

SKILLS

- Carry out a material selection and select an appropriate processing method for such material
- Identify materials through acquired methods for material testing
- Evaluate if a material is suitable for a given purpose based on the properties of the material
- Select materials for a given application
- Select a processing method and method for joining of materials if required

COMPETENCES

- Evaluate the properties and applicability of a given material for engineering purposes
- Evaluate if a material will be subject to chemical or mechanical degradation in a given environment, and if needed subsequently select an appropriate surface treatment or substitution of the material

TYPE OF INSTRUCTION

Lectures and theoretical exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Material Science and Material Selection
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	Materialelære og materialevalg
Module code	K-KT-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 Esbjerg
Responsible for the module	Morten Enggrob Simonsen

ORGANISATION

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

CHEMICAL REACTION ENGINEERING

2020/2021

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module builds on knowledge gained in Fundamental Chemical Engineering and Thermodynamics, General Chemistry, Inorganic and organic chemistry

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- explain fundamental concepts of chemical reaction engineering
- account for ideal and non-ideal chemical reactors and reactor systems
- describe the development of kinetic models on the basis of chemical reaction mechanisms
- explain how reactor design and process conditions can be used to optimize yield and product distribution
- explain the principles for catalysis and catalytic reactions
- describe the reaction systems for major chemical and biotechnological products

SKILLS

- analyze kinetic data from ideal reactors
- set up rate equations for chemical and biochemical reactions based on knowledge of reaction mechanisms
- test rate equations from kinetic data
- solve equations for analysis and design of ideal reactors or reactor systems operating isothermally or adiabatically
- optimize yield and selectivity of multiple reactions
- model and analyze reactors for chemical or biochemical industrial reactions

COMPETENCES

- apply the knowledge of kinetics and reactor design to the modelling systems for e.g. natural processes

TYPE OF INSTRUCTION

- Lectures and theoretical exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Chemical Reaction Engineering
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	Kemisk reaktionsteknik
Module code	K-KT-B5-4
Module type	Course
Duration	1 semester
Semester	Autumn
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Esbjerg
Responsible for the module	Marco Maschietti

ORGANISATION

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

VARMETRANSMISSION OG STRØMNINGSMEKANIK

2020/2021

FORUDSÆTNINGER/ANBEFALEDE FORUDSÆTNINGER FOR AT DELTAGE I MODULET

Modulet bygger på viden opnået i modulet "Grundlæggende mekanik og termodynamik".

MODULETS INDHOLD, FORLØB OG PÆDAGOGIK

LÆRINGSMÅL

VIDEN

Studerende der gennemfører modulet:

- Skal have viden om maskinteknisk termodynamik, grundlæggende strømningslære, konvektiv varmeovergang, varmeledning udtrykt ved termisk modstandsnetværk og laboratoriesikkerhed.
- Skal kunne forstå
    - Grundlæggende maskinteknisk termodynamik:
    - Grundlæggende strømningslære
    - Grundlæggende varmetransmission
    - Sikkerhed ved arbejde i laboratoriet

FÆRDIGHEDER

Studerende der gennemfører modulet:

- Skal kunne anvende maskinteknisk termodynamik til løsning af praktiske problemstillinger i ingeniørmæssige sammenhænge.
- Skal kunne anvende grundlæggende strømningslære til at løse strømningsrelaterede problemstillinger omkring strømninger i større rørsystemer med forskellige komponenter, såsom pumper, turbiner, ventiler, bøjninger og dyser.
- Skal kunne anvende simpel strømningslære til at analysere de fluidmekaniske påvirkninger på objekter omgivet af en fluid i bevægelse.
- Skal kunne beregne varmestrøm i termiske modstandsnetværk.
- Skal kunne beregne varmeovergang ved såvel eksterne som interne strømninger.
- Skal kunne vurdere sikkerheden ved arbejdet i laboratorier.

KOMPETENCER

Studerende der gennemfører modulet:

- Skal have evnen til at anvende fagområdet i tværfagligt samarbejde med andre fagområder.
- Skal have evnen til at anvende viden omkring sikkerhed i laboratoriet på en måde, så arbejdet med opstillinger udføres sikkerheds og sundhedsmæssigt korrekt.

UNDERVISNINGSFORM

Undervisningen tilrettelægges i henhold til de generelle undervisningsformer for uddannelsen, jf. § 17/18.

OMFANG OG FORVENTET ARBEJDSINDSATS

Kursusmodulets omfang er 5 ECTS svarende til 150 timers studieindsats.

EKSAMEN

PRØVER

Prøvens navn	Varmetransmission og strømningsmekanik
Prøveform	Skriftlig og mundtlig Der udarbejdes et miniprojekt, hvor problemstillingen forankres i den enkelte studerendes studieprogram. I miniprojektet analyseres en praktisk problemstilling, og resultatet præsenteres med afsæt i de indlærte færdigheder. Projektet dokumenteres med en kort rapport (max 10 sider) samt en præsentation på max 10 minutter.
ECTS	5
Bedømmelsesform	7-trins-skala
Censur	Intern prøve
Vurderingskriterier	Vurderingskriterierne er angivet i Universitetets eksamensordning

FAKTA OM MODULET

Engelsk titel	Heat Transfer and Fluid Mechanics
Modulkode	B-MT-D5-11
Modultype	Kursus
Varighed	1 semester
Semester	Efterår
ECTS	5
Undervisningssprog	Dansk og engelsk
Undervisningssted	Campus Esbjerg
Modulansvarlig	Lars Damkilde, Søren Heide Lambertsen

ORGANISATION

Studienævn	Studienævn for Byggeri, By og Miljø
Institut	Institut for Byggeri, By og Miljø
Fakultet	Det Ingeniør- og Naturvidenskabelige Fakultet

MATHEMATICAL MODELING AND NUMERICAL METHODS

2020/2021

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

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

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Account for basic modeling and analysis of certain ordinary and partial differential equations
- Account for basic analysis of the above ordinary and partial differential equations
- Account for basic concepts of numerical methods
- Explain numerically solving non-linear systems of equations, integrals, and ordinary and partial differential equations
- Account for the modeling and analysis of the above ordinary and partial differential equations

SKILLS

- Use extra- and interpolation techniques such as Taylor polynomials and Lagrange polynomials
- Use Laplace transforms to solve differential equations
- Apply vector analysis and integral principles for mathematical modeling
- Apply methods, analytical as well as numerical, to solve the above ordinary and partial differential equations
- Set up and use the correct numerical method for solving a variety of areas, such as finding the zero point, integration, interpolation, differential equations
- Set up and solve 1- and 2-dimensional heat equations by analytical and numerical methods
- Set up and solve 1- and 2-dimensional wave equations by analytical and numerical methods
- Set up and solve Poisson's and Laplace's equations by numerical methods
- Develop solutions of differential equations using systems of eigenfunctions
- Solve partial differential equations using Fourier series and the separation method

COMPETENCES

- Engage in a dialogue regarding the optimal choice of analytical and numerical solution methods for partial differential equations, and results from mathematical modeling in general
- Disseminate setup and results of solving certain partial differential equations to others, including colleagues, government agencies and others

TYPE OF INSTRUCTION

- Lectures and theoretical exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Mathematical Modeling and Numerical Methods
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	Matematisk modellering og numeriske metoder
Module code	K-KT-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 Esbjerg
Responsible for the module	Morten Grud Rasmussen

ORGANISATION

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

DESIGN OF EXPERIMENTS

2020/2021

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module adds to the knowledge obtained in Applied Statistics

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Explain the establishment of experimental design with qualitative and quantitative factors
- Account for complete, partial and confounding 2k and 3k factorial experiments
- Explain incomplete block design and splitplot designs
- Explain how to perform control experiments, including the use of central points
- Account for orthogonal experimental design
- Describe methods of optimization of the experimental factors and minimizing noise factors
- Account for regression analysis (including step-wise regression) of the drop in data
- Explain response surface design

SKILLS

- Develop study plans with qualitative and quantitative factors
- Perform control experiments
- Optimize the experimental factors
- Minimize the noise factors
- Use multiple analysis of variance and regression analyzes, including the combined variance and regression analyzes
- Analyze experimental data and be able to evaluate the methods used, validity and usefulness
- Use statistical design of experiments in practice within the domain of quality / process optimization and to process the results by statistical methods on a computer

TYPE OF INSTRUCTION

Lectures and theoretical exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Design of Experiments
Type of exam	Oral exam Based on a prepared mini project
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	Statistisk forsøgsplanlægning
Module code	K-KT-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 Esbjerg
Responsible for the module	Sergey Kucheryavskiy

ORGANISATION

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

PROCESS CONTROL, INSTRUMENTATION AND SAFETY

2020/2021

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module adds to the knowledge obtained in:

Mathematical Modeling and Numerical Methods

Fundamental Fluid Mechanics and Heat Transfer

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Account for diagrams and system interconnections
- Explain modeling of physical systems, determination of operating points and linearization
- Explain a system's dynamic and stationary behavior, including the effects of the type and order of the system, as well as poles and zero points and their impact on the response of the system
- Account for analysis by root curves and knowledge of controller design using root curves
- Account for a system's frequency response (open-loop and closed - loop)
- Account for stability analyses
- Describe design using frequency response techniques
- Explain analog implementation of controllers
- Describe measurement techniques and data collection using a PC
- Account for software for building/developing applications for data acquisition and control
- Account for the structure and operation of the measurement system including sensors, signal processing and monitoring system
- Explain the operation of classical sensors (pressure, temperature, position, velocity, acceleration and flow)
- Account for sampling, different connections and noise from measurements

SKILLS

- Analyze block diagrams on the basis of PI – charts
- Model and analyze basic dynamical systems, including electrical, mechanical and thermal systems and analogies between these
- Develop models of dynamic systems in the form of transfer functions
- Apply control theory to achieve performance criteria
- Analyze a system's response and stability using the classical methods
- Select appropriate regulators and predict/assess their impact
- Use standard software for data acquisition, control and regulation
- Connect classical sensors and conduct research with classical sensors for pressure, temperature, position, velocity, acceleration and flow
- Assess the quality of the measurements and apply appropriate processing on them
- Disseminate the problem, the used solution method and interpret the outcome

TYPE OF INSTRUCTION

Lectures and theoretical exercises

EXTENT AND EXPECTED WORKLOAD

150 hours

EXAM

EXAMS

Name of exam	Process Control, Instrumentation and Safety
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	Procesregulering, instrumentering og sikkerhed
Module code	K-KT-B6-7
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Esbjerg
Responsible for the module	Sergey Kucheryavskiy

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 IN CHEMICAL ENGINEERING AND BIOTECHNOLOGY

2020/2021

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Explain the specific concepts, models, methods and techniques that are relevant to the professionalism of the project work
- Describe the traditions of engineering, the engineer's role in society, as well as ethical issues in engineering science
- Describe the scientific approaches and traditions and different theories of science and concepts of truth
- Describe possible career directions in the engineering profession
- Account for entrepreneurship, including opportunities for self-employment

SKILLS

- Apply theoretical methods and concepts within the disciplines of engineering
- Write a project report following the standards of the field of study, include relevant literature, use the correct terminology and communicate the problem and results in writing, graphically and orally in a coherent way
- Justify the choice of literature, methods, models and other tools used in the project and asses the problem of the project and results in relevant professional and social contexts and in relation to literature

COMPETENCES

- Handle starting up a self-motivated business and be part of the daily work in a company
- Handle the planning, implementation and management of a project and handle complex and development-oriented tasks during the project work and contribute to the project group's work and results
- Identify own learning needs for continued development and education in the field of study

TYPE OF INSTRUCTION

Project work

Projects are focused on one of the following themes

- Development of a chemical or bio industrial product
- Development, design and optimization of a chemical or bio industrial process
- Development and optimization of a process analytical technology

EXTENT AND EXPECTED WORKLOAD

600 hours

EXAM

EXAMS

Name of exam	BSc Project in Chemical Engineering and Biotechnology

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 i kemi og bioteknologi
Module code	K-KT-B6-14
Module type	Project
Duration	1 semester
Semester	Spring
ECTS	20
Language of instruction	English
Location of the lecture	Campus Esbjerg
Responsible for the module	Sergey Kucheryavskiy
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

MATERIALETEKNOLOGI

2020/2021

FORUDSÆTNINGER/ANBEFALEDE FORUDSÆTNINGER FOR AT DELTAGE I MODULET

The module adds to the knowledge obtained in:

Chemical and Bio Industrial Products II

Fundamental Chemical Engineering and Thermodynamics

Methods in Quantitative Chemical Analysis

Applied Statistics

MODULETS INDHOLD, FORLØB OG PÆDAGOGIK

LÆRINGSMÅL

VIDEN

Students who have passed the module should be able to

- Account for the fundamental structure and physical/chemical properties of materials
- Account for the production and application of materials
- Describe relevant methods for analysis and testing of materials

FÆRDIGHEDER

- Select relevant analytical methods and approaches for a given problem
- Conduct a series of experiments to gain information about key parameters
- Evaluate results from experiments using statistical methods
- Select materials to improve either a process or product
- Write a project report following the standards of the field of study, include relevant literature, use the correct terminology, and communicate the problem and results in writing, graphically and orally in a coherent way
- Justify the choice of methods, models and other tools used in the project and asses the problem of the project and results in relevant professional contexts

KOMPETENCER

- Interpret and evaluate knowledge about materials
- Evaluate results from experimental work and their applicability to a given problem
- Handle the planning, implementation and management of a project and handle complex and development-oriented tasks during the project work and contribute to the project group's work and results
- Identify own learning needs for continued development and education in the field of study

UNDERVISNINGSFORM

Project work

Access to perform laboratory experiments requires participation in laboratory safety instructions

OMFANG OG FORVENTET ARBEJDSINDSATS

450 timer

EKSAMEN

PRØVER

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

FAKTA OM MODULET

Engelsk titel	Material Science
Modulkode	K-KT-B4-13
Modultype	Projekt
Varighed	1 semester
Semester	Forår
ECTS	15
Undervisningssprog	Dansk og engelsk
Tomplads	Ja
Undervisningssted	Campus Esbjerg
Modulansvarlig	Morten Enggrob Simonsen

ORGANISATION

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

APPLIED MICROBIOLOGY

2020/2021

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module adds to the knowledge obtained in:

Chemical and Bio Industrial Products II

Chemical Analysis of Homogeneous Analysis

Methods in Quantitative Chemical Analysis

Applied Statistics

Microbial Biotechnology (in parallel)

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Account for basic microbiology
- Account for basic security in relation to the handling of microorganisms and enzymes
- Describe reactor types that are relevant for Technical Microbiology, configurations thereof as well as their advantages and limitations
- Account for scale-up of microbiological processes including physical conditions and limitations
- Describe sterilization procedures and decimation time for microorganisms

SKILLS

- Demonstrate basic skills in practical methods for the characterization of microorganisms, substrates and products
- Select suitable microorganisms or enzymes to a specific technical problem
- Set up and solve relevant mass and energy balances for microbiological processes at laboratory scale and in technical scale
- Describe the necessary safety measures at all scale levels
- Account for proper waste management at all scale levels
- Account for suitable analytical methods for monitoring the microbiological process
- Construct an experimental setup equipped with appropriate data collection
- Analyze and interpret data from a fermentation process based on knowledge of the microorganism used
- Report data from the technical microbiological studies using proper statistical computing
- Write a project report following the standards of the field of study, include relevant literature, use the correct terminology, and communicate the problem and results in writing, graphically and orally in a coherent way
- Justify the choice of methods, models and other tools used in the project and asses the problem of the project and results in relevant professional contexts

COMPETENCES

- Provide technical microbiological knowledge to a broad range of people with different professional backgrounds
- Handle the planning, implementation and management of a project and handle complex and development-oriented tasks during the project work and contribute to the project group's work and results

- Identify own learning needs for continued development and education in the field of study

TYPE OF INSTRUCTION

Project work

Access to perform laboratory experiments requires participation in laboratory safety instructions

EXTENT AND EXPECTED WORKLOAD

450 hours

EXAM

EXAMS

Name of exam	Applied Microbiology
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	Teknisk Mikrobiologi
Module code	K-KT-B4-18
Module type	Project
Duration	1 semester
Semester	Spring
ECTS	15
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Esbjerg
Responsible for the module	Jens Laurids Sørensen
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

PETROCHEMICAL SEPARATION PROCESSES

2020/2021

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module adds to the knowledge obtained in:

Chemical and Bio Industrial Products II

Fundamental Chemical Engineering and Thermodynamics

Methods in Quantitative Chemical Analysis

Applied Statistics

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Describe the fundamental separation technologies used in production of oil and gas
- Account for the fundamental aspects of oil and gas production
- Account for fundamental types of calculations related to the separation of oil and gas
- Explain fundamental knowledge thermodynamics related to oil and gas separation

SKILLS

- Perform relevant calculations relating to oil and gas separation
- Design a separation train for a given production
- Evaluate which types of material are appropriate for the construction of the separation units
- Set specifications for a unit design based on the process in question
- Select an appropriate separation process for a given process
- Write a project report following the standards of the field of study, include relevant literature, use the correct terminology and communicate the problem and results in writing, graphically and orally in a coherent way
- Justify the choice of methods, models and other tools used in the project and asses the problem of the project and results in relevant professional contexts

COMPETENCES

- Evaluate the effectiveness and applicability of different separation methods in oil and gas technology
- Handle the planning, implementation and management of a project and handle complex and development-oriented tasks during the project work and contribute to the project group's work and results
- Identify own learning needs for continued development and education in the field of study

TYPE OF INSTRUCTION

Project work

Access to perform laboratory experiments requires participation in laboratory safety instructions

EXTENT AND EXPECTED WORKLOAD

450 hours

EXAM

EXAMS

Name of exam	Petrochemical Separation Processes
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	Petrokemiske separationsprocesser
Module code	K-KT-B4-19
Module type	Project
Duration	1 semester
Semester	Spring
ECTS	15
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Esbjerg
Responsible for the module	Rudi P. Nielsen
Time allocation for external examiners	B

ORGANISATION

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

CHEMICAL PROCESS ENGINEERING

2020/2021

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module adds to the knowledge obtained in Chemical and Bio Industrial Products II

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Describe the industrial or application context, in which the project work is included in, or may affect
- Describe general aspects of process engineering
- Explain the main unit operations in the process relating to the project work

SKILLS

- Determine which unit operation or reactor type is suitable in a given case
- Set specifications for process equipment for a given chemical process
- Analyze, model or size a selected process unit
- Perform relevant calculations for a given process
- Set up mass and energy balances for a given process
- Evaluate the effect of changing parameters for a given process
- Evaluate the potential of the project for further development, assessing and incorporating relevant economic factors
- Write a project report following the standards of the field of study, include relevant literature, use the correct terminology, and communicate the problem and results in writing, graphically and orally in a coherent way
- Justify the choice of literature, methods, models and other tools used in the project and asses the problem of the project and results in relevant professional and social contexts and in relation to literature

COMPETENCES

- Propose relevant laboratory experiments to allow for better modelling of a process
- Evaluate if changes to a given process could be beneficial
- Propose a course of action regarding a given process
- Evaluate the quality of experimental data obtained and their applicability to a model of a given process
- Handle the planning, implementation and management of a project and handle complex and development-oriented tasks during the project work and contribute to the project group's work and results
- Identify own learning needs for continued development and education in the field of study

TYPE OF INSTRUCTION

Project work

EXTENT AND EXPECTED WORKLOAD

450 hours

EXAM

EXAMS

Name of exam	Chemical Process Engineering
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	Kemisk procesteknologi
Module code	K-KT-B5-14
Module type	Project
Duration	1 semester
Semester	Autumn
ECTS	15
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Esbjerg
Responsible for the module	Rudi P. Nielsen
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

BIOPROCESS ENGINEERING

2020/2021

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module adds to the knowledge obtained in: Chemical and Bio Industrial Products, Microbial Biotechnology II, Chemical Thermodynamics and Separation Processes and Chemical Reaction Engineering is Followed Simultaneously

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Describe the industrial or application context, in which the project work is included in, or may affect
- Account for general aspects of process engineering
- Describe the main unit operations in the process relating to the project work

SKILLS

- Determine which unit operation or reactor type is suitable in a given case
- Set specifications for process equipment for a given chemical process
- Analyze, model or size a selected process unit
- Perform relevant calculations for a given process
- Set up mass and energy balances for a given process
- Evaluate the effect of changing parameters for a given process
- Evaluate the potential of the project for further development, assessing and incorporating relevant economic factors
- Propose relevant laboratory experiments to allow for better modelling of a process
- Write a project report following the standards of the field of study, include relevant literature, use the correct terminology, and communicate the problem and results in writing, graphically and orally in a coherent way
- Justify the choice of literature, methods, models and other tools used in the project and asses the problem of the project and results in relevant professional and social contexts and in relation to literature

COMPETENCES

- Evaluate if changes to a given process could be beneficial
- Propose a course of action regarding a given process
- Evaluate the quality of experimental data obtained and their applicability to a model of a given process
- Handle the planning, implementation and management of a project and handle complex and development-oriented tasks during the project work and contribute to the project group's work and results
- Identify own learning needs for continued development and education in the field of study

TYPE OF INSTRUCTION

- Project work

EXTENT AND EXPECTED WORKLOAD

450 hours

EXAM

EXAMS

Name of exam	Bioprocess Engineering
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	Bioprocesteknologi
Module code	K-KT-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 Esbjerg
Responsible for the module	Rudi P. Nielsen
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

REFINERY PRODUCTS AND PROCESSES

2020/2021

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module adds to the knowledge obtained in Chemical and Bio Industrial Products II

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Students who have passed the module should be able to

- Account for crude oil production
- Account for the composition of crude oil
- Describe the general structure of an oil refinery
- Explain the main refinery processes such as distillation, cracking and desulphurization
- Describe a given refinery process

SKILLS

- Perform relevant calculations for a given refinery process
- Set up mass and energy balances for a given refinery process
- Evaluate the effect of changing parameters for a given refinery process
- Evaluate the potential of the project for further development, assessing and incorporating relevant economic factors
- Propose relevant laboratory experiments to allow for better modelling of a process
- Write a project report following the standards of the field of study, include relevant literature, use the correct terminology, and communicate the problem and results in writing, graphically and orally in a coherent way
- Justify the choice of literature, methods, models and other tools used in the project and asses the problem of the project and results in relevant professional and social contexts and in relation to literature

COMPETENCES

- Evaluate if changes to a given process could be beneficial
- Propose a course of action regarding a given process
- Evaluate the quality of experimental data obtained and their applicability to a model of a given refinery process
- Handle the planning, implementation and management of a project and handle complex and development-oriented tasks during the project work and contribute to the project group's work and results
- Identify own learning needs for continued development and education in the field of study

TYPE OF INSTRUCTION

- Project work

EXTENT AND EXPECTED WORKLOAD

450 hours

EXAM

EXAMS

Name of exam	Refinery Products and Processes
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	Raffinaderiprodukter og processer
Module code	K-KT-B5-16
Module type	Project
Duration	1 semester
Semester	Autumn
ECTS	15
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Esbjerg
Responsible for the module	Rudi P. Nielsen
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