AALBORG UNIVERSITET

STUDIEORDNING FOR BACHELORUDDANNELSEN I ANVENDT INDUSTRIEL ELEKTRONIK, 2024

BACHELOR (BSC) I TEKNISK VIDENSKAB
ESBJERG

MODULER SOM INDGÅR I STUDIEORDNINGEN

INDHOLDSFORTEGNELSE

BASIC ELECTRONIC SYSTEMS

2025/2026

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

- Have knowledge about simple basic electronic systems
- Be able to define and understand basic electronic system engineering terms used in the project work and have a fundamental comprehension for the applied methods, theories and/or models in electronics engineering
- Be familiar with working processes applied to project work, acquisition of knowledge and cooperation with the supervisor

SKILLS

- Be able to define and analyse a subject in basic electronic systems and analyse this subject from one or more angles of approach
- Be able to set up solutions to non-complicated electronic system problems based on an idea generation process
- Be able to communicate coherently the project results in a written, graphical and oral manner
- Be able to analyse personal learning process
- Be able to define the basic electronic engineering and contextual terms used in a project report
- Be able to write a problem analysis and a problem formulation
- Be able to describe the applied theories and methods to analyse the chosen problem in relevant contexts
- Be able to create non-complicated models for the whole, or parts of, the selected electronic system

COMPETENCES

- Be able to identify problems in basic electronic systems and reflect upon these in the problem based and project organised form of study
- Be able to communicate the results during the project work in a project report
- Be able to plan and reflect on own experience with project work and problem-solving techniques by applying relevant analysis methods
- Be able to apply methods/theories during the project work in order to analyse an electronic engineering problem
- Be able to contribute to team work, cooperate, handle conflicts and ensure motivation in the project work

TYPE OF INSTRUCTION

Project work including supervision may be supplemented with lectures, workshops, presentation seminars, consultant meetings regarding PBL content, laboratory tests, etc. The project can be discipline oriented, interdisciplinary or be a part of a multi-disciplinary project dependent on project choice. The project work is split in two periods: P0 for problem definition and P1 for problem solving. The first period P0 lasts about 5-6 weeks. The work in the P0 period includes a problem analysis and a problem formulation for the subject to be dealt with in the P1 part of the project. This is written in a P0 document including also a process analysis for the P0 period. The P0 document is presented in a P0 status and presentation seminar as part of the course in Problem Based Learning, where the project group’s documents are discussed.

Based on the problem analysis and problem formulation, the students then make a P1 project report where project goals are set up, analyses are performed and results are discussed. The project report should contain: Problem analysis, problem formulation, problem solution, analyses and results, as well as discussion and conclusion.

EXTENT AND EXPECTED WORKLOAD

Since it is a 15 ECTS project module, the work load is expected to be 450 hours for the student.

EXAM

PREREQUISITE FOR ENROLLMENT FOR THE EXAM

- It is a precondition for participation in the exam that the student has submitted a P0 document and has participated in the P0 status and presentation seminar.
- In case the student does not submit a P0 document or does not participate in the planned P0 status seminar, the student will have to present the P0 document to the supervisor no later than two weeks after the planned status seminar.

EXAMS

Name of exam	Basic Electronic Systems
Type of exam	Oral exam based on a project including process analysis.
ECTS	15
Permitted aids	With certain aids: For more information about permitted aids, please visit the course description in Moodle.
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	Enkle elektroniske systemer
Module code	E-AIE-B1-1C
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	Mandø

ORGANISATION

Education owner	Bachelor of Science (BSc) in Engineering (Applied Industrial Electronics)
Study Board	Study Board of Build, Energy, Electronics and Mechanics in Esbjerg
Department	Department of Energy
Faculty	The Faculty of Engineering and Science

CALCULUS

2025/2026

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

- Real functions of two and more variables – definitions, results and techniques concerning partial derivatives.

- Integration in plane and space wrt. various coordinate systems – including connections between such integrals.
- Complex numbers as an extension of the real numbers – in a geometric as well as an algebraic setup. The connection between the complex exponential function and trigonometric functions.
- The structure of the set of solutions to different types of first and second order differential equations.

SKILLS

- Differentiation of functions of several variables (including composite functions) as well as a geometric understanding of this.
- Extrema for functions of two and three variables.
- Maxima and minima for functions of two variables.
- Set up and evaluate simple integrals in plane and space wrt. various coordinate systems.
- Add, multiply and divide complex numbers. Transform between polar and Cartesian form.
- Solve and plot various types of first- and second order differential equations.

COMPETENCES

Can apply methods and concepts from calculus, including integration, complex numbers and differential equations to given problems relevant to the study programme.

TYPE OF INSTRUCTION

Lectures, exercises, videos, quiz, digitalised self-study, workshops on calculus problems relevant to the study programme.

EXTENT AND EXPECTED WORKLOAD

Since it is a 5 ECTS course, the work load is expected to be 150 hours for the student.

EXAM

EXAMS

Name of exam	Calculus
Type of exam	Written or oral exam
ECTS	5
Permitted aids	Der henvises til den pågældende semesterbeskrivelse/modulbeskrivelse
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	MATCAL1345GB
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	Rasmussen

ORGANISATION

Study Board	Study Board of Mathematical Sciences
Department	Department of Mathematical Sciences
Faculty	The Faculty of Engineering and Science

ENERGISYSTEMER OG ELEKTROFYSIK

2025/2026

MODULETS INDHOLD, FORLØB OG PÆDAGOGIK

LÆRINGSMÅL

VIDEN

- Have viden og forståelse inden for energitekniske koncepter som elproduktion fra sol, vind, bølge, varme og affald til vedvarende brændstoffer og elektricitet.
- Have viden om og forståelse for overordnede energibegreber og energi- og varmebalancer og enkle energimæssige beregninger
- Have viden om og forståelse for energisystemers grundlæggende opbygning og deres effekt på samfund og miljø
- Have viden om større energimaskiner såsom pumper, turbiner, varmevekslere, electrolyzers, elektriske maskiner og generatorer samt deres funktioner
- Have viden om de grundlæggende aspekter anvendt i økonomiske og miljømæssige vurderinger
- Have viden om håndtering af energi, miljø og økonomi i forhold til national og international lovgivning
- Have opnået viden om statiske og kvasi-statiske, elektriske og magnetiske felter, kapacitet og induktans

FÆRDIGHEDER

- Kunne gennemføre grundlæggende energi- og effektmæssige beregninger
- Kunne vurdere miljømæssige konsekvenser ift. brugen af forskellige energiressourcer og -teknologier
- Kunne opstille simple økonomiske modeller og metoder for grundlæggende energisystemer
- Kunne analysere statiske og kvasi-statiske elektriske og magnetiske felter og deres udbredelse
- Kunne anvende elektrofysikken til bestemmelse af elektrisk modstand, kapacitans og induktans
- Kunne anvende elektrofysikken til beregning af mekaniske kræfter frembragt af elektriske og magnetiske felter
- Have færdigheder inden for emner som elektrisk strøm, elektriske og magnetiske felter samt Ampères lov, Faradays lov, Lenz' lov samt Maxwells ligninger og ferromagnetiske materialer

KOMPETENCER

- Tilegne sig terminologien for fagområdet
- Kunne identificere egne læringsbehov og strukturere egen læring inden for energisystemer og elektrofysik

UNDERVISNINGSFORM

Forelæsninger, eventuelt suppleret med laboratorieøvelser og selvstudier inkluderende e-learning via digitale platforme.

OMFANG OG FORVENTET ARBEJDSINDSATS

Kursusmodulets omfang er 5 ECTS svarende til 150 timers studieindsats.

EKSAMEN

PRØVER

Prøvens navn	Energisystemer og elektrofysik
Prøveform	Mundtlig
ECTS	5
Tilladte hjælpemidler	Med visse hjælpemidler: For yderligere oplysninger om hjælpemidler henvises til kursusbeskrivelsen i Moodle.

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

FAKTA OM MODULET

Engelsk titel	Energy Systems and Electro Physics
Modulkode	E-EN-B1-4DZ
Modultype	Kursus
Varighed	1 semester
Semester	Efterår
ECTS	5
Undervisningssprog	Engelsk
Tomplads	Ja
Undervisningssted	Campus Esbjerg
Modulansvarlig	Kerekes, Mandø

ORGANISATION

Uddannelsesejer	Bachelor (BSc) i teknisk videnskab (anvendt industriel elektronik)
Studienævn	Studienævn for Byggeri, Energi, Elektronik og Maskin i Esbjerg
Institut	Institut for Energi
Fakultet	Det Ingeniør- og Naturvidenskabelige Fakultet

PROBLEMBASERET LÆRING

2025/2026

MODULETS INDHOLD, FORLØB OG PÆDAGOGIK

LÆRINGSMÅL

VIDEN

- centrale tilgange, begreber og teknikker i problembaseret læring
- forskellige problemtyper, projekttyper og deres indbyrdes relationer
- videnskabsteoretiske positioner i problembaseret projektarbejde

FÆRDIGHEDER

- definere problembaseret læring med udgangspunkt i teori og egne erfaringer
- planlægge og styre et problembaseret projektarbejde under hensynstagen til den givne problemtype, projektets længde og gruppens sammensætning
- identificere, analysere og formulere en åben og kompleks problemstilling under hensynstagen til de menneskelige og samfundsmæssige sammenhænge i hvilke problemet indgår
- udpege relevante fokusområder, begreber og metoder til åben og bæredygtig problemløsning af komplekse problemer
- diskutere metodiske konsekvenser af forskellige videnskabsteoretiske positioner
- analysere, sammenstille og vurdere processerne i arbejdet med forskellige problemtyper
- analysere og vurdere gruppeprocesserne i det problemorienterede projektarbejde, herunder gruppens planlægning, monitorering og udvikling af gruppearbejdet

KOMPETENCER

- udvikle en studiepraksis, der er tilpasset et problembaseret, projektorganiseret og digitaliseret læringsmiljø
- udpege, afprøve og evaluere relevante teknikker og tilgange til at forbedre et problembaseret projektarbejde
- overføre erfaringer fra problembaserede projekter til handlingsanvisninger for lignende projekter
- vurdere egen progression i PBL på et erfaringsbaseret og læringsteoretisk grundlag.

UNDERVISNINGSFORM

Se § 17: Uddannelsens indhold og tilrettelæggelse

EKSAMEN

PRØVER

Prøvens navn	Problembaseret læring
Prøveform	Skriftlig
ECTS	5
Bedømmelsesform	Bestået/ikke bestået
Censur	Intern prøve
Vurderingskriterier	Vurderingskriterierne er angivet i Universitetets eksamensordning

FAKTA OM MODULET

Engelsk titel	Problem Based Learning
Modulkode	TECENGPBLE20
Modultype	Kursus
Varighed	1 semester
Semester	Efterår
ECTS	5
Undervisningssprog	Engelsk
Tomplads	Ja
Undervisningssted	Campus Esbjerg
Modulansvarlig	Holgaard

ORGANISATION

Studienævn	Studienævn for Planlægning og Landinspektøruddannelsen
Institut	Institut for Bæredygtighed og Planlægning
Fakultet	Det Teknisk Fakultet for IT og Design

PROGRAMMING OF MICROPROCESSOR BASED SYSTEMS

2025/2026

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

- Have knowledge about the fundamentals of embedded systems
- Be able to build and program a microprocessor based system in embedded C/C++
- Must have knowledge of the methodology used for designing simple digital systems
- Must have insight of basic terminology for the architecture of microprocessors
- Must have insight of basic terminology for sensor and actuator interface to the microprocessor
- Have knowledge about recognized standards for documentation of electronic circuits.

SKILLS

- Be about to choose, describe and apply relevant technical, scientific and context models, theories and methods for analysis, processing and problem solving in relation to microprocessor based systems
- Be able to perform critical evaluation of the relevance of the gained knowledge in relation to the project work including evaluation of the suitability of models, theories or methods
- Be able to design an embedded system operating with no human interactions
- Must be able to design a microprocessor program which can run on its own for controlling the digital/analogue outputs
- Must be able to perform analysis, program development, programming and testing for the entire microprocessor based system
- Be able to obtain data online using real-time data acquisition
- Be able to synthesize, document and bring the entire system (hardware and software) to working condition
- Be able to use graphical programming methods on microcontrollers

COMPETENCES

- Be able to design a microprocessor based system based on the design specifications
- Independently identify and analyse embedded programs
- Independently be able to design and apply embedded programming
- Have a fundamental understanding of timers, counters, interrupts, analog and digital signals, and how these concepts can be applied
- Be able to implement and test the developed system with the purpose of verifying the hypothesis, as well as draw conclusions based on the achieved result.
- Be able to plan, control and put a project work in perspective including planning of project meetings and delegation of the work

TYPE OF INSTRUCTION

Problem based and project oriented project work in groups. The project can be discipline oriented, interdisciplinary or be a part of a multi-disciplinary project dependent on project choice The project work is documented in a P2 project report and participation in a presentation seminar.

To support the learning goals of this module, an AAU Micro (microcredential) course is offered on C/C++ programming. Students are strongly encouraged to complete this AAU Micro as part of the project work.

EXTENT AND EXPECTED WORKLOAD

Since it is a 15 ECTS project module, the work load is expected to be 450 hours for the student.

EXAM

EXAMS

Name of exam	Programming of Microprocessor Based Systems
Type of exam	Oral exam based on a project and presentation seminar.
ECTS	15
Permitted aids	With certain aids: For more information about permitted aids, please visit the course description in Moodle.
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	Programmering af Mikroprocessor-baserede systemer
Module code	E-AIE-B2-1B
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	Mandø

ORGANISATION

Education owner	Bachelor of Science (BSc) in Engineering (Applied Industrial Electronics)
Study Board	Study Board of Build, Energy, Electronics and Mechanics in Esbjerg
Department	Department of Energy
Faculty	The Faculty of Engineering and Science

ELEKTRISKE GRUNDFAG

2025/2026

MODULETS INDHOLD, FORLØB OG PÆDAGOGIK

LÆRINGSMÅL

VIDEN

- Have opnået viden om og forståelse for resistive elektriske kredsløb
- Have opnået viden om og forståelse for operationsforstærkere
- Have opnået viden om og forståelse for induktive og kapacitive elektriske kredsløb
- Have opnået viden om og forståelse for elektrisk måleteknik
- Have opnået viden om forskellige elektriske læresætninger
- Have opnået viden om og forståelse for laboratorieprocedurer i forbindelse med el-tekniske laboratorieforsøg

FÆRDIGHEDER

- Kunne analysere enkle og sammensatte elektriske DC-kredse
- Kunne anvende kredsløbsteknikken til at beregne strømme, spændinger, energier og effekter i DC-kredse
- Kunne anvende kredsløbsreduktionsmetoder til at reducere elektriske kredse
- Kunne anvende analysemetoder til at designe operationsforstærkerkoblinger
- Kunne planlægge og udføre velgennemtænkte, succesfulde el-tekniske laboratorieforsøg på en sikker og hensigtsmæssig vis
- Kunne anvende softwareværktøjer til digitalt design af elektriske kredse
- Have færdigheder inden for følgende områder:
    - Grundlæggende DC-kredsløbsteori (indeholdende energilagrende komponenter), Ohms lov, enheder, Kirchhoffs love, kredsløbsreduktioner (serie og parallel), stjerne-trekant koblinger, afhængige og uafhængige kilder, knudepunkts- og maskemetoden, grundlæggende operationsforstærkerkoblinger, den ideelle operationsforstærker, Thévenin og Nortons teoremer, superposition og maksimal effektoverføring, første og anden ordens transienter
    - Måling af strøm, spænding, effekt og energi, anvendelse af almindelige elektriske måleinstrumenter som voltmeter, amperemeter, wattmeter i digital teknologi samt oscilloskoper
    - Målenøjagtighed, sammensat målefejl og usikkerhedsberegninger
- Kunne anvende software til digitale beregninger af forskellige elektriske signaler i enkle elektriske kredse

KOMPETENCER

- Skal kunne håndtere enkle udviklingsorienterede situationer i forbindelse med elektriske kredse og laboratorieopstillinger i studie- eller arbejdssammenhænge
- Skal selvstændigt kunne indgå i fagligt og tværfagligt samarbejde med en professionel tilgang inden for grundlæggende DC-kredsløbsteori
- Skal kunne identificere egne læringsbehov og strukturere egen læring inden for grundlæggende kredsløbsteori og el-tekniske laboratorieforsøg.

UNDERVISNINGSFORM

Forelæsninger med tilhørende opgaveregning evt. suppleret med e-læring via digitale platforme i henhold til §17 i bachelorstudieordningen og §18 i diplomingeniørstudieordningen.

OMFANG OG FORVENTET ARBEJDSINDSATS

Kursusmodulets omfang er 5 ECTS svarende til 150 timers studieindsats.

EKSAMEN

FORUDSÆTNING FOR INDSTILLING TIL PRØVEN

- Der er obligatorisk deltagelse i alle kursusgange med laboratorieøvelser samt krav om aflevering af samtlige skriftlige laboratorierapporter.
- I tilfælde af manglende deltagelse i laboratorieøvelser eller manglende aflevering af skriftlige laboratorierapporter skal den studerende deltage i en ekstraordinær laboratorieøvelse, som finder sted inden re-eksamen afholdes.

PRØVER

Prøvens navn	Elektriske grundfag
Prøveform	Skriftlig 4 timers prøve.
ECTS	5
Tilladte hjælpemidler	Med visse hjælpemidler: For yderligere oplysninger om hjælpemidler henvises til kursusbeskrivelsen i Moodle.
Bedømmelsesform	7-trins-skala
Censur	Intern prøve
Vurderingskriterier	Vurderingskriterierne er angivet i Universitetets eksamensordning

FAKTA OM MODULET

Engelsk titel	Introduction to Electrical Engineering
Modulkode	N-EN-B2-2BZ
Modultype	Kursus
Varighed	1 semester
Semester	Forår
ECTS	5
Undervisningssprog	Engelsk
Tomplads	Ja
Undervisningssted	Campus Aalborg, Campus Esbjerg
Modulansvarlig	Kerekes, Mandø

ORGANISATION

Studienævn	Studienævn for Byggeri, Energi, Elektronik og Maskin i Esbjerg
Institut	Institut for Energi
Fakultet	Det Ingeniør- og Naturvidenskabelige Fakultet

LINEAR ALGEBRA

2025/2026

RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module builds on knowledge from the module Calculus.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

- Vectors, matrices and systems of linear equations
- Connections between solution of systems of linear equations, associated matrices and operations on those
- Linear independence and dimension. Eigenvalues and eigenvectors
- The connection between properties of a matrix and of the echelon form of it
- The connection between a vector space of dimension n and R^n
- Orthogonality and orthonormal bases

SKILLS

- Matrix-vector product, product and sum of matrices. Row operations. Gauss elimination.
- Eigenvalues and eigenspaces.
- Solution of a system of linear equations on vector form.
- Bases of subspaces associated with a matrice.
- Given a basis for a vector space finding coordinates for vectors and the matrix of a linear map.
- Gram Schmidt, projection on a subspace, projection matrices. Coordinates for a vector wrt. an orthonormal basis.

COMPETENCES

Can apply methods and concepts from linear algebra, including vector spaces and orthonormal bases to given problems relevant to the study programme.

TYPE OF INSTRUCTION

Lectures, exercises, videos, quiz, digitalised self-study, workshops on calculus problems relevant to the study programme.

EXTENT AND EXPECTED WORKLOAD

Since it is a 5 ECTS course, the work load is expected to be 150 hours for the student.

EXAM

EXAMS

Name of exam	Linear Algebra
Type of exam	Written or oral exam
ECTS	5
Permitted aids	Der henvises til den pågældende semesterbeskrivelse/modulbeskrivelse
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	MATLIA1234GB
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	Rasmussen

ORGANISATION

Study Board	Study Board of Mathematical Sciences
Department	Department of Mathematical Sciences
Faculty	The Faculty of Engineering and Science

REAL-TIME SYSTEMS AND GRAPHICAL PROGRAMMING LANGUAGES

2025/2026

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

The module is based on knowledge achieved in the module Applied engineering mathematics or similar.

LEARNING OBJECTIVES

KNOWLEDGE

- Have knowledge of numeric systems (binary, decimal, hexadecimal), basic arithmetic operators and representation of whole and decimal numbers
- Have knowledge of methods for program development and be able to understand the development process for a program from problem formulation to final implementation
- Have a basic understanding of microcontrollers, their architecture and application in real-time systems
- Have knowledge of basic peripheral devices in microcontrollers, including digital input and output as well as analog input and output
- Have knowledge of the operation of digital to analog converters and analog to digital converters as well as their practical use in a microcontroller
- Have knowledge of special peripheral devices, including pulse width modulator and interface to an encoder with quadrature signals
- Have basic knowledge of time-discrete implementation of simple algorithms
- Have knowledge of methods for graphical programming
- Have knowledge of programming using data flow techniques using basic data types and control structures for both non-time-critical and real-time applications
- Have knowledge of using an integrated development environment for graphical programming and troubleshooting
- Have knowledge of hardware for use in data collection

SKILLS

- Be able to interface a microcontroller's peripherals to external devices (actuators, sensors, etc.) by taking into account all relevant electrical conditions
- Be able to select an appropriate real-time system and associated programming environment for a given engineering problem
- Be able to break down a program into smaller modules that can be programmed, debugged and tested individually
- Be able to develop applications in the programming language using graphical programming that can solve a given problem, which may have real-time requirements
- Be able to plan, carry out and document experiments where a microcontroller is used in a real-time system with both analogue and digital inputs and outputs

COMPETENCES

- Must be able to independently carry out design and development in the field of real-time systems and their programming
- Must be independently able to further develop own knowledge and skills within the subject area in addition to the content of this course module

TYPE OF INSTRUCTION

The course is a mix of lectures, workshops, exercises, self-study, E-learning and mini project.

EXTENT AND EXPECTED WORKLOAD

Since it is a 5 ECTS course, the work load is expected to be 150 hours for the student.

EXAM

EXAMS

Name of exam	Real-Time Systems and Graphical Programming Languages
Type of exam	Oral exam based on a project
ECTS	5
Permitted aids	With certain aids: For more information about permitted aids, please visit the course description in Moodle.
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	Realtidssystemer og grafisk programmeringssprog
Module code	E-EN-B4-4DZ
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	Mandø

ORGANISATION

Study Board	Study Board of Build, Energy, Electronics and Mechanics in Esbjerg
Department	Department of Energy
Faculty	The Faculty of Engineering and Science

INSTRUMENTATION

2025/2026

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

The module is based on knowledge achieved in the project module Programming of Microprocessor Based Systems or similar.

LEARNING OBJECTIVES

KNOWLEDGE

- Have knowledge about instrumentation and conditioning of sensors, actuators and the conversion of measurement variables into electrical signals
- Have obtained knowledge about calibration for the measurements systems
- Be able to design and implement sensor and actuator interface hardware to the microprocessor
- Have knowledge about the design of efficient algorithms capable of performing data processing and actuation in real time

SKILLS

- Be able to understand the importance of using efficient algorithms to process data on a microcontroller
- Be able to understand the connections and interfaces between microprocessors and sensor and actuator hardware
- Be able to understand the design of efficient algorithms and data processing algorithms for embedded systems applications
- Based on the above, be able to create requirements and test specifications that enable the completed system to be tested rigorously
- Be able to design and implement basic analogue and digital circuits by means of laboratory demonstration or validation using real measured data series

COMPETENCES

- Be able to design and implement instrumentation for systems based on demanded specifications
- Be able to select the appropriate microcontroller and interface for specific applications
- Be able to implement and test the developed system with the purpose of verifying the hypothesis, as well as draw conclusions based on the achieved result
- Have the ability to participate in a professional and interdisciplinary collaboration within the instrumentation area

TYPE OF INSTRUCTION

Problem based and project organised project work in groups where the students, in the collaboration process to find the technical solutions, are focused on effective team work with the ability to listen actively, give constructive feedback and motivation in the collaboration as well as having responsibility for own learning. The project may be discipline-oriented, interdisciplinary or part of a multidisciplinary project depending on project choice.

EXTENT AND EXPECTED WORKLOAD

Since it is a 15 ECTS project module, the work load is expected to be 450 hours for the student.

EXAM

EXAMS

Name of exam	Instrumentation
Type of exam	Oral exam based on a project

	Oral examination with external adjudicator based on a presentation seminar and project report.
ECTS	15
Permitted aids	With certain aids: For more information about permitted aids, please visit the course description in Moodle.
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	Instrumentering
Module code	E-AIE-B3-1D
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	Mandø

ORGANISATION

Education owner	Bachelor of Science (BSc) in Engineering (Applied Industrial Electronics)
Study Board	Study Board of Build, Energy, Electronics and Mechanics in Esbjerg
Department	Department of Energy
Faculty	The Faculty of Engineering and Science

AC-KREDSLØBSTEORI

2025/2026

MODULETS INDHOLD, FORLØB OG PÆDAGOGIK

Modulet bygger på viden opnået i modulet elektriske grundfag eller tilsvarende.

LÆRINGSMÅL

VIDEN

- Have opnået forståelse for:
  - Grundlæggende steady-state analyser inden for AC-kredsløb
  - Grundlæggende steady-state effekt analyser inden for AC-kredsløb
  - Koncepterne for gensidig induktans, koblingskoefficienter, den ideelle transformer og vindingsforhold
  - Karakteristika for balancerede trefasede kredsløb
  - Basale trefasede stjerne og delta koblinger
  - Variable frekvensforhold for basale R, L og C kredsløb
  - Karakteristika for basale filtre: lavpas, højpas, båndpas og båndstop
  - Forskellige typer af kredsløbsfunktioner
  - Definition af poler og nulpunkter
  - Laplace domæne repræsentation af grundlæggende kredsløbselementer (medtaget begyndelsesbetingelser): R, L og C
  - Karakteristika for dioder og passive enfasede og trefasede ensrettere
  - Fourier-teknikker til kredsløbsanalyse

FÆRDIGHEDER

- Kunne foretage beregninger af strømme og spændinger i steady-state AC-kredsløb
- Kunne foretage steady-state effektanalyser inden for AC-kredsløb
- Kunne foretage beregninger på magnetisk koblede kredsløb
- Kunne beregne spændinger, strømme, effekter og effektfaktor i trefasede kredsløb
- Kunne lave Bode-plot og frekvensanalyser for variable-frekvens kredsløb
- Kunne lave kredsløbsanalyser ved hjælp af Laplace transformation
- Kunne designe enfasede og trefasede diodeensrettere
- Kunne lave Fourier-analyser af periodiske signaler i elektriske kredsløb

KOMPETENCER

- Skal kunne håndtere enkle udviklingsorienterede situationer i forbindelse med AC-kredsløbstekniske problemstillinger i studie- eller arbejdssammenhænge.
- Skal kunne udføre laboratoriearbejde, lave dataopsamling og analysere resultaterne for AC-kredsløb under studie- og i arbejdssammenhænge

UNDERVISNINGSFORM

Forelæsninger med efterfølgende opgaveregning og laboratorieøvelser, evt. supplering med e-læringsaktiviteter.

OMFANG OG FORVENTET ARBEJDSINDSATS

Kursusmodulets omfang er 5 ECTS svarende til 150 timers studieindsats.

EKSAMEN

PRØVER

Prøvens navn	AC-kredsløbsteori
Prøveform	Skriftlig eller mundtlig
ECTS	5
Tilladte hjælpemidler	Med visse hjælpemidler: For yderligere oplysninger om hjælpemidler henvises til kursusbeskrivelsen i Moodle.
Bedømmelsesform	7-trins-skala
Censur	Intern prøve
Vurderingskriterier	Vurderingskriterierne er angivet i Universitetets eksamensordning

FAKTA OM MODULET

Engelsk titel	AC Circuit Theory
Modulkode	N-EN-B3-2BZ
Modultype	Kursus
Varighed	1 semester
Semester	Efterår
ECTS	5
Undervisningssprog	Engelsk
Tomplads	Ja
Undervisningssted	Campus Aalborg, Campus Esbjerg
Modulansvarlig	Kerekes, Mandø

ORGANISATION

Uddannelsesejer	Bachelor (BSc) i teknisk videnskab (energi)
Studienævn	Studienævn for Byggeri, Energi, Elektronik og Maskin i Esbjerg
Institut	Institut for Energi
Fakultet	Det Ingeniør- og Naturvidenskabelige Fakultet

ANVENDT INGENIØRMATEMATIK

2025/2026

ANBEFALEDE FAGLIGE FORUDSÆTNINGER FOR AT DELTAGE I MODULET

Modulet bygger på viden opnået i modulerne Calculus og Lineær algebra eller tilsvarende.

MODULETS INDHOLD, FORLØB OG PÆDAGOGIK

LÆRINGSMÅL

VIDEN

- Skal have viden om grundlæggende regneregler inden for vektoranalyse i det 2 og 3 dimensionale rum, og hvordan de anvendes på ingeniørområdet
- Skal kunne forstå Laplace-transformation og anvende den til løsning af differentialligninger bla. eksemplificeret ved problemstillinger fra fx mekanik, elektronik eller varmeledning
- Skal have viden om komplekse analytiske funktioner
- Skal have forståelse for potensrækker og Taylor-rækker
- Skal have forståelse for hvordan komplekse analytiske funktioner og rækkeudviklinger kan anvendes i forhold til fysiske systemer

FÆRDIGHEDER

- Skal kunne anvende vektoranalyse, herunder:
  - Indre produkt (prik-produkt)
  - Vektor-produkt (kryds-produkt)
  - Vektor- og skalarfunktioner og felter
  - Vektor kurver, tangent og længde
  - Vektordifferentialregning: Gradient, divergens, rotation
  - Vektorintegralregning: Linje-integraler, kurveuafhængighed af linje-integraler, dobbelt-integraler, Greens sætning i planet, overflade-integraler
- Skal kunne anvende Fourier-rækker, herunder:
  - Fourier-rækker og trigonometriske rækker
  - Periodiske funktioner
  - Lige og ulige funktioner
  - Komplekse Fourier-rækker

- Skal kunne anvende LaPlace-transformation, herunder:
  - Definition af LaPlace-transformation. Invers transformation. Linearitet og s-skifte
  - Transformation af almindelige funktioner, herunder periodiske, impuls og trin funktioner
  - Transformation af afledede og integraler
  - Løsning af differentialligninger
  - Foldning og integralligninger
  - Differentiation og integration af transformerede systemer med ordinære differentialligninger

- Skal kunne anvende komplekse analytiske funktioner inden for konform afbildning og komplekse integraler, herunder:
  - Komplekse tal og kompleks plan
  - Polær form for komplekse tal
  - Eksponentielle funktioner
  - Trigonometriske og hyperbolske funktioner
  - Logaritmiske funktioner og generelle potensfunktioner
  - Kompleks integration: Linje-integraler i det komplekse plan
  - Cauchys integral sætning

KOMPETENCER

- Skal kunne håndtere vektoranalyse, rækker, LaPlace-transformation og komplekse analytiske funktioner på grundlæggende ingeniørmæssige eksempler

UNDERVISNINGSFORM

Uddannelsen bygger på en kombination af faglige, problemorienterede og tværfaglige tilgange og tilrettelægges ud fra følgende arbejds- og evalueringsformer, der kombinerer færdigheder og faglig refleksion:

- forelæsninger
- klasseundervisning
- projektarbejde
- workshops
- opgaveløsning (individuelt og i grupper)
- lærerfeedback
- faglig refleksion
- porteføljearbejde
- laboratoriearbejde
- e-learning

OMFANG OG FORVENTET ARBEJDSINDSATS

Kursusmodulets omfang er 5 ECTS svarende til 150 timers studieindsats.

EKSAMEN

PRØVER

Prøvens navn	Anvendt ingeniørmatematik
Prøveform	Skriftlig 4 timers prøve
ECTS	5
Tilladte hjælpemidler	Med visse hjælpemidler: For yderligere oplysninger om hjælpemidler henvises til kursusbeskrivelsen i Moodle.
Bedømmelsesform	7-trins-skala
Censur	Intern prøve
Vurderingskriterier	Vurderingskriterierne er angivet i Universitetets eksamensordning

FAKTA OM MODULET

Engelsk titel	Applied Engineering Mathematics
Modulkode	24ETMATDELE2
Modultype	Kursus
Varighed	1 semester
Semester	Efterår
ECTS	5
Undervisningssprog	Engelsk
Tomplads	Ja
Undervisningssted	Campus Aalborg, Campus Esbjerg
Modulansvarlig	Kerekes,

	Mandø

ORGANISATION

Studienævn	Studienævn for Matematiske Fag
Institut	Institut for Matematiske Fag
Fakultet	Det Ingeniør- og Naturvidenskabelige Fakultet

DATA STRUCTURES AND ALGORITHMS

2025/2026

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

The module is based on knowledge achieved in the module Real-time systems and programming languages or similar.

LEARNING OBJECTIVES

KNOWLEDGE

- Have knowledge about object-oriented programming using a modern computer language such as Python or C++
- Have knowledge about abstract data types
- Have knowledge about algorithm analysis, complexity classes and recursion
- Have knowledge about data structures such as stacks, queues, lists, sets, maps, trees and graphs
- Have knowledge about sorting algorithms such as insertion sort, merge sort and quick sort
- Have knowledge about searching algorithms and heuristics

SKILLS

- Be able to use, design and implement data structures within a computer program
- Be able to analyse the complexity of algorithms in time and space using the big O notation
- Be able to design and write computer programs using object-oriented techniques and data structures
- Be able to design and implement divide and conquer algorithms using recursion

COMPETENCES

- Independently demonstrate knowledge and capacity to apply algorithms and heuristics to design solutions for problems in different application domains
- Independently design computer programs with efficient data structures and algorithms
- Independently design and use classes and objects to implement computer programs for real time systems

TYPE OF INSTRUCTION

Lectures with exercises, possibly supplemented with e-learning as stated in § 17 in the BSc curriculum and §18 in the BE curriculum.

EXTENT AND EXPECTED WORKLOAD

Since it is a 5 ECTS course, the work load is expected to be 150 hours for the student.

EXAM

EXAMS

Name of exam	Data Structures and Algorithms
Type of exam	Written or oral exam
ECTS	5
Permitted aids	With certain aids: For more information about permitted aids, please visit the course description in Moodle.
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	Datastrukturer og algoritmer
Module code	N-AIE-B3-4A
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	Mandø

ORGANISATION

Education owner	Bachelor of Science (BSc) in Engineering (Applied Industrial Electronics)
Study Board	Study Board of Build, Energy, Electronics and Mechanics in Esbjerg
Department	Department of Energy
Faculty	The Faculty of Engineering and Science

CONTROL SYSTEMS

2025/2026

RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module is based on knowledge achieved in the project module Instrumentation on the 3rd semester or similar.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

- Have insight of transfer functions described via the Laplace formulation, including feature analysis, such as poles, zeros, and analogue/digital implementation
- Have the insight of first-principle modelling and verification by experiments
- Be able to linearize non-linear system models in order to approximate them by linear models
- Have insight into real-time aspects in relation to digital systems communicating with other analogue and/or digital systems

SKILLS

- Be able to analyse and select methods for modelling of physical systems, such as electric, electro-mechanical, thermal and fluid dynamical systems, or power electronic systems at a level where the resulting models can be utilized in a control system design
- Be able to set up a specific goal for the project
- Be able to apply selected modeling techniques for modeling dynamic systems and simulating them
- Be able to analyse the open-loop and closed-loop system features and specify system performances in transfer function descriptions
- Be able to apply basic linear control techniques for analysis and design of a control system based on a given specification

COMPETENCES

- Be able to apply different modelling techniques to illustrate dynamic system’s features and performance for control design purpose
- Be able to simulate the obtained mathematical model by employing some simulation tools, such as Matlab/Simulink.
- Be able to analyse, design and implement a control solution for a given specific regulation problem, by using fundamental control theories
- Have gained ability to participate in a professional and interdisciplinary cooperation within the control area

TYPE OF INSTRUCTION

Lectures with subsequent assignment calculations and laboratory work; possibly supplemented with self-study/study groups and e-learning activities.

EXTENT AND EXPECTED WORKLOAD

Since it is a 15 ECTS project module, the work load is expected to be 450 hours for the student.

EXAM

EXAMS

Name of exam	Control Systems

Type of exam	Oral exam based on a project and a presentation seminar.
ECTS	15
Permitted aids	With certain aids: For more information about permitted aids, please visit the course description in Moodle.
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	Styring og regulering
Module code	E-AIE-B4-1B
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	Mandø

ORGANISATION

Education owner	Bachelor of Science (BSc) in Engineering (Applied Industrial Electronics)
Study Board	Study Board of Build, Energy, Electronics and Mechanics in Esbjerg
Department	Department of Energy
Faculty	The Faculty of Engineering and Science

GRUNDLÆGGENDE REGULERING

2025/2026

MODULETS INDHOLD, FORLØB OG PÆDAGOGIK

Modulet bygger på viden opnået i modulerne Calculus, Lineær algebra og Anvendt ingeniørmatematik eller tilsvarende.

LÆRINGSMÅL

VIDEN

- Skal have viden om modellering af fysiske systemer og deres dynamik
- Skal have viden om metoder til linearisering af ulineære systemer
- Skal have forståelse for et systems stationære egenskaber og dynamiske respons, herunder indflydelse af systemets type og orden samt placering af poler og nulpunkter
- Skal have forståelse for åben- og lukket-sløjfe-begreberne
- Skal have forståelse for et systems frekvensrespons
- Skal have forståelse for absolut og relativ stabilitet og metoder til analyse af stabilitet
- Skal have forståelse for rodkurve-analyse og viden om regulatordesign vha. rodkurver
- Skal have forståelse for regulatordesign vha. frekvensresponsteknikker
- Skal have viden om praktisk implementering af regulatorer

FÆRDIGHEDER

- Skal kunne modellere og analysere enkle dynamiske systemer (elektriske, mekaniske og termiske), samt have forståelse for analogierne mellem disse
- Skal kunne opstille lineære modeller af dynamiske systemer vha. blokdiagrammer og overføringsfunktioner
- Skal kunne anvende reguleringsteori til at specificere performancekriterier
- Skal kunne analysere et systems respons og stabilitet vha. de lineære metoder
- Skal kunne udvælge passende lineære regulatorer og forudsige/vurdere deres indflydelse på et givet system
- Skal kunne dimensionere en lineær regulator til et givet system, således performancekrav overholdes
- Skal kunne vurdere problemstillingen og den anvendte løsningsmetode samt formidle resultatet heraf til et teknisk publikum

KOMPETENCER

- Skal kunne håndtere udviklingsorienterede situationer i forbindelse med grundlæggende reguleringsteknik og modellering
- Skal selvstændigt kunne indgå i fagligt og tværfagligt samarbejde med en professionel tilgang inden for grundlæggende reguleringsteknik og modellering
- Skal kunne identificere egne læringsbehov og strukturere egen læring inden for grundlæggende reguleringsteknik og modellering

UNDERVISNINGSFORM

Uddannelsen bygger på en kombination af faglige, problemorienterede og tværfaglige tilgange og tilrettelægges ud fra følgende arbejds- og evalueringsformer, der kombinerer færdigheder og faglig refleksion:

- forelæsninger
- klasseundervisning
- projektarbejde
- workshops
- opgaveløsning (individuelt og i grupper)
- lærerfeedback
- faglig refleksion
- porteføljearbejde
- laboratoriearbejde
- e-læring

OMFANG OG FORVENTET ARBEJDSINDSATS

Kursusmodulets omfang er 5 ECTS svarende til 150 timers studieindsats.

EKSAMEN

PRØVER

Prøvens navn	Grundlæggende regulering
Prøveform	Skriftlig eller mundtlig
ECTS	5
Tilladte hjælpemidler	Med visse hjælpemidler: For yderligere oplysninger om hjælpemidler henvises til kursusbeskrivelsen i Moodle.
Bedømmelsesform	7-trins-skala
Censur	Intern prøve
Vurderingskriterier	Vurderingskriterierne er angivet i Universitetets eksamensordning

FAKTA OM MODULET

Engelsk titel	Fundamental Control Theory
Modulkode	N-EN-B4-2AZ
Modultype	Kursus
Varighed	1 semester
Semester	Forår
ECTS	5
Undervisningssprog	Engelsk
Tomplads	Ja
Undervisningssted	Campus Aalborg, Campus Esbjerg
Modulansvarlig	Mandø

ORGANISATION

Uddannelsesejer	Bachelor (BSc) i teknisk videnskab (energi)
Studienævn	Studienævn for Byggeri, Energi, Elektronik og Maskin i Esbjerg
Institut	Institut for Energi
Fakultet	Det Ingeniør- og Naturvidenskabelige Fakultet

MODELLING AND SIGNAL PROCESSING

2025/2026

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

The module is based on knowledge achieved in the modules Calculus, Linear algebra and Applied engineering mathematics or similar.

LEARNING OBJECTIVES

KNOWLEDGE

- Have knowledge and comprehension of theoretical modelling for dynamic systems, including the principles of mass balance, energy balance and momentum balance.
- Have knowledge and comprehension of experimental modelling of dynamic systems, including the experiment design, data collection, model structure selection, parameter estimation and model validation.
- Have knowledge about analogue signal processing and its application in analysis and design of signals and systems, time, and frequency domains.
- Have knowledge about sampling theories, embedded systems, and methods for processing of physical signals on a computer.
- Have knowledge about measurement and instrumentation principles.

SKILLS

- Be able to apply basic theoretical and experimental modelling techniques for modelling dynamic systems, form of block diagrams and be able to reformulate the equivalent diagrams
- Be able to linearize an obtained nonlinear system and analyse the difference between the linearized and the original systems
- Be able to simulate the obtained mathematical model of concerned system and analyse the system features
- Be able to apply theories and methods for spectral estimation including Fourier transform
- Be able to apply theories and methods for design of digital filters
- Be able to implement filters onto embedded systems

COMPETENCES

- Be able to apply the theoretical modelling approach to model linear and non-linear physical systems, with emphasis on control design.
- Be able to identify systems using white and black box methods
- Be able to describe dynamic systems in transfer function and state-space formulations
- Be able to design and develop analog and digital filters
- Be able to collect data from sensors, understand the limitations of measurement techniques and analyze signals

TYPE OF INSTRUCTION

The programme is based on a combination of academic, problem oriented and interdisciplinary approaches and organised based on the following types of instruction that combine skills and reflection:

- Lectures
- Class teaching

- Project work

- Work shops

- Exercises (individually and in groups)

- E-learning
- Supervisor feedback
- Professional reflection
- Portfolio work
- Laboratory work

EXTENT AND EXPECTED WORKLOAD

Since it is a 5 ECTS project module, the work load is expected to be 150 hours for the student.

EXAM

EXAMS

Name of exam	Modelling and Signal Processing
Type of exam	Written or oral exam
ECTS	5
Permitted aids	With certain aids: For more information about permitted aids, please visit the course description in Moodle.
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	Modellering og signalbehandling
Module code	E-AIE-B4-2B
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	Mandø

ORGANISATION

Study Board	Study Board of Build, Energy, Electronics and Mechanics in Esbjerg
Department	Department of Energy
Faculty	The Faculty of Engineering and Science

EFFEKTELEKTRONIK

2025/2026

ANBEFALEDE FAGLIGE FORUDSÆTNINGER FOR AT DELTAGE I MODULET

Modulet bygger på viden opnået i modulerne Elektriske grundfag og AC-kredsløbsteori eller tilsvarende.

MODULETS INDHOLD, FORLØB OG PÆDAGOGIK

LÆRINGSMÅL

VIDEN

- Have viden om teorier for effektiv energiomsætning vha. effektelektroniske systemer og apparater
- Have kendskab til effektelektroniske komponenters funktion og virkemåde
- Have viden om og forstå hvordan effektelektroniske systemer, apparater og komponenter modelleres
- Have viden om digitale værktøjer til modellering

FÆRDIGHEDER

- Kunne anvende viden om energieffektive effektelektroniske systemer, apparater og deres komponenter til simulering
- Kunne vurdere resultatet af modelleringen, i hvor stort omfang det er repræsentativt for den fysiske verden
- Kunne forholde sig til både teoretiske og digitale modeller på forskellige abstraktionsniveauer og deres anvendelser

KOMPETENCER

- Have opnået evne til at kunne omsætte akademiske kundskaber og færdigheder inden for analyse af effektive effektelektroniske systemer, apparater og deres komponenter til en praktisk problemstilling og kunne bearbejde en sådan problemstilling
- Have opnået evne til at kunne indgå i fagligt og tværfagligt samarbejde inden for effektelektroniske systemer

UNDERVISNINGSFORM

Uddannelsen bygger på en kombination af faglige, problemorienterede og tværfaglige tilgange og tilrettelægges ud fra følgende arbejds- og evalueringsformer, der kombinerer færdigheder og faglig refleksion:

- forelæsninger
- klasseundervisning
- projektarbejde
- workshops
- opgaveløsning (individuelt og i grupper)
- lærerfeedback
- faglig refleksion
- porteføljearbejde
- laboratoriearbejde
- evt. e-learning

OMFANG OG FORVENTET ARBEJDSINDSATS

Kursusmodulets omfang er 5 ECTS svarende til 150 timers studieindsats.

EKSAMEN

PRØVER

Prøvens navn	Effektelektronik
Prøveform	Skriftlig eller mundtlig
ECTS	5
Tilladte hjælpemidler	Med visse hjælpemidler: For yderligere oplysninger om hjælpemidler henvises til kursusbeskrivelsen i Moodle.
Bedømmelsesform	7-trins-skala
Censur	Intern prøve
Vurderingskriterier	Vurderingskriterierne er angivet i Universitetets eksamensordning

FAKTA OM MODULET

Engelsk titel	Power Electronics
Modulkode	N-EN-B5-4C
Modultype	Kursus
Varighed	1 semester
Semester	Efterår
ECTS	5
Undervisningssprog	Dansk og engelsk
Tomplads	Ja
Undervisningssted	Campus Aalborg, Campus Esbjerg
Modulansvarlig	Kerekes, Mandø

ORGANISATION

Uddannelsesejer	Bachelor (BSc) i teknisk videnskab (energi)
Studienævn	Studienævn for Energi
Institut	Institut for Energi
Fakultet	Det Ingeniør- og Naturvidenskabelige Fakultet

AUTOMATION INCLUDING POWER ELECTRONICS

2025/2026

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

The module is based on knowledge achieved in the project module Control systems or similar.

LEARNING OBJECTIVES

KNOWLEDGE

- Have insight of sampling mechanism and sampling theorem for an ADC implementation
- Be able to simulate the concerned digital control solution applied to a power electronic system in an efficient and reliable manner
- Be able to deal with real-time issues in a systematic manner when a digital controller is implemented for a power electronic system
- Must have the knowledge of developing state-space model of power electronic systems and their controllers
- Be able to understand and create an economic analysis for the automated power electronic device or system

SKILLS

- Be able to determine a correct sampling frequency based on the system frequency feature analysis
- Be able to analyse and develop controls for power electronic systems based on derived state-space models
- Be able to handle the real-time issues of digital implementation in a professional manner
- Be able to make a cost-benefit analysis of the automated power electronic system or apparatus

COMPETENCES

- Be able to analyse and design a controller in a professional way
- Be able to perform the real-time analysis and programming of the designed controller
- Be able to evaluate the basic economic conditions for the development and commissioning of systems or devices

TYPE OF INSTRUCTION

Problem based and project oriented work in project groups.

Some lectures are given in business economy to support the objectives in this area.

The students are introducted to the entrepreneurship PBL Model from AAU. They are introduced to models, tools and methods often used in entrepreneurial projects.

EXTENT AND EXPECTED WORKLOAD

Since it is a 15 ECTS project module, the work load is expected to be 450 hours for the student.

EXAM

EXAMS

Name of exam	Automation including Power Electronics
Type of exam	Oral exam based on a project Oral examination with external examiner based on a presentation of the project report.
ECTS	15
Permitted aids	With certain aids:

	For more information about permitted aids, please visit the course description in Moodle.
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	Automatisering med anvendt effektelektronik
Module code	E-AIE-B5-1B
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	Mandø
Time allocation for external examiners	B

ORGANISATION

Education owner	Bachelor of Science (BSc) in Engineering (Applied Industrial Electronics)
Study Board	Study Board of Build, Energy, Electronics and Mechanics in Esbjerg
Department	Department of Energy
Faculty	The Faculty of Engineering and Science

ELEKTRISKE MASKINER

2025/2026

MODULETS INDHOLD, FORLØB OG PÆDAGOGIK

Modulet bygger på viden opnået i modulerne Lineær algebra, Calculus, Anvendt ingeniørmatematik samt AC kredsløbsteori eller tilsvarende

LÆRINGSMÅL

VIDEN

- Have grundlæggende viden om elektromagnetiske fænomener, driftsmåden samt opbygningen af transformere og elektriske maskiner
- Have viden om flux, flux-sammenkobling, fase induktanser og gensidig induktans og deres karakteristika
- Have grundlæggende viden om elektromekanisk energiomformning
- Have viden om trefasede vindinger og roterende magnetiske felter
- Have viden om maskinmaterialer og deres karakteristika samt praktiske forhold og standarder for elektriske maskiner
- Have viden om transformere, DC-, AC- og synkronmaskiner og fastlæggelsen af deres parametre ved test og opstilling af digitale steady-state ækvivalentkredsløbsmodeller herfor under forskellige driftsbetingelser

FÆRDIGHEDER

- Kunne lave beregninger på ækvivalentkredsløbsmodeller for transformere og elektriske maskiner
- Kunne lave nødvendige simplificeringer af transformerens ækvivalentdiagram ved forskellige applikationer
- Kunne tegne vektordiagrammer for transformeren og elektriske maskiner
- Kunne beregne effekt, moment, hastighed, strøm, effektfaktor og virkningsgrad for transformere og elektriske maskiner
- Kunne udføre eksperimentelle forsøg til fastlæggelse af ønskede parametre for transformere og elektriske maskiner

KOMPETENCER

- Være i stand til at anvende ækvivalentkredsløbsdiagrammer for transformere, synkronmaskiner og asynkronmaskiner og analysere deres performance under forskellige driftsbetingelser
- Være i stand til at udføre laboratoriemålinger til fastlæggelse af ønskede parametre for digitale ækvivalentdiagramsmodeller
- Være i stand til at håndtere udviklingspecifikke situationer relateret til steady-state design, analyse og anvendelse af transformere og elektriske maskiner

UNDERVISNINGSFORM

Forelæsninger, opgaver og laboratorieøvelser samt evt. e-læring via digitale platforme.

OMFANG OG FORVENTET ARBEJDSINDSATS

Kursusmodulets omfang er 5 ECTS svarende til 150 timers studieindsats.

EKSAMEN

PRØVER

Prøvens navn	Elektriske maskiner
Prøveform	Skriftlig eller mundtlig

ECTS	5
Tilladte hjælpemidler	Med visse hjælpemidler: For yderligere oplysninger om hjælpemidler henvises til kursusbeskrivelsen i Moodle.
Bedømmelsesform	7-trins-skala
Censur	Intern prøve
Vurderingskriterier	Vurderingskriterierne er angivet i Universitetets eksamensordning

FAKTA OM MODULET

Engelsk titel	Electrical Machines
Modulkode	N-EN-B5-5B
Modultype	Kursus
Varighed	1 semester
Semester	Efterår
ECTS	5
Undervisningssprog	Dansk og engelsk
Tomplads	Ja
Undervisningssted	Campus Aalborg, Campus Esbjerg
Modulansvarlig	Kerekes, Mandø

ORGANISATION

Uddannelsesejer	Bachelor (BSc) i teknisk videnskab (energi)
Studienævn	Studienævn for Energi
Institut	Institut for Energi
Fakultet	Det Ingeniør- og Naturvidenskabelige Fakultet

MODERNE DIGITAL REGULERING

2025/2026

MODULETS INDHOLD, FORLØB OG PÆDAGOGIK

Modulet bygger på viden opnået i modulerne Grundlæggende regulering og Procesregulering, instrumentering og sikkerhed eller tilsvarende.

LÆRINGSMÅL

VIDEN

- Have viden om digital tilstandsmodellering og formulering af systemer på tilstandsform
- Have viden om kanoniske former og sammenhæng med overføringsfunktioner
- Have viden om et systems opførsel og stabilitet i relation til systemets egenværdier
- Have viden om styrbarhed og observerbarhed
- Have viden om polplacering og observerdesign
- Have viden om diskretisering (sampling) og rekonstruktion af tidskontinuerte digitale signaler
- Have viden om metoder til analyse af diskret-tidssignaler og -systemer (*Z*-transformation)
- Have viden om metoder til design af diskrettids-regulatorer
- Have viden om metoder til diskretisering af tidskontinuerte regulatorer

FÆRDIGHEDER

- Kunne modellere tidskontinuerte lineære dynamiske systemer på tilstandsform med digitale beregningsværktøjer
- Kunne løse tilstandsligningen og kunne analysere et systems respons og stabilitet ud fra en tilstandsmodel
- Kunne designe både tilstandsregulator og tilstandsobserver til et tidskontinuert system
- Kunne modellere og analysere tidsdiskrete systemer i både åbent- og lukket-sløjfe
- Kunne vælge samplingstid via digital regulering
- Kunne opstille performancekrav til et lukket-sløjfe system og kunne udvælge diskrettids-regulatorstruktur
- Kunne designe diskretids-regulator direkte i *z*-domænet
- Kunne anvende metoder til diskretisering af tidskontinuert digital regulator og være i stand til at vurdere resultatets anvendelighed
- Have forståelse for den praktiske implementering af tidsdiskrete digitale regulatorer

KOMPETENCER

- Kunne håndtere udviklingsorienterede situationer i forbindelse med digital tilstandsregulering og diskret regulering
- Selvstændigt kunne indgå i fagligt og tværfagligt samarbejde med en professionel tilgang til digital tilstandsregulering og diskret regulering
- Kunne identificere egne læringsbehov og strukturere egen læring inden for digital tilstandsregulering og diskret regulering

UNDERVISNINGSFORM

Forelæsninger med efterfølgende opgaveregning og laboratoriearbejde; evt. suppleret med selvstudie/studiekredse og e-læringsaktiviteter.

OMFANG OG FORVENTET ARBEJDSINDSATS

Kursusmodulets omfang er 5 ECTS svarende til 150 timers studieindsats.

EKSAMEN

PRØVER

Prøvens navn	Moderne digital regulering
Prøveform	Skriftlig eller mundtlig
ECTS	5
Tilladte hjælpemidler	Med visse hjælpemidler: For yderligere oplysninger om hjælpemidler henvises til kursusbeskrivelsen i Moodle.
Bedømmelsesform	7-trins-skala
Censur	Intern prøve
Vurderingskriterier	Vurderingskriterierne er angivet i Universitetets eksamensordning

FAKTA OM MODULET

Engelsk titel	Modern and Digital Control
Modulkode	E-EN-B5-2C
Modultype	Kursus
Varighed	1 semester
Semester	Efterår
ECTS	5
Undervisningssprog	Dansk og engelsk
Tomplads	Ja
Undervisningssted	Campus Esbjerg
Modulansvarlig	Mandø

ORGANISATION

Studienævn	Studienævn for Byggeri, Energi, Elektronik og Maskin i Esbjerg
Institut	Institut for Energi
Fakultet	Det Ingeniør- og Naturvidenskabelige Fakultet

NUMERISKE METODER

2025/2026

ANBEFALEDE FAGLIGE FORUDSÆTNINGER FOR AT DELTAGE I MODULET

Modulet bygger videre på viden opnået i ”Anvendt ingeniørmatematik" eller lignende.

MODULETS INDHOLD, FORLØB OG PÆDAGOGIK

LÆRINGSMÅL

VIDEN

- Have viden og forståelse for grundlæggende numeriske metoder indenfor maskinteknik, energiteknik og byggeteknik.
- Have viden og forståelse for numeriske metoder til løsning af systemer af lineære og ikke-lineære ligninger.
- Have viden om matrix egenværdiproblemer.
- Have viden og forståelse for interpolationsmetoder.
- Have viden og forståelse for numeriske integrationsmetoder.
- Have viden og forståelse for numeriske metoder til første og anden ordens ordinære differentialligninger.
- Have viden og forståelse for elliptiske, parabolske og hyperbolske partielle differentialligninger samt brugen af disse indenfor ingeniørområdet.
- Have viden og forståelse for numerisk løsning af partielle differentialligninger ved brug af differensmetoder, finite volume metoder og finite element metoder, samt have viden om brugen af disse metoder til ingeniørmæssige problemer.

FÆRDIGHEDER

- Skal kunne anvende numeriske metoder til at løse lineære ligningssystemer ved brug af direkte og iterative løsningsmetoder.
- Skal kunne løse en ikke-lineær ligning og systemer af ikke-lineære ligninger ved brug af numeriske metoder.
- Skal kunne estimere og beregne egenværdier og egenvektorer af en matrix.
- Skal kunne anvende forskellige metoder til interpolation af data.
- Skal kunne anvende forskellige metoder til numerisk løsning af bestemte integraler.
- Skal kunne løse første og anden ordens ordinære differentialligninger ved brug af numeriske metoder.
- Skal kunne anvende analytiske metoder til at løse partielle differentialligninger.
- Skal kunne anvende differensmetoder til at løse elliptiske, parabolske og hyperbolske partielle differentialligninger.
- Skal kunne anvende finite volume metoden til at løse diffusionsligninger.
- Skal kunne anvende finite element metoden til at løse diffusionsligninger.
- Skal kunne anvende computerprogrammet MATLAB til de numeriske metoder dækket i kurset.

KOMPETENCER

- Skal kunne håndtere udviklingsorienterede situationer i forbindelse med numeriske metoder i studie- eller arbejdssammenhænge.
- Skal selvstændigt kunne indgå i fagligt og tværfagligt samarbejde med en professionel tilgang inden for matematiske numeriske metoder.
- Skal kunne identificere egne læringsbehov og strukturere egen læring inden for numeriske metoder.

UNDERVISNINGSFORM

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

OMFANG OG FORVENTET ARBEJDSINDSATS

Da det er et 5 ECTS kursus forventes der en arbejdsbyrde på 150 timer.

EKSAMEN

PRØVER

Prøvens navn	Numeriske metoder
Prøveform	Skriftlig eller mundtlig
ECTS	5
Tilladte hjælpemidler	Oplysninger om tilladte hjælpemidler til eksamen offentliggøres under beskrivelsen af semesteret/kurset.
Bedømmelsesform	7-trins-skala
Censur	Intern prøve
Vurderingskriterier	Vurderingskriterierne er angivet i Universitetets eksamensordning

FAKTA OM MODULET

Engelsk titel	Numerical Methods
Modulkode	M-MP-B5-3B
Modultype	Kursus
Varighed	1 semester
Semester	Efterår og Forår
ECTS	5
Undervisningssprog	Engelsk
Tomplads	Ja
Undervisningssted	Campus Aalborg, Campus Esbjerg
Modulansvarlig	Lund, Thomas Condra

ORGANISATION

Uddannelsesejer	Civilingeniør, cand.polyt. i indeklima og energi
Studienævn	Studienævn for Mekanik og Fysik
Institut	Institut for Materialer og Produktion
Fakultet	Det Ingeniør- og Naturvidenskabelige Fakultet

BACHELOR PROJECT: MODELLING AND CONTROL OF INDUSTRIAL ELECTRONIC APPLICATIONS

2025/2026

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

The module is based on knowledge achieved in the project module Automation including power electronics or similar.

LEARNING OBJECTIVES

KNOWLEDGE

- Have knowledge about control of industrial electronic applications in forms of apparatus or systems including power electronics, electric drives or motion controls for applications such as robotic systems, electric propulsion systems, electric and autonomous vehicles, etc.
- Have development-based knowledge and understanding within the profession and the discipline’s practice and applied theories and methods
- Be able to understand scientific methods and theories compared to the semester theme and be able to see the project in a larger context

SKILLS

- Be able to apply knowledge about designing power electronics system, electrical drive and/or motion control for applications such as robotic systems, electric propulsion systems, electric and autonomous vehicles, etc. using digital platforms
- Be able to apply the discipline’s methods and tools and master the skills associated with employment in the profession
- Be able to assess practical and theoretical issues and the reasons for and select the options
- Be able to present practical and professional issues and solutions to partners and user
- Be able to analyse results from simulations and laboratory work or real measured data series, and assemble them to give an overall impression of the system's performance

COMPETENCES

- Have the ability to provide robust time and work plans for own project.
- Be able to handle complex and development-oriented situations in study or work contexts within electrical machine and power electronics and/or motion controls for applications such as robotic systems, electric propulsion systems, electric and autonomous vehicles etc
- Have the ability to enter into professional and interdisciplinary collaboration with a professional approach in the field as electrical machine and drives and power electronic engineering and/or motion controls for applications such as robotic systems, electric propulsion systems, electric and autonomous vehicles etc
- Be able to identify own learning needs and structure learning in different environments in industrial electronics
- Be able to translate academic knowledge and skills in the field of industrial electronics including electrical machines, power electronic and/or motion controls for applications such as robotic systems, electric propulsion systems, electric and autonomous vehicles etc to a practical problem

TYPE OF INSTRUCTION

Problem based and project organised work in project groups focused on self-critical reflection and proactive participation. The project may be discipline-oriented, interdisciplinary or part of a multidisciplinary project depending on project choice.

EXTENT AND EXPECTED WORKLOAD

Since it is a 15 ECTS project module, the work load is expected to be 450 hours for the student.

EXAM

EXAMS

Name of exam	Bachelor Project: Modelling and Control of Industrial Electronic Applications
Type of exam	Master's thesis/final project Oral examination based on a project report.
ECTS	15
Permitted aids	With certain aids: For more information about permitted aids, please visit the course description in Moodle.
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: Modellering og styring af industrielle elektroniske applikationer
Module code	E-AIE-B6-5C
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	Mandø

ORGANISATION

Education owner	Bachelor of Science (BSc) in Engineering (Applied Industrial Electronics)
Study Board	Study Board of Build, Energy, Electronics and Mechanics in Esbjerg
Department	Department of Energy
Faculty	The Faculty of Engineering and Science

INTRODUCTION TO ARTIFICIAL INTELLIGENCE

2025/2026

RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module is based on knowledge achieved in the modules Linear algebra, Calculus, Data structures and algorithms, Real-time systems and programming languages.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

- Have knowledge about what encompasses artificial intelligence (AI) and its main applications
- Have knowledge about the basic algorithms and heuristics used for searching in graphs such as shortest path, A* and the travelling salesman problem
- Have knowledge about optimisation techniques such as gradient based methods for convex functions and metaheuristic methods
- Have knowledge about the concepts of supervised and unsupervised machine learning techniques, about perceptron learning and multilayer perceptron learning for classification
- Have knowledge about crisp logic systems and knowledge representation
- Have knowledge about image processing and computer vision algorithms

SKILLS

- Be able to design and implement AI based algorithms and heuristics for searching, optimisation or knowledge representation in a modern computer language such as Python or C++
- Be able to develop computer programs using libraries to implement machine learning based systems for specific applications
- Be able to design AI based computer programs for computer vision and reasoning using 1st order logic

COMPETENCES

- Independently be able to apply AI to solve problems in robotics and computer vision
- Independently develop an AI based system solutions for a specific application domain
- Have a fundamental understanding of the techniques used in AI

TYPE OF INSTRUCTION

Lectures with exercises, possibly supplemented with e-learning as stated in § 17 in the BSc curriculum and §18 in the BE curriculum.

EXTENT AND EXPECTED WORKLOAD

Since it is a 5 ECTS project module, the work load is expected to be 150 hours for the student.

EXAM

EXAMS

Name of exam	Introduction to Artificial Intelligence
Type of exam	Written or oral exam
ECTS	5
Permitted aids	With certain aids: For more information about permitted aids, please visit the course description in Moodle.
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	Introdution til kunstig intelligens
Module code	N-AIE-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	Mandø

ORGANISATION

Education owner	Bachelor of Science (BSc) in Engineering (Applied Industrial Electronics)
Study Board	Study Board of Build, Energy, Electronics and Mechanics in Esbjerg
Department	Department of Energy
Faculty	The Faculty of Engineering and Science

MODELLING AND CONTROL OF ROBOT MANIPULATOR

2025/2026

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

The module is based on knowledge achieved in the modules Modelling and signal processing and Modern digital control or similar.

LEARNING OBJECTIVES

KNOWLEDGE

- Have knowledge about the fundamentals of the different robotic systems
- Be able to develop models of robotic systems including actuators and sensors
- Be able to design controllers for considered robots in the presence of uncertain and possibly varying system parameters
- Have knowledge on centralized and distributed control of robot manipulators

SKILLS

- Be able to analyse system dynamics as basis for controller dimensioning
- Be able to apply the obtained models for linear and non-linear observer designs
- Be able to design both motion and force controllers for robotic systems
- Be able to perform trajectory planning and apply path-following control algorithms using digital platforms

COMPETENCES

- Independently identify and analyse robotic systems
- Independently be able to design and apply modelling and control techniques for the robotic automation systems
- Have a fundamental understanding of typical actuators and measurements on the considered systems

TYPE OF INSTRUCTION

Lectures with subsequent assignment calculations and laboratory work; possibly supplemented with self-study/study groups and e-learning activities.

EXTENT AND EXPECTED WORKLOAD

Since it is a 5 ECTS project module, the work load is expected to be 150 hours for the student

EXAM

EXAMS

Name of exam	Modelling and Control of Robot Manipulator
Type of exam	Written or oral exam
ECTS	5
Permitted aids	With certain aids: For more information about permitted aids, please visit the course description in Moodle.
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	Modellering og regulering af robotter
Module code	E-AIE-B6-3C
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	Mandø

ORGANISATION

Education owner	Bachelor of Science (BSc) in Engineering (Applied Industrial Electronics)
Study Board	Study Board of Build, Energy, Electronics and Mechanics in Esbjerg
Department	Department of Energy
Faculty	The Faculty of Engineering and Science

TEST AND VALIDATION INCLUDING SYSTEM SET-UP AND UNDERSTANDING

2025/2026

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

The module is based on knowledge achieved in the modules Introduction to Electrical Engineering and Modelling and signal processing or similar.

LEARNING OBJECTIVES

KNOWLEDGE

- Have knowledge about how different physical systems are built up and interact, this includes for instance understanding of:
    - System division in different layers
    - How to take different time-constants in a system into account
    - How inner control loops affects outer control loops and vise versa
- Have knowledge about what to measure and with which precision, this includes knowledge about
    - Different measurement techniques to be applied
    - Planning and documentation
    - Accuracy
        - analogue versus digital measurements and the combination hereof
    - What affects the accuracy and the resolution of measured signals
- Have knowledge about how to detect signals in noise
    - Mean values and standard deviation
    - Noise and interference, coupling mechanisms

SKILLS

- Be able to split up a system in different subparts to have better overview of the total system and to understand how the subparts affects each other
    - Physical layers contra data, business and control layers
    - Sub-systems with different time constants
- Be able to calculate the accuracy of a given measurement
- Be able to document a validate a test set up

COMPETENCES

- Be able to use the acquired skills for test and validation and understanding of system set ups for different systems and apparatus
- Be able to use the professional approach for test and validation and understanding of system set ups in academic and interdisciplinary collaboration
- Be able to identify their own learning needs and to structure own learning within test and validation
- Be able to understand the difference between test, train, and validation systems

TYPE OF INSTRUCTION

Lectures, laboratory work and practical exercises.

EXTENT AND EXPECTED WORKLOAD

Since it is a 5 ECTS project module, the work load is expected to be 150 hours for the student

EXAM

EXAMS

Name of exam	Test and Validation including System Set-up and Understanding
Type of exam	Written or oral exam
ECTS	5
Permitted aids	With certain aids: For more information about permitted aids, please visit the course description in Moodle.
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	Test og validering inklusiv systemopbygning og -forståelse
Module code	E-AIE-B6-4B
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	Mandø

ORGANISATION

Education owner	Bachelor of Science (BSc) in Engineering (Applied Industrial Electronics)
Study Board	Study Board of Build, Energy, Electronics and Mechanics in Esbjerg
Department	Department of Energy
Faculty	The Faculty of Engineering and Science

CYBER-PHYSICAL SYSTEMS

2025/2026

RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module is based on knowledge achieved in the project module Control systems and microprocessor based systems or similar.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

- Have insight on the modeling of a system and the computational aspects in hardware (HW) and software (SW) needed to implement cyber-physical systems
- Have insight on how to implement digital communication within the components of a cyber-physical system using libraries
- Be able to understand how to use discrete time to model the cyber or computational part and continuous time to model the physical world
- Be able to understand basic concepts in operating systems, concurrency, finite state machines or flow charts to design the software of a cyber-physical system
- Be able to understand the effect of the HW components and SW algorithms on the overall performance of a cyber-physical system
- Be able to understand and create an economic analysis for the cyber-physical system
- Energy digital auditing and sensor placement in energy assets for predictive control maintenance

SKILLS

- Be able to design cyber-physical systems that include digital controllers, their algorithms and their implementation in HW and SW
- Be able to simulate parts or the whole of a cyber-physical system using data-flow based tools such as Matlab Simulink, LabVIEW, Microprocessors or other industrial platform software
- Be able to design and implement the SW of a cyber-physical system using high-level computer languages and libraries
- Be able to implement the interface of a cyber-physical system to the physical world using ADC, DAC, microprocessor systems, sensors and actuators
- Be able to use a cyber-physical systems approach to design, implement and solve an engineering problem in industry 4.0, IoT, robotics or within the energy sector and power electronics.
- Be able to make a cost-benefit analysis of the cyber-physical system

COMPETENCES

- Be able to design a cyber-physical system in a professional way
- Be able to perform real-time analysis and programming of the designed system
- Be able to evaluate the basic economic conditions for the development and commissioning of the cyber-physical system

TYPE OF INSTRUCTION

Problem based and project oriented work in project groups.

Some lectures are given in business economy to support the objectives in this area.

The students are introducted to PBL based entrepreneurship. They are introduced to models, tools and methods often used in entrepreneurial projects.

EXTENT AND EXPECTED WORKLOAD

Since it is a 15 ECTS project module, the work load is expected to be 450 hours for the student.

EXAM

EXAMS

Name of exam	Cyber-Physical Systems
Type of exam	Oral exam based on a project
ECTS	15
Permitted aids	With certain aids: For more information about permitted aids, please visit the course description in Moodle.
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	Cyber-fysiske systemer
Module code	E-AIE-B5-2B
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	Mandø
Time allocation for external examiners	B

ORGANISATION

Education owner	Bachelor of Science (BSc) in Engineering (Applied Industrial Electronics)
Study Board	Study Board of Build, Energy, Electronics and Mechanics in Esbjerg
Department	Department of Energy
Faculty	The Faculty of Engineering and Science

CYBER PHYSICAL SYSTEMS DESIGN AND PROGRAMMING

2025/2026

RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module is based on knowledge achieved in the modules Real-time systems and programming languages, modelling and signal processing, Data structures and algorithms, Fundamental control theory.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

- Have knowledge about the main concepts used in cyber physical systems (CPS)
- Have knowledge about design methodologies for CPS
- Have knowledge about modern ARM processors and architectures used in CPS
- Have knowledge about operating systems concepts, concurrency, state machines and communication protocols
- Have knowledge about modern intelligent sensors and actuators used in CPS
- Have knowledge about publisher-subscriber programming model for distributed tasks and meta operating systems such as Robot Operating System (ROS)
- Have knowledge about verification and validation methods for CPS

SKILLS

- Be able to design and implement CPS for applications in robotics or IoT
- Be able to apply control systems concepts on the design of CPS
- Be able to apply continuous time models in designing CPS

COMPETENCES

- Independently develop and evaluate a CPS solution to a practical problem in robotics or IoT
- Independently analyse a problem application domain and design a CPS based solution to it
- Have a fundamental understanding of the techniques used in CPS

TYPE OF INSTRUCTION

Lectures with subsequent assignment calculations and laboratory work; possibly supplemented with self-study/study groups and e-learning activities.

EXTENT AND EXPECTED WORKLOAD

Since it is a 5 ECTS project module, the work load is expected to be 150 hours for the student.

EXAM

EXAMS

Name of exam	Cyber Physical Systems Design and Programming
Type of exam	Written or oral exam
ECTS	5
Permitted aids	With certain aids:

	For more information about permitted aids, please visit the course description in Moodle.
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	Cyberfysisk systemdesign og programmering
Module code	E-AIE-B5-3A
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	Mandø

ORGANISATION

Education owner	Bachelor of Science (BSc) in Engineering (Applied Industrial Electronics)
Study Board	Study Board of Build, Energy, Electronics and Mechanics in Esbjerg
Department	Department of Energy
Faculty	The Faculty of Engineering and Science

BACHELOR PROJECT: AUTONOMOUS ROBOTIC SYSTEMS AND LANGUAGES

2025/2026

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

The module is based on knowledge achieved in the module Cyber physical systems or similar.

LEARNING OBJECTIVES

KNOWLEDGE

- Have knowledge about the modelling and simulation of autonomous robotic systems such as robotic manipulators or unmanned autonomous vehicle (UAV) such as drones or ground robots
- Have knowledge about mission planning, path planning, and autonomous navigation of UAVs
- Have knowledge about the design of special purpose domain specific computer languages for mission and task descriptions and planning
- Have knowledge about the use of programming paradigms to implement high level abstractions for concurrency, logical reasoning and learning
- Have knowledge about centralized and distributed control

SKILLS

- Be able to design and implement an autonomous robotic system or UAV to solve an automation problem on a specific application domain
- Be able to design both motion and actuator controllers for navigation of UAV
- Be able to design and implement trajectory and path planning or visual servoing on a robotic manipulator or UAV
- Be able to design and implement a task control system for robotic manipulators or mission control system for an UAV

COMPETENCES

- Independently propose and evaluate a robotic system solution to solve an automation problem within an application domain
- Independently be able to apply modelling, simulation and control techniques for the automation of the considered systems
- Independently propose and evaluate the architecture in software and hardware of an autonomous robotic system

TYPE OF INSTRUCTION

Problem based and project organised work in project groups focused on self-critical reflection and proactive participation. The project may be discipline-oriented, interdisciplinary or part of a multidisciplinary project depending on project choice.

EXTENT AND EXPECTED WORKLOAD

Since it is a 15 ECTS project module, the work load is expected to be 450 hours for the student.

EXAM

EXAMS

Name of exam	Bachelor Project: Autonomous Robotic Systems and Languages
Type of exam	Master's thesis/final project Oral examination based on a project report.

ECTS	15
Permitted aids	With certain aids: For more information about permitted aids, please visit the course description in Moodle.
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: Autonome robotsystemer og programmeringssprog
Module code	E-AIE-B6-6A
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	Mandø

ORGANISATION

Education owner	Bachelor of Science (BSc) in Engineering (Applied Industrial Electronics)
Study Board	Study Board of Build, Energy, Electronics and Mechanics in Esbjerg
Department	Department of Energy
Faculty	The Faculty of Engineering and Science

PROGRAMMING PARADIGMS AND TRANSLATORS

2025/2026

RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module is based on knowledge achieved in the modules Real-time systems and programming languages, Data structures and algorithms, Introduction to artificial intelligence, or similar.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

- Have knowledge about the fundamental programming paradigms used in artificial intelligence and robotics such as distributed computing, object oriented, functional and logic paradigms
- Have knowledge on the application of distributed, functional, object oriented and logical paradigms in robotics and AI
- Have knowledge on the process of building compilers and interpreters
- Have knowledge on automata theory, parsing, lexical and semantic analysis and code generation

SKILLS

- Be able to develop distributed computing systems using libraries
- Be able to design algorithms and heuristics used in robotics and AI using the object oriented, functional or logic paradigm
- Be able to design interpreters or compilers for simple domain specific languages

COMPETENCES

- Independently be able to apply distributed computing to implement robotic systems consisting of multiple computing devices
- Independently be able to evaluate which of the programming paradigms should be used to building robotic systems and AI based applications
- Independently develop a parser, interpreter or compiler using libraries
- Have a fundamental understanding on computer languages, programming paradigms and its applications

TYPE OF INSTRUCTION

Lectures with exercises, possibly supplemented with e-learning as stated in § 17 in the BSc curriculum and §18 in the BE curriculum.

EXTENT AND EXPECTED WORKLOAD

Since it is a 5 ECTS project module, the work load is expected to be 150 hours for the student.

EXAM

EXAMS

Name of exam	Programming Paradigms and Translators
Type of exam	Written or oral exam
ECTS	5
Permitted aids	With certain aids:

	For more information about permitted aids, please visit the course description in Moodle.
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	Programmeringsparadigmer og oversættere
Module code	N-AIE-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	Mandø

ORGANISATION

Education owner	Bachelor of Science (BSc) in Engineering (Applied Industrial Electronics)
Study Board	Study Board of Build, Energy, Electronics and Mechanics in Esbjerg
Department	Department of Energy
Faculty	The Faculty of Engineering and Science