



AALBORG UNIVERSITET

BACHELOR (BSC) I TEKNISK VIDENSKAB (IT, KOMMUNIKATIONS- OG MEDIETEKNOLOGI), 2018

**BACHELOR (BSC) I TEKNISK VIDENSKAB
KØBENHAVN**

MODULER SOM INDGÅR I STUDIEORDNINGEN

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PROJECT IN CONCEPTUAL DESIGN OF AN ICT APPLICATION (P0)

2019/2020

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

Students who complete P0 project unit will have gained their first experience in using the problem-based learning method. Furthermore, students will be introduced to the discipline of IT, communication and new media.

The students will be required to present a general conceptual design of an ICT application. The concept must include a business model, considerations on user friendliness, a SWOT analysis and an actor analysis. An example of an ICT-based application suitable for the project is an e-shop selling goods or services via web portal or a mobile portal. Furthermore, the students will be required to prepare a written P0 process analysis.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about typical work processes in a problem based project
- Must have knowledge about the basic principles in scientific work, e.g., academic honesty
- Must have knowledge of what the subject of IT, Communication and New Media includes
- Must have knowledge about the concept of user friendliness
- Must be able to understand the concept of problem based learning

SKILLS

- Must be able to analyse individual as well as organisational learning processes
- Must be able to organise a short period (less than a month) of collaboration in-group and with supervisor
- Must be able to communicate the reflections and results of the problem based project work: orally, graphically and in writing
- Must be able to apply problem based learning in group work
- Must be able to perform a simple SWOT analysis

COMPETENCES

- Must be able to reflect upon the problem oriented and problem based learning approach taken throughout the study
- Must be able to document the results achieved during the project in a report
- Must be able to cooperate with other students during the project period and make a joint presentation of the results achieved in the project.
- Must be able to reflect upon different ways of presenting results achieved with the project in writing, orally, and graphically.

EXAM

EXAMS

Name of exam	Project in Conceptual Design of an ICT Application (P0)
Type of exam	Oral exam based on a project
ECTS	5
Assessment	Passed/Not Passed
Type of grading	Internal examination

Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures
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FACTS ABOUT THE MODULE

Danish title	Projekt i konceptuelt design af en IKT-applikation (P0)
Module code	ESNITCOB1P1
Module type	Project
Duration	1 semester
Semester	Autumn
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Ove Kjeld Andersen

ORGANISATION

Study Board	Study Board of Electronics and IT
Department	Department of Electronic Systems
Faculty	Technical Faculty of IT and Design

PROJECT IN OBJECT-ORIENTED PROGRAMMING (P1)

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The project builds on knowledge obtained in the P0 project module: Project in Conceptual design of an ICT application (Projekt i konceptuelt design af en IKT-applikation).

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

To provide the student with practical experience defining a project within the area of IT, communication and new media, which includes use of object-oriented programming, to implement the project by working in groups and to document the solution in a project report.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about IT, communication and new media technologies in order to identify relevant contextual perspectives of a given technology
- Must have knowledge about project management in a long-term problem based project (in this case 2-3 months)
- Must have knowledge of methodological consideration to describe the theoretical and empirical foundation of the project
- Must have knowledge about how an object oriented programming language can be used to solve a specific problem
- Must have knowledge about commonly occurring data structures and algorithms
- Must have knowledge about the implementation and use of commonly occurring data structures and abstract data types

SKILLS

- Must be able to analyse individual as well as organisational learning processes by scientifically recognised concepts and methods
- Must be able to organise and manage a longer-term project considering group and supervisor collaboration
- Must be able to structure and communicate the reflections and results of the problem based project work; orally, graphically and in writing
- Must be able to identify and define a problem suitable for a project involving object-oriented programming
- Must be able to use an object-oriented programming language and associated class library to implement parts of programs and small programs in order to solve a specific problem
- Must be able to plan and perform systematic test of the programme applied
- Must be able to discuss/assess the quality of the solution in a wider context

COMPETENCES

- Must be able to take responsibility of one's own learning during a longer-termed project period and be able to generalise the gained experiences
- Must have competencies in using object oriented programming in solving programming tasks, especially programming tasks related to communication and new media
- Must have competences in documentation and discussion of the wider market related implications of a real life application

TYPE OF INSTRUCTION

Students will do their project work in groups. The groups will receive instruction and feedback from the teacher. Students have to prepare a written P1 process analysis. Students will get support to identify relevant contextual perspectives by consultancy, a group meeting, and commenting on papers and presentation at the status seminar.

EXAM

EXAMS

Name of exam	Project in Object-oriented Programming (P1)
Type of exam	Oral exam based on a project
ECTS	10
Assessment	7-point grading scale
Type of grading	Internal examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

FACTS ABOUT THE MODULE

Danish title	Projekt i objektorienteret programmering (P1)
Module code	ESNITCOB1P2
Module type	Project
Duration	1 semester
Semester	Autumn
ECTS	10
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Ove Kjeld Andersen

ORGANISATION

Study Board	Study Board of Electronics and IT
Department	Department of Electronic Systems
Faculty	Technical Faculty of IT and Design

PROBLEM BASED LEARNING IN SCIENCE, TECHNOLOGY AND SOCIETY

2019/2020

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

The students shall theoretically as well as practically understand how to plan and execute a scientific problem-based project with technological, social and humanistic relevance. This includes an understanding of how technological aspects and contextual circumstances can be identified and included in the development of a problem solution.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge of basic learning theories
- Must have knowledge of project planning and managements techniques
- Must have knowledge of different approaches to problem-based learning (PBL), including the Aalborg model approach, where problems are related to social and/or humanistic contexts
- Must have understanding of different resources for analysis and assessment of problems and solutions related to IT, communication and new media technologies from scientific, technological, ethical and social perspectives
- Must apply methods for analysis and assessment of problem within the field of IT, communication and new media technologies, including market and stakeholder analysis, and technologies and services assessments

SKILLS

- Must be able to apply basic principles related to planning and management of a problem-based project: basic study techniques, phases in a problem-oriented project, from initial problem to problem analysis and problem formulation, design and implementation
- Must be able to analyse and evaluate the organisation of the project group work and collaboration, especially regarding identification of strong and weak factors, and, based on this, suggest how group organisation and collaboration can be improved in future situations: team roles, group dynamics, communication within the group and externally, creativity, methods for analysis and documentation of learning processes
- Must be able to analyse group conflicts, causes and possible solutions
- Must be able to analyse and evaluate own contribution to study and learning, especially regarding identification of strong and weak factors, and, based on this, consider continuous course of events and their contributions to the learning processes, learning styles and the study
- Must be able to analyse methods used in the project from a scientific point of view: science theory, qualitative and quantitative approaches
- Must be able to apply fundamental key areas, concepts and methods for evaluation and development of technical solutions considering the technology in itself, and in relation to social contexts and human circumstances (holistically): technology assessment methods, contexts and communication, media sociology (e.g., life styles, consumption, sociological methods), different forms of user test, innovation and creativity

COMPETENCES

- Must be able to apply knowledge (application) and understanding regarding being part of a team-based project work
- Must be able to understand and communicate project work (application)
- Must be able to analyse own learning processes
- Must be able to analyse and document learning processes within the group (analysis)
- Must be able to create optimal collaborative learning processes (application)

- Must be able to apply knowledge and understanding of science, technology and society (application); from a technological perspective (including competencies on applying different technology assessment methods), and from a holistic perspective (including competencies on life style, consumption, and technology development, different contexts and forms of communication, innovative and creative processes)

TYPE OF INSTRUCTION

Types of instruction are listed at the start of §17; Structure and contents of the programme.

The types of instruction for this course are decided according to the current Joint Programme Regulations and directions are decided and given by the Study Board for Electronics and IT.

EXAM

EXAMS

Name of exam	Problem Based Learning in Science, Technology and Society
Type of exam	Written or oral exam
ECTS	5
Assessment	Passed/Not Passed
Type of grading	Internal examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

FACTS ABOUT THE MODULE

Danish title	Problembaseret læring i videnskab, teknologi og samfund
Module code	ESNITCOB1K1
Module type	Course
Duration	1 semester
Semester	Autumn
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Ove Kjeld Andersen

ORGANISATION

Study Board	Study Board of Electronics and IT
Department	Department of Electronic Systems
Faculty	Technical Faculty of IT and Design

LINEAR ALGEBRA

2019/2020

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

Linear algebra is a fundamental tool for virtually all engineering mathematics.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about definitions, results and techniques within the theory of systems of linear equations
- Must be able to demonstrate insight into linear transformations and their connection with matrices
- Must have obtained knowledge about the computer tool MATLAB and how it can be used to solve various problems in linear algebra
- Must have acquired knowledge of simple matrix operations
- Must know about invertible matrices and invertible linear mappings
- Must have knowledge of the vector space \mathbb{R}^n and various subspaces
- Must have knowledge of linear dependence and independence of vectors and the dimension and bases of subspace
- Must have knowledge of the determinant of matrices
- Must have knowledge of Eigen values and eigenvectors of matrices and their use
- Must have knowledge of projections and orthonormal bases
- Must have knowledge of first order differential equations, and on systems of linear differential equations

SKILLS

- Must be able to apply theory and calculation techniques for systems of linear equations to determine solvability and to provide complete solutions and their structure
- Must be able to represent systems of linear equations using matrix equations, and vice versa
- Must be able to determine and apply the reduced Echelon form of a matrix
- Must be able to use elementary matrices for Gaussian elimination and inversion of matrices
- Must be able to determine linear dependence or linear independence of small sets of vectors
- Must be able to determine the dimension of and basis for small subspaces

COMPETENCES

- Must demonstrate development of his/her knowledge of, understanding of, and ability to make use of, mathematical theories and methods within relevant technical fields
- Given certain pre-conditions, must be able to make mathematical deductions and arguments based on concepts from linear algebra

TYPE OF INSTRUCTION

Refer to the overview of instruction types listed in § 17. The types of instruction for this course are decided according to the current Joint Programme Regulations and directions are decided and given by The Study Board of Electronics and IT.

EXAM

EXAMS

Name of exam	Linear Algebra
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	Lineær algebra
Module code	ESNITCOB1K2
Module type	Course
Duration	1 semester
Semester	Autumn
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Ove Kjeld Andersen

ORGANISATION

Study Board	Study Board of Electronics and IT
Department	Department of Electronic Systems
Faculty	Technical Faculty of IT and Design

OBJECT-ORIENTED PROGRAMMING 1

2019/2020

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

To provide the student with a foundation for the systematic development of programs using object-oriented modelling and programming.

The student should acquire an understanding of basic concepts and mechanisms in an object-oriented programming language such that the student is able to use the language and associated class library to implement small programs.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about commonly occurring concepts and mechanisms in an object-oriented programming language
- Must have knowledge about commonly occurring data structures and algorithms
- Must have knowledge about the implementation and use of commonly occurring data structures and abstract data types

SKILLS

- Must be able to use an object-oriented programming language and associated class library to implement parts of programs and small programs
- Must be able to plan and perform systematic test of small programs
- Must be able to discuss/assess the quality of a given program

COMPETENCES

- Must have competencies in using object-oriented programming in solving programming tasks, especially programming tasks related to communication and new media

TYPE OF INSTRUCTION

Refer to the overview of instruction types listed in the start of chapter 3. The types of instruction for this course are decided according to the current Joint Programme Regulations and directions are decided and given by The Study Board of Electronics and IT.

EXAM

EXAMS

Name of exam	Object-oriented Programmng 1
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	Objektorienteret programmering 1
Module code	ESNITCOB1K3
Module type	Course
Duration	1 semester
Semester	Autumn
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Ove Kjeld Andersen

ORGANISATION

Study Board	Study Board of Electronics and IT
Department	Department of Electronic Systems
Faculty	Technical Faculty of IT and Design

PROJECT IN SYSTEM DEVELOPMENT

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The students should have competencies equivalent to those gained from the P0 og P1 modules. Furthermore, basic programming experience is recommended.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

For students to develop key competences in how to use system development processes for development of software and IT, and to work with requirements specifications. Overall, the project balances around possibilities and limitations of communication networks and how these are incorporated in requirements specifications and actual system development.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about methods for planning and developing an IT product in order to identify, analyse and assess the contextual impacts and perspectives of a given technology
- Must have knowledge about how to design the interaction between a potential user and an IT product
- Must have knowledge about the most important concepts in iterative system developments such as for example UP
- Must have knowledge about central IT and software development models such as the Waterfall model, Agile development, the spiral lifecycle model, Extreme Programming, etc.
- Must have knowledge about development of requirement specifications as a basis for developing an IT project

SKILLS

- Analyse and model individual as well as organisational learning processes based on experiences from P0 and P1
- Must be able to apply IT development models to an actual case
- Must be able to apply user interaction models as a basis for requirements specifications
- Must be able to apply advanced object-oriented system development
- Must be able to develop a requirement specification for a given IT product
- Must be able to link user requirements with the requirement specification for a given product using UML diagrams
- Must be able to evaluate an IT development project based on requirements
- Must be able to reflect on the construction and reconstruction of science and technology in a user and society perspective
- Must be able to relate the professional practice within the discipline to the needs of humans and different societies
- Must be able to analyse technical or natural scientific problems by use of social science methodology
- Must be able to assess the impacts on humans and society from the proposed solutions

COMPETENCES

- Must have competencies in independently managing a longer termed project
- Have competencies in generalising the gained experiences with project management and put them into perspective of the future course of study
- Must have competencies in reflection on the ethical perspective of engineering and science and discussion of implications of a responsible professional practice
- Must have competencies in development of a requirements specification
- Must have competencies in elicitation of user requirements and to translate these into the requirement specification for a specific product
- Must have competencies in user interaction models
- Must have competencies in IT development (for example a mobile application) by use of the System Development Process

TYPE OF INSTRUCTION

Students will do their project work in groups. The groups will receive instruction and feedback from the teacher. Students have to prepare a written P2 process analysis. Students will get support to identify relevant contextual perspectives by consultancy; a group meeting, and commenting on papers and presentation at the status seminar.

EXAM

EXAMS

Name of exam	Project in System Development
Type of exam	Oral exam based on a project
ECTS	10
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	Projekt i systemudvikling
Module code	ESNITCOB2P1A
Module type	Project
Duration	1 semester
Semester	Spring
ECTS	10
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Ove Kjeld Andersen

ORGANISATION

Study Board	Study Board of Electronics and IT
Department	Department of Electronic Systems
Faculty	Technical Faculty of IT and Design

SOFTWARE ENGINEERING

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The students should have basic programming experience.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

To provide students with knowledge in different development methods for development of software. This involves understanding of process models (plan-driven as well as agile), analyses for requirements as well as software validation and evolution.

LEARNING OBJECTIVES

KNOWLEDGE

- Must understand about requirements engineering and specification
- Must know about different process models for software design and development
- Must understand the difference between a plan driven process model and an incrementable agile process model
- Must know the Waterfall model, the Spiral model, Extreme Programming and SCRUM, amongst others
- Must understand when to use which process model for a given project
- Must be able to link user requirements and technical requirements for a specific IT software
- Must be able to explain the interaction between a system and users
- Must be able understand different methods for validation and testing

SKILLS

- Must be able to identify and compare different use situations for a particular IT product
- Must be able to identify, analyse and compare different methodologies for elicitation of requirements
- Must be able to describe and use different techniques for requirements analysis and specification
- Must be able to use UML as part of the requirements analysis and specification development
- Must be able to define verifiable criteria for a software or parts of a software
- Must be able to evaluate and validate different software solutions
- Must be able to plan and perform evaluations of software or parts of the software
- Must be able to design and conclude on a requirement specification for a given application

COMPETENCES

- Must be able to develop a requirement specification for particular software
- Must have competences in discussing and documenting different approaches to development of software competences
- Must have competences in carrying out the different phases of a software engineering process
- Must be able to evaluate the process of software engineering and the single elements in relation to the purpose of the software being developed

TYPE OF INSTRUCTION

Types of instruction are listed at the start of §17; Structure and contents of the programme.

The types of instruction for this course are decided according to the current Joint Programme Regulations and directions are decided and given by The Study Board of Electronics and IT.

EXAM

EXAMS

Name of exam	Software 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	Software engineering
Module code	ESNITCOB2K1
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Ove Kjeld Andersen

ORGANISATION

Study Board	Study Board of Electronics and IT
Department	Department of Electronic Systems
Faculty	Technical Faculty of IT and Design

OBJECT-ORIENTED PROGRAMMING 2

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module adds to knowledge obtained in Object-oriented Programming 1.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

- To provide the student with knowledge of important concepts in object-oriented analysis and design that can be used to build programming models
- To provide the student with skills to perform object-oriented implementation and testing of developed programming models in Java

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about common architectures and design patterns
- Must understand complex programming issues such as: the concept of multithreaded programs, typical synchronisation problems and common solutions to these
- Must have knowledge about programming for portable devices in Java
- Must have knowledge of manual and automated software testing principles and methods

SKILLS

- Must be able to implement modelled systems by using object-oriented principles
- Must be able to use common architectures and design patterns
- Must be able to implement and execute test-cases
- Must be able to perform complex programming such as data-serialisation and use the Java API classes to program “attractive” GUIs, including using custom dialog boxes
- Must be able to discuss and evaluate the design and quality of object-oriented programs

COMPETENCES

- Must have the competencies to apply object-oriented principles, programming, and testing in the context of IT, communication and new media services.

TYPE OF INSTRUCTION

Refer to the overview of instruction types listed in the start of chapter 3. The types of instruction for this course are decided according to the current Joint Programme Regulations and directions are decided and given by The Study Board of Electronics and IT.

EXAM

EXAMS

Name of exam	Object-oriented Programmng 2
Type of exam	Written or oral exam
ECTS	10
Assessment	7-point grading scale

Type of grading	Internal examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

FACTS ABOUT THE MODULE

Danish title	Objektorienteret programmering 2
Module code	ESNITCOB2K2A
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	10
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Ove Kjeld Andersen

ORGANISATION

Study Board	Study Board of Electronics and IT
Department	Department of Electronic Systems
Faculty	Technical Faculty of IT and Design

DISCRETE MATHEMATICS

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module builds on knowledge obtained in Linear Algebra.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

- Must understand set theory: sets, relations, functions, partial orderings, equivalence relations
- Must understand fundamental number theory: modular arithmetic, Euclidean algorithm, the Chinese remainder theorem, Fermat's little theorem and prime factorisation
- Countability of the rational numbers
- Must understand recursive/iterative algorithms
- Must understand time complexity: asymptotic notation and Big-O notation
- Must know about logarithm and exponential functions with base 2
- Must know about combinatorics and the binomial formula
- Must know about recursive functions and recurrence relations
- Must know about proof techniques: weak and strong induction and proof by contradiction, contraposition and constructive
- Must understand logic: propositional logics and quantifiers
- Must understand graph theory: directed and undirected graphs, path, simple path and trees
- Graph algorithms: search in graphs and shortest path

SKILLS

- Must be able to construct proofs (using the proof techniques of the course) for results within the course
- Must be able for formulate in writing mathematical results related to the course

COMPETENCES

- Must have competencies in the use of concepts and techniques of discrete mathematics, including in connection with algorithms

TYPE OF INSTRUCTION

The teaching in Discrete Mathematics is a combination of sessions with lectures, exercises, and mini-projects.

EXAM

EXAMS

Name of exam	Discrete Mathematics
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
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FACTS ABOUT THE MODULE

Danish title	Diskret matematik
Module code	ESNITCOB2K3
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Ove Kjeld Andersen

ORGANISATION

Study Board	Study Board of Electronics and IT
Department	Department of Electronic Systems
Faculty	Technical Faculty of IT and Design

PROJECT IN DISTRIBUTED SYSTEMS AND USERS

2019/2020

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

The purpose of this project module is to acquire knowledge, skills and competencies regarding the implementation and use of distributed information technology in a specific application based on identified user requirement.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about computer networks
- Must have knowledge about distributed information technology systems including protocol design and system architecture
- Must have knowledge about methodologies for elicitation of user requirements and user evaluations

SKILLS

- Must be able to involve users in requirement specifications for user interfaces
- Must have basic skills in implementing network technologies and distributed information technology systems, including intranet and groupware
- Must be able to implement client-server based or a peer-to-peer based application

COMPETENCES

- Must demonstrate competences in performing analyses of user requirements for information and knowledge
- Must have competences in presenting user scenarios based on user needs
- Must have competences in choosing relevant computer networks and information technology systems meeting organisational needs for knowledge and information sharing
- Must have competences in development and implementation of a distributed system

TYPE OF INSTRUCTION

Types of instruction are listed at the start of §17; Structure and contents of the programme.

The types of instruction for this course are decided according to the current Joint Programme Regulations and directions are decided and given by The Study Board of Electronics and IT.

EXAM

EXAMS

Name of exam	Project in Distributed Systems and Users
Type of exam	Oral exam based on a project
ECTS	15
Assessment	7-point grading scale
Type of grading	Internal examination
Criteria of assessment	The criteria of assessment are stated in the Examination Policies and Procedures

FACTS ABOUT THE MODULE

Danish title	Projekt i distribuerede systemer og brugere
Module code	ESNITCOB3P1
Module type	Project
Duration	1 semester
Semester	Autumn
ECTS	15
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Ove Kjeld Andersen

ORGANISATION

Study Board	Study Board of Electronics and IT
Department	Department of Electronic Systems
Faculty	Technical Faculty of IT and Design

DISTRIBUTED SYSTEMS

2019/2020

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

To introduce the student to a number of different techniques used for development of distributed systems

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about architectures of distributed systems
- Must have knowledge about application layer protocols
- Must have knowledge about relevant client side web technologies
- Must have knowledge about using Java Beans
- Must have knowledge about simple client/server applications using Java RMI

SKILLS

- Must be able to use relevant architectures to design distributed systems
- Must be able to design application layer protocols
- Must be able to use relevant client side web technologies
- Must be able to use Java Beans
- Must be able to implement simple client/server applications using Java RMI

COMPETENCES

Must be able to apply distributed technologies in design development of IT applications

TYPE OF INSTRUCTION

The lessons consist of theory combined with practical exercises and are closely related to the project course consisting in the development of a distributed system.

EXAM

EXAMS

Name of exam	Distributed Systems
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	Distribuerede systemer
Module code	ESNITCOB3K1
Module type	Course

Duration	1 semester
Semester	Autumn
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Ove Kjeld Andersen

ORGANISATION

Study Board	Study Board of Electronics and IT
Department	Department of Electronic Systems
Faculty	Technical Faculty of IT and Design

DIGITAL SIGNAL PROCESSING

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module adds to knowledge obtained in Discrete Mathematics.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge of basic signal sampling and its limitations
- Must be able to explain the concepts of aliasing
- Must have knowledge about linear time invariant systems including impulse response, difference equation, convolution, stability, and causality
- Must have knowledge of finite impulse response filters
- Must have knowledge about definition, basic properties and theorems regarding discrete Fourier transform
- Must be able to explain frequency domain spectra and relate them to their time domain representations.

SKILLS

- Must be able to analyse digital signals and finite impulse response filters by using the methods of convolution, difference equation, impulse response and frequency domain response
- Must be able to design finite impulse response filters from a set of specifications using MATLAB functions
- Must be able to apply the design tools of MATLAB to calculate the filter coefficients
- Must be able to implement and test digital filters using MATLAB

COMPETENCES

- Must be able to solve signal processing related problems in a practical context
- Must be able to apply signal processing algorithms and analyse the results

TYPE OF INSTRUCTION

Refer to the overview of instruction types listed in the start of chapter 3. The types of instruction for this course are decided according to the current Joint Programme Regulations and directions are decided and given by The Study Board of Electronics and IT.

EXAM

EXAMS

Name of exam	Digital Signal Processing
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	Digital signalbehandling
Module code	ESNITCOB3K2
Module type	Course
Duration	1 semester
Semester	Autumn
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Ove Kjeld Andersen

ORGANISATION

Study Board	Study Board of Electronics and IT
Department	Department of Electronic Systems
Faculty	Technical Faculty of IT and Design

INTERACTION DESIGN

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

Students should have experience in Software Engineering.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

- To provide students with competences in involving users in software design and development of user interfaces.
- To provide students insight into the process of interaction design
- To provide a foundation for students to understand the concept of user centric design and can relate this to software engineering in general.
- To obtain experience in prototyping as foundation for design

LEARNING OBJECTIVES

KNOWLEDGE

- Must be able to understand central concepts interaction design, user centric development, process models, GUI, usability, and user experience, amongst others
- Must know different techniques and methods for elicitation of user requirements hereunder creativity techniques
- Must be able to characterise different types of users and their needs
- Must have knowledge about how to involve users in a design process. This includes knowledge about design models such as participatory design
- Must have knowledge about prototyping as design approach
- Must have knowledge about different techniques of how to do usability test designs such as cognitive walkthroughs, heuristic evaluation, focus groups, questionnaires, field studies, etc.
- Must understand how to formulate different goals and evaluation criteria for interaction design of different interfaces

SKILLS

- Must be able to perform user evaluation of a particular software, system or interface using specific user involving techniques
- Must be able to elicitate user requirements by involvement of users and application of techniques (such as “think-aloud” test, and interviews, amongst others)
- Must be able to reflect on the interaction design and decide on which users to involve in the process
- Must be able to demonstrate how a system or interface design has been made through use of conceptual models

COMPETENCES

- Must have competencies in evaluation of different user interfaces (GUIs) and interface styles
- Must have competencies in analysing different target/user types and understand the differences in involvement of various user segments and user groups for feedback on design
- Must have competencies in involvement of users for user requirement elicitation
- Must be able to apply an iterative method for interaction design
- Must be able to select and apply user-involving evaluation methods and techniques

TYPE OF INSTRUCTION

Refer to the overview of instruction types listed in § 17. The types of instruction for this course are decided according to the current Joint Programme Regulations and directions are decided and given by The Study Board of Electronics and IT.

EXAM

EXAMS

Name of exam	Interaction Design
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	Interaktionsdesign
Module code	ESNITCOB3K3
Module type	Course
Duration	1 semester
Semester	Autumn
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Ove Kjeld Andersen

ORGANISATION

Study Board	Study Board of Electronics and IT
Department	Department of Electronic Systems
Faculty	Technical Faculty of IT and Design

PROJECT IN COMMUNICATIONS AND MEDIA TECHNOLOGIES

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The project adds to knowledge obtained in P0 and P1. The course Communication and Media Technologies constitutes an important prerequisite.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

The purpose of this project is to give the students an understanding of the technologies behind ICTs and media technologies. The students must use the theories and methods learned from the course Communication and Media Technologies on a specific case within ICT and media technologies

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about the key technologies and standards for fixed, mobile and wireless networks
- Must have knowledge about the structure, architecture and topologies deployed in the communication networks
- Must have knowledge about the key technologies and standards for the major media technologies
- Must have knowledge about Quality of Service (QoS) parameters for different service classes in different networks

SKILLS

- Must be able to discuss the advantages and disadvantages of different network types in relation to specific services and applications
- Must be able to identify the QoS parameters related to specific service classes and evaluate their role in design of communication and media networks infrastructures

COMPETENCES

- Must have competencies in applying project- and team-based learning to complete a team project, including preparation of problem definition, coherent analysis and writing of a technical report with clear formulation of results and conclusions, and with proper use of source references
- Must have competencies in assessing the usefulness of different media and communication technologies in relation to different services and applications
- Must have the competencies in deploying the knowledge, skills and competencies acquired in the course Communication and Media Technologies while developing this project

TYPE OF INSTRUCTION

Students will do their project work in groups. The groups will receive instruction and feedback from the teacher. In this project, the groups choose either to implement a communication service or to analyse a concrete problem related to communication technologies.

EXAM

EXAMS

Name of exam	Project in Communications and Media Technologies
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	Projekt i kommunikations- og medieteknologi
Module code	ESNITCOB4P1
Module type	Project
Duration	1 semester
Semester	Spring
ECTS	15
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Ove Kjeld Andersen

ORGANISATION

Study Board	Study Board of Electronics and IT
Department	Department of Electronic Systems
Faculty	Technical Faculty of IT and Design

COMMUNICATION AND MEDIA TECHNOLOGIES

2019/2020

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

The objective of this course is to give the students an understanding of the communication networks, technologies, architecture, topologies and standards, including the major technological components used in the communication networks. The aim is to have an understanding of the major parameters, which are decisive when constructing network infrastructures.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about the structure of a communication network, including the specific characteristics of communicative versus distributive networks
- Must have knowledge about different network topologies and architectures and their advantages and disadvantages in relation to specific applications
- Must have knowledge about the reference models used in communication networks, including the OSI and TCP/IP reference models
- Must have knowledge about different transmission media technologies
- Must have knowledge about different modulation technologies
- Must have knowledge about different multiplexing technologies
- Must have knowledge about radio propagation
- Must have knowledge about QoS parameters and services classes
- Must have knowledge about mobility issues in communication networks
- Must have knowledge about the main mobile and wireless communication standards
- Must have knowledge about the major media infrastructure technologies, including digital TV and radio

SKILLS

- Must be able to specify the parameters influencing the coverage, capacity and QoS in communication networks
- Must be able to discuss mobility management within one network and between different networks
- Must be able to discuss the parameters affecting the development of mobile and wireless communication networks

COMPETENCES

- Must have competencies to combine the acquired knowledge and skills to develop a technical analysis related to a specific problem in communication networks

TYPE OF INSTRUCTION

Refer to the overview of instruction types listed in § 17. The types of instruction for this course are decided according to the current Joint Programme Regulations and directions are decided and given by The Study Board of Electronics and IT.

EXAM

EXAMS

Name of exam	Communication and Media Technologies
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	Kommunikations- og medieteknologier
Module code	ESNITCOB4K1
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Ove Kjeld Andersen

ORGANISATION

Study Board	Study Board of Electronics and IT
Department	Department of Electronic Systems
Faculty	Technical Faculty of IT and Design

INTRODUCTION TO ECONOMICS

2019/2020

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

The overall objective is to provide a basic understanding of key concepts in economic theory with emphasis on microeconomics.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about the type of problems addressed by economic theory
- Must have knowledge about the market forces of supply and demand
- Must have knowledge about the different types of market structures
- Must have knowledge about the main cost concepts including short and long term aspects
- Must have knowledge about consumer and producer behaviour

SKILLS

- Must be able to apply economic theories and methodologies for analysing the markets for ICT services
- Must be able to apply a variety of economics concepts to both the business and individual decision making process
- Must be able to apply national account figures for a description of economic development
- Must be able to explain wage and price determination in an open economy
- Must be able to apply economics models to real world scenarios

COMPETENCES

- Must have the competencies to discuss the changes in the ICT market
- Must have the competencies to discuss how differences in market structure affect price and output
- Must have the competencies to discuss the role of the competitive process
- Must be able to discuss the role of technical development in economic theory

TYPE OF INSTRUCTION

Types of instruction are listed at the start of §17; Structure and contents of the programme.

The types of instruction for this course are decided according to the current Joint Programme Regulations and directions are decided and given by The Study Board of Electronics and IT.

EXAM

EXAMS

Name of exam	Introduction to economics
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	Indledende økonomi
Module code	ESNITCOB4K2
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Ove Kjeld Andersen

ORGANISATION

Study Board	Study Board of Electronics and IT
Department	Department of Electronic Systems
Faculty	Technical Faculty of IT and Design

INTRODUCTION TO PROBABILITY THEORY AND STATISTICS

2019/2020

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

To introduce the student to concepts and ideas within statistics and how statistics can be applied to problems relevant to engineers in "ITCOM".

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about fundamental concepts in probability, including conditional probability and independence.
- Must have knowledge about discrete and continuous random variables and relevant properties of these
- Must have knowledge about various examples of descriptive statistics, e.g. histograms and scatterplots.
- Must have knowledge about statistical inference, including estimation, confidence intervals and hypothesis testing.
- Must have knowledge about important statistical models, like linear regression (simple and multiple), analysis of variance, logistic regression and log-linear models (in particular contingency tables).

SKILLS

- Must be able to, given specific data, specify a relevant statistical model and account for the assumptions and limitations of the chosen model.
- Must be able to use relevant software for carrying out the statistical analysis of given data and be able to interpret the results of the analysis

COMPETENCES

- Must be able to judge the applicability of statistics within own area.
- Must be capable of performing a critical judgement of the results of a statistical analysis.
- Must be capable of communicating the results of a statistical analysis to people with no or little background within statistics.

TYPE OF INSTRUCTION

Lectures in combination with practical exercises and self-study or similar.

EXAM

EXAMS

Name of exam	Introduction to Probability Theory and 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	Introduktion til sandsynlighedsregning og statistik
Module code	ESNITCOB4K3
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Ove Kjeld Andersen

ORGANISATION

Study Board	Study Board of Electronics and IT
Department	Department of Electronic Systems
Faculty	Technical Faculty of IT and Design

PROJECT IN APPLICATION DEVELOPMENT AND SECURITY

2019/2020

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

To enable students to develop advanced secure applications and services based on state-of-the-art technologies and the knowledge and skills acquired during the previous semesters. The project should make use of solid skills in software engineering, network and media technologies, and analysis of user requirements in an organisation.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about computer networks and network protocols
- Must have knowledge of user interface design
- Must have knowledge about theories on knowledge sharing and knowledge management in an organisation
- Must have knowledge of security concepts

SKILLS

- Must be able to understand information and communication needs in an organisation
- Must be able to develop applications using context information and media distribution
- Must be able to understand and overcome limitations of servers, networks and mobile terminals
- Must be able to make qualified decisions on client-server issues and choice of networks
- Must be able to include security elements in mobile and web-based applications, e.g., for mobile payment

COMPETENCES

- Must have competencies in identifying user needs in an organisation
- Must have competencies in combining a wide range of networks, technologies and devices in order to realise advanced and non-trivial applications and solutions
- Must have competencies in comparing and assessing the potential of different technologies, methods and approaches in order to make the proper design choices for optimum functionality

TYPE OF INSTRUCTION

Students will do their project work in groups. The groups will receive instruction and feedback from the teacher.

EXAM

EXAMS

Name of exam	Project in Application Development and Security
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	Projekt i applikationsudvikling og sikkerhed
Module code	ESNITCOB5P2
Module type	Project
Duration	1 semester
Semester	Autumn
ECTS	15
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Ove Kjeld Andersen

ORGANISATION

Study Board	Study Board of Electronics and IT
Department	Department of Electronic Systems
Faculty	Technical Faculty of IT and Design

NETWORK AND APPLICATION SECURITY

2019/2020

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

Today any computer professional must have a basic knowledge about network security. This course will present a practical and theoretical survey of the basic concepts, principles and practice of cryptography and network security.

LEARNING OBJECTIVES

KNOWLEDGE

- Must be able to understand the basic concepts, principles and practice of cryptography and network security
- Must be able to understand professional articles and documentation concerning security issues
- Must have knowledge about where to get more information concerning security issues
- Must be able to understand the various threats, vulnerabilities and attack methods and the function and application of network components and applications used for countering threats
- Must be able to understand the various classes of cryptographic algorithms, explain their relative properties and the interplay of algorithms in network security applications and protocols
- Must be able to understand the methods for authentication of people, network traffic and systems in the covered protocols and applications
- Must be able to understand the typical content and best practices in a company's security policy

SKILLS

- Must be able to design, realise and document a security solution in a network
- Must be able to apply tools for analysing and generating network traffic to study security protocols and to test, verify and document the implemented solution
- Must have the ability to take security issues into account when developing IT-systems

COMPETENCES

- Must have competencies in implementing security systems based on current best practices

TYPE OF INSTRUCTION

Class teaching, lab exercises and one group project.

Approximately 60% of the time will be spent on lab exercises and the group project.

EXAM

EXAMS

Name of exam	Network and Application Security
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	Netværks- og applikationssikkerhed
Module code	ESNITCOB5K1
Module type	Course
Duration	1 semester
Semester	Autumn
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Ove Kjeld Andersen

ORGANISATION

Study Board	Study Board of Electronics and IT
Department	Department of Electronic Systems
Faculty	Technical Faculty of IT and Design

COMPUTER NETWORKS AND THE INTERNET

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

Basic programming experience in one programming language (C, C++, Java, etc.)

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

To enable the student to analyse network architectures, define protocols and analyse network traffic using protocol analysers like Wireshark / Ethereal.

Content:

Basic architecture: Computer Networks and the Internet

Application layer: HTTP, FTP, SMTP, POP3, DNS and socket programming.

Transport layer: TCP and UDP.

Network layer: IP, ICMP, NAT, Routing Algorithms and Routers.

Data Link Layer: Ethernet, Wireless LAN, Bridges, Switches and Hubs.

LEARNING OBJECTIVES

KNOWLEDGE

- Must be able to understand concepts like protocol, congestion and flow control, fragmentation, addressing forms, byte stuffing and multiplexing /de-multiplexing
- Must have knowledge about mainstream network components like routers, switches, hubs and their use
- Must have knowledge about services provided by the most important protocols and explain the relations among the services provided and the content of the protocol header

SKILLS

- Must be able to use FSM-diagrams and ladder diagrams to design a protocol
- Must be able to use protocol analysers like Wireshark / Ethereal to analyse network traffic
- Must be able to discuss and evaluate the use of a) addressing forms, b) forward error correction versus error detection, c) stability of routing algorithms, d) explicit and implicit congestion control, e) available standards for local area networks (wired as wireless), f) implications on higher protocol layers of the NAT protocol, and g) IP4 versus IP6
- Must be able to implement, document and demonstrate a product that fulfils the requirement specification
- Must be able to identify, execute and document relevant tests for the developed product
- Must be able to demonstrate and document the ability to identify the major problem areas and the ability to carry out a systematic reduction into well-defined sub problems
- Must be able to identify and execute measurements and experiments for further reduction of uncertainties within the problem areas
- Must be able to create alternative models for the solutions. Select a particular solution based on a documented evaluation of the alternatives

COMPETENCES

- Must be able to use network principles and methods for design of protocols to analyse subjects related to computer networks

TYPE OF INSTRUCTION

Types of instruction are listed at the start of §17; Structure and contents of the programme.

The types of instruction for this course are decided according to the current Joint Programme Regulations and directions are decided and given by The Study Board of Electronics and IT

EXAM

EXAMS

Name of exam	Computer Networks and the Internet
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	Computernet og internettet
Module code	ESNITCOB5K2
Module type	Course
Duration	1 semester
Semester	Autumn
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Ove Kjeld Andersen

ORGANISATION

Study Board	Study Board of Electronics and IT
Department	Department of Electronic Systems
Faculty	Technical Faculty of IT and Design

ICT IN ORGANIZATIONS

2019/2020

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

The purpose of this module is for the students to develop a theoretical understanding and practical skills and competences concerning the implementation and use of information and communication technologies as a means in managing organisations and private companies.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge about theories on organisations and communities
- Must have knowledge about theories regarding the management of distributed organisations and communities
- Must have knowledge about theories on knowledge sharing and management
- Must have knowledge about drivers and barriers concerning the implementation of information technology systems in organisations
- Must have knowledge about needs and use of ICT systems in different kinds of organisations
- Must have knowledge about basic e-business concepts

SKILLS

- Must have skills in the use and application of different relevant information technology systems
- Must have basic skills in analysing organisational structures

COMPETENCES

- Must demonstrate competences in the identification and analysis of the organisational requirements for knowledge and information sharing
- Must have competences in describing and discussing the challenges in sharing information and knowledge via information technology systems
- Must have competences in choosing and describing knowledge and information for IT based system
- Must have acquired competences in choosing relevant technology systems
- Must have competences in applying the acquired knowledge and skills on specific company cases

TYPE OF INSTRUCTION

Refer to the overview of instruction types listed in the start of chapter 3. The types of instruction for this course are decided according to the current Joint Programme Regulations and directions are decided and given by The Study Board of Electronics and IT.

EXAM

EXAMS

Name of exam	ICT in Organizations
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	IKT i organisation
Module code	ESNITCOB5K3A
Module type	Course
Duration	1 semester
Semester	Autumn
ECTS	5
Language of instruction	English
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Ove Kjeld Andersen

ORGANISATION

Study Board	Study Board of Electronics and IT
Department	Department of Electronic Systems
Faculty	Technical Faculty of IT and Design

BSC PROJECT

2018/2019

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module builds on knowledge obtained in the 1st - 5th semester.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

To demonstrate the total acquired knowledge, skills and competencies as described for this bachelor study program (cf. chapter 2 and 3 of this document).

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge of how to design and develop a solution to an ICT related problem serving the needs of the end user

SKILLS

- Must be able to identify organisational, market and legal implications of a given solution to a problem

COMPETENCES

- Must show command of the competencies acquired in the semesters 1-5

TYPE OF INSTRUCTION

Students will work individually or in groups. The students will receive instruction and feedback from the teacher.

EXAM

EXAMS

Name of exam	BSc Project
Type of exam	Oral exam based on a project
ECTS	20
Assessment	7-point grading scale
Type of grading	External examination
Criteria of assessment	As stated in the Joint Programmes Regulations http://www.tech.aau.dk/uddannelse/Studieadministration/

FACTS ABOUT THE MODULE

Danish title	Bachelorprojekt
Module code	ESNITCOB6P1
Module type	Project

Duration	1 semester
Semester	Spring
ECTS	20
Empty-place Scheme	Yes
Location of the lecture	Campus Copenhagen
Responsible for the module	Ove Kjeld Andersen

ORGANISATION

Study Board	Study Board of Electronics and IT
Department	Department of Electronic Systems
Faculty	Technical Faculty of IT and Design

PHYSICAL INTERFACE DESIGN

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module adds to knowledge obtained in Introduction to Programming, Interaction Design, and Mathematics for Multimedia Applications.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

Objectives:

Physical Interface Design is a course module where students learn about basic principles of electronics and how different sensors can be interfaced to a microcontroller to design novel forms of interactions between man and machines.

LEARNING OBJECTIVES

KNOWLEDGE

Students who complete the module will obtain the following qualifications:

- Should be able to recall basic circuit theory concepts and rules, including resistance, voltage, current, Ohm's law, and Kirchoff's laws (**knowledge**)
- Should be able to describe basic analog (e.g., potentiometers, force sensitive resistors) and digital (e.g., push button, touch interface) sensing technologies (**knowledge**)
- Should be able to express how a micro-controller can be used for measuring/actuating analog and digital inputs/outputs by the use of sensors and output devices (e.g., displays, LEDs, and vibrators) (**understanding**)
- Should be able to recall that some functionalities can be implemented using both hardware and software (**knowledge**), and to discuss the pros and cons of either solution (**understanding**)
- Should be able to identify practical needs in electric circuits such as DC filtering and circuit protection (**understanding**)
- Should be able to describe basic amplification (e.g., OpAmp) and filtering (e.g., RC and RL) circuits (**knowledge**)
- Should be able to explain basic concepts such as sampling and scaling in context of real-time use of signals (**understanding**)

SKILLS

Students who complete the module will obtain the following qualifications:

- Should be able to apply the taught skills and methods on physical interface design to develop a prototype/artifact, and to demonstrate its use (**application**)
- Should be able to formulate a linear system of equations for voltage, current and resistance relationships in an electric circuit, and to solve the system to find unknown currents, voltages, or resistances (**application**)
- Should be able to use an electronic circuit simulator (**application**)
- Should be able to sketch and interpret an electric circuit diagram (**application**)
- Should be able to program a microcontroller to make it read inputs from sensor circuits and produce output(s) to a user (e.g., vibration, light, and text) (**application**)
- Should be able to examine and verify basic electric circuit designs using, e.g., a multimeter, and to test if a build electric circuit has the desired functionalities (**analysis**)
- Should be able to apply basic interface design principles for realizing a physical interface for human-computer interaction in the context of use (**application**)
- Should be able to assess the artifact by applying taught evaluation method(s) (**evaluation**)

COMPETENCES

Students who complete the module will obtain the following qualifications:

- Should be able to summarize the whole design process of the artifact (**synthesis**)

- Should be able to use correct technical and theoretical terms in dissemination (**application**)

TYPE OF INSTRUCTION

Refer to the overview of instruction types listed in § 17. The types of instruction for this course are decided in accordance with the current Joint Programme Regulations and directions are decided and given by the Study Board for Media Technology.

EXAM

PREREQUISITE FOR ENROLLMENT FOR THE EXAM

- Handing in of written assignments or the like
- Completion of certain – or all – study activities

EXAMS

Name of exam	Physical Interface Design
Type of exam	Written or oral exam Note that if admittance to the exam or parts of the assessment is to be based on written work or exercises, a deadline is stipulated for when the work must be handed in.
ECTS	5
Permitted aids	With certain aids: See semester description
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 interfacdesign
Module code	MSNMEDB4174
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Location of the lecture	Campus Aalborg, Campus Copenhagen
Responsible for the module	Claus Brøndgaard Madsen

ORGANISATION

Study Board	Study Board of Media Technology, Study Board of Electronics and IT
Department	Department of Architecture, Design and Media Technology
Faculty	Technical Faculty of IT and Design

AUDIO PROCESSING

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module adds to knowledge obtained in Human Senses and Perception, Programming of Complex Software Systems, and Mathematics for Multimedia Applications

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

Objectives:

The objective of this course is to give the students an introduction to audio processing, including a basic understanding of audio and music signals, how these are generated and what their properties are. The course takes its starting point in the physics of sound and how audio signals are measured using computers by sampling and quantization. The course then covers how to manipulate audio signals using filters and audio effects, like chorus, flanger, phaser, reverb, and equalizer, and how to design and analyse such effects. Moreover, it covers how to synthesise sound and music signals using, for example, physical models. Finally, the course covers how to analyse audio signals using the Fourier transform and auto-correlation.

LEARNING OBJECTIVES

KNOWLEDGE

Students who complete the module will obtain the following qualifications:

- **Apply** knowledge from auditory perception in working with sound
- **Knowledge** of the physics of sound
- **Knowledge** of how to measure physical properties of sound
- **Understand** sampling, aliasing, quantization and signal-to-noise ratio
- **Understand** the time and frequency domains
- **Understand** the properties of audio signals in the time and frequency domains
- **Understand** filters and filtering in the time domain and frequency domain
- **Understand** convolution, impulse responses and transfer functions
- **Understand** correlation
- **Understand** basic sound synthesis techniques
- **Understand** basic filter-based sound effects
- **Understand** aspects of audio processing in real-time and off-line

SKILLS

Students who complete the module will obtain the following qualifications:

- Implement filters for processing digital audio (**application**)
- Quantitatively **analyse** audio signals using correlation and the Fourier transform
- Implement sound effects and sound synthesis techniques (**application**)
- Express and analyse filters as rational functions (**application**)
- Apply complex numbers, finite/infinite sums, and integrals to analyse signals and filters (**application**)

COMPETENCES

Students who complete the module will obtain the following qualifications:

- Students who complete this module will be able to build audio processing systems for interactive multimedia applications (**synthesis**)

TYPE OF INSTRUCTION

Refer to the overview of instruction types listed in § 17. The types of instruction for this course are decided in accordance with the current Joint Programme Regulations and directions are decided and given by the Study Board for Media Technology.

EXAM

PREREQUISITE FOR ENROLLMENT FOR THE EXAM

- Handing in of written assignments or the like
- Completion of certain – or all – study activities

EXAMS

Name of exam	Audio Processing
Type of exam	Written or oral exam Note that if admittance to the exam or parts of the assessment is to be based on written work or exercises, a deadline is stipulated for when the work must be handed in.
ECTS	5
Permitted aids	With certain aids: See semester description
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	Lydbehandling
Module code	MSNMEDB4172
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Location of the lecture	Campus Aalborg, Campus Copenhagen
Responsible for the module	Claus Brøndgaard Madsen

ORGANISATION

Study Board	Study Board of Media Technology
Department	Department of Architecture, Design and Media Technology
Faculty	Technical Faculty of IT and Design

DESIGN AND ANALYSIS OF EXPERIMENTS

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module adds to knowledge obtained in Interaction Design, Mathematics for Multimedia Applications, and Human Senses and Perception.

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

Objectives:

A crucial aspect of designing mediology systems, tools or applications is the need to evaluate the work experimentally. The knowledge of how to properly design experiments to collect and evaluate data is essential to answer many of the problems within mediology. Examples are testing which of two tracking algorithms is the most efficient; how users perform with different kinds of feedback; possible relationship between age and performance, etc.

LEARNING OBJECTIVES

KNOWLEDGE

Students who complete the module will obtain the following qualifications:

- Must be able to **understand** the basic concepts of probability: sample space of all possible events; combinatorics; independent events; conditional probability; Bayes' formula; binomial distribution, etc.
- Must display **knowledge** about basic statistic terminology and treatment of data: distributions (probability density function, cumulative distribution function, quantile function); measures of central tendency and variability; histogram; central limit theorem, significance, power, type I and II errors, etc.
- Must be able to **understand** advantages and disadvantages with different types of designs and studies (between-group and within-group designs; correlational studies; blind/double blind, complete/incomplete and balanced/unbalanced designs)
- Must be able to **understand** the difference between common experimental designs, e.g., single sample experiments, two sample experiments, and factorial/multifactorial experiments
- Must **understand** the basic experimental design principles of independence, randomization, replication, and blocking and how these can be applied in experiments.
- Must be able to relate frequency distributions to the concept of hypothesis testing (**understanding**)
- Must be able to **understand** possible ethical concerns for a study

SKILLS

Students who complete the module will obtain the following qualifications:

- Must be able to design an experiment to measure changes in a dependent variable, identifying and efficiently controlling relevant independent variables (**application**)
- Must be able to properly inform and instruct persons participating in a study (**application**)
- Must be able to **understand** and select among the most common methods for statistical analysis and assessment of experimental data (e.g., t-test, analysis of variance, chi-square tests, binomial test, correlation, and simple linear and logistic regression)
- Must be able to **understand** the difference between parametric and non-parametric analysis methods
- Must be able to **understand** different measurement scales and discuss experiments in terms of reliability, bias and sensitivity
- Must be able to discuss own data in terms of assumptions for statistical testing (**application**)
- Must be able to use an existing statistical package to **analyse** and present experimental results
- Must be able to discuss and represent empirical data in different ways (describing text, numbers, formulas, graphs and figures) and shift between these according to the needs of the situation and context (**application**)
- Must be able to read, understand and implement experimental and empirical work as described in relevant literature (**application**)

COMPETENCES

Students who complete the module will obtain the following qualifications:

- Students who complete this module will be able to systematically design quantitative, scientific experiments, taking into account relevant factors (**application**)
- Students who complete this module will be able to use a statistical software package to analyse experimental data (**application**)
- Students who complete this module will be able to document their experimental results, and to understand experimental results presented by others (**application**)

TYPE OF INSTRUCTION

Refer to the overview of instruction types listed in § 17. The types of instruction for this course are decided in accordance with the current Joint Programme Regulations and directions are decided and given by the Study Board for Media Technology.

EXAM

PREREQUISITE FOR ENROLLMENT FOR THE EXAM

- Handing in of written assignments or the like
- Completion of certain – or all – study activities

EXAMS

Name of exam	Design and Analysis of Experiments
Type of exam	Written or oral exam Note that if admittance to the exam or parts of the assessment is to be based on written work or exercises, a deadline is stipulated for when the work must be handed in.
ECTS	5
Permitted aids	With certain aids: See semester description
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	Design og analyse af eksperimenter
Module code	MSNMEDB4173
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Location of the lecture	Campus Aalborg, Campus Copenhagen
Responsible for the module	Claus Brøndgaard Madsen

ORGANISATION

Study Board	Study Board of Media Technology
Department	Department of Architecture, Design and Media Technology
Faculty	Technical Faculty of IT and Design

ETHNOGRAPHICALLY INFORMED DESIGN

2019/2020

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

Objectives:

In this course, we consider the larger picture and the situated nature of where and how people act and interact with media technologies. We work with theories, methods and material developed in successful design companies such as IDEO and Frog Design, which continue to evolve. The students will work with multiple evaluation methods that they apply in a hands-on approach that they consider as part of their ongoing critical reflection to the design process. The course will give students a better understanding of how chosen approaches, conceptual frameworks and methods produce different kinds of possible analyses for both the development, use and improvement of media technologies.

The students will understand and apply selected user-centered, contextual and situational theories which can include ethnographic, psychological and sociological approaches and methods when analysing the use of media technology. The course will cover some of the large ranges of responses (e.g., interaction, reaction, deliberation, active and passive engagement) users can make when consuming media technologies, and provide students with methodological and analytic tools to analyse these responses in a given context and to implement these tools in their future design work.

LEARNING OBJECTIVES

KNOWLEDGE

Students who complete the module will obtain the following qualifications:

- Must have **knowledge** and **understanding** of empirical and critical research, including systematic quantitative and qualitative research data gathering, analysis and interpretation methods
- Must **understand** and **apply** interpretative paradigms to media development. This includes **evaluation** of those approaches that promote qualitative methodologies, such as ethnography, grounded theory, case studies, discourse analysis, narrative research, diary studies, cultural probes and video interaction analysis, as well as **application** of quantitative methods including, for example, logging of use, physiological capture, or statistical analysis
- Must **understand** that the theories and methodology adopted impact on the nature of evidence gathered in media related research (**evaluation**)
- Must have **knowledge** of psychological, statistical, ethnographic, or sociological approaches to the study of contextual behaviour and their relevance and implications to media development and design (**understand**)
- Must have **knowledge** and **understanding** how a variety of ethnographic methods including contextual data capture are useful for guidelines for testing and evaluation and iterative design (**application**) which can be implemented for user-oriented problems

SKILLS

Students who complete the module will obtain the following qualifications:

- Must have ability to **apply** a range of qualitative methods (e.g., interviewing, contextual inquiry, etc.) to elicit user needs, preferences and capabilities and be able to **analyse** and explain the findings (**understanding**)
- Must have ability to **apply** a range of quantitative methods, which may include logging and analysis, statistical tests, correlation and cluster analysis to assess perception and user behavior (**understanding**).
- **Apply** observational methods to situations as they happen in real time and **evaluate** data in relation to end-user groups
- **Apply, analyse** and **evaluate** social, situated and digital micro and macro acts in interactions
- Design (**apply**) guidelines and **apply** adequate theories and study designs, using advanced qualitative and quantitative methods for collection and analysis of data (**analysis**)
- Design (**apply**) guidelines and **apply** different observational methods, including video observations and exploration of user states (e.g., immersed, engaged, emotional, pleasant).
- Design (**apply**) solutions to design and situated context related problems (**synthesis**)

COMPETENCES

Students who complete the module will obtain the following qualifications:

- Plan, organize and implement a full cycle of design, evaluation and re-design for a real world problem (**evaluation**)
- **Synthesise** and **apply** knowledge and understanding gained in the course regarding the consequence of choosing a specific approach, method, conceptual framework and theory in relation to media technology and a specific research question or problem
- **Understand** advantages, disadvantages, possibilities and limitations regarding the use of specific methods, for example, video card game, video Interaction analysis, discourse analysis, interviewing, questionnaires, storyboards, scenarios, and **know** statistical methods (e.g., tests, clustering, correlation analysis) or various psychological experimental paradigms (e.g., free categorization) (**analysis**)
- Synthesise, **understand** and **apply** in situ observational strategies, for example, shadowing, participation, video-observation for user evaluation and analysis in a context of media technologies (**application**)

TYPE OF INSTRUCTION

Refer to the overview of instruction types listed in § 17. The types of instruction for this course are decided in accordance with the current Joint Programme Regulations and directions are decided and given by the Study Board for Media Technology.

EXAM

PREREQUISITE FOR ENROLLMENT FOR THE EXAM

- Handing in of written assignments or the like
- Completion of certain – or all – study activities

EXAMS

Name of exam	Ethnographically Informed Design
Type of exam	Written or oral exam Note that if admittance to the exam or parts of the assessment is to be based on written work or exercises, a deadline is stipulated for when the work must be handed in.
ECTS	5
Permitted aids	With certain aids: See semester description
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	Etnografisk inspireret design
Module code	MSNMEDB6173
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Location of the lecture	Campus Aalborg, Campus Copenhagen

Responsible for the module	Claus Brøndgaard Madsen
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ORGANISATION

Study Board	Study Board of Media Technology
Department	Department of Architecture, Design and Media Technology
Faculty	Technical Faculty of IT and Design

REAL-TIME INTERFACES AND INTERACTIONS

2019/2020

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

Objectives:

Real-time Interfaces and Interactions is a course module offering the students opportunities to investigate technologies addressing different modalities that are commonly associated with creation of integrated multimodal interactive systems. The course is built upon the previous five semesters to augment foundational knowledge, skills and competences needed to achieve integration of technologies and evaluation methods.

LEARNING OBJECTIVES

KNOWLEDGE

Students who complete the module will obtain the following qualifications:

- **Understanding** of the state-of-the-art in the field of alternative input and output technologies for uni- and multimodal applications (application)
- **Understanding** of visualization techniques such as virtual or augmented reality (application)
- **Understanding** of sound design methods and real-time audio processing techniques such as interactive auralization and sonification (application)
- **Understanding** of the measurement and analysis of physiological data via sensors detecting signals present in the human body for techniques such as affective computing
- **Understanding** of haptic interfaces, theory and implementation of haptic feedback systems using vibrotactile stimulation
- **Understanding** adaptive systems which change behaviour according to user input within a session
- **Understanding** of iterative design processes as used in the design of real-time interfaces and multimodal interactive systems

SKILLS

Students who complete the module will obtain the following qualifications:

- Ability to **synthesise** new interface components of responsive Human-Computer Interaction systems, and log data from users and/or their interactions for data analysis
- Ability to scientifically **analyse** and argue with theoretical and methodological justification to demonstrate understanding of related research/work in the current scientific discourse
- Ability to **apply** real-time sensor inputs in the design of an interactive media product
- Ability to **synthesise** and **apply** contextual understanding and knowledge related to human factors in the design of novel interfaces
- Ability to **apply** theories, techniques and methods for the design and implementation of systems which can adapt to human needs and level of expertise

COMPETENCES

Students who complete the module will obtain the following qualifications:

- Ability to **synthesise** knowledge and understanding regarding previous research and current trends concerning interactive media systems
- Ability to **apply** such knowledge, understanding and skills toward creation of new interfaces and interactive systems that function in real-time (low latency response)

TYPE OF INSTRUCTION

Refer to the overview of instruction types listed in § 17. The types of instruction for this course are decided in accordance with the current Joint Programme Regulations and directions are decided and given by the Study Board for Media Technology.

EXAM

PREREQUISITE FOR ENROLLMENT FOR THE EXAM

- Handing in of written assignments or the like
- Completion of certain – or all – study activities

EXAMS

Name of exam	Real-time Interfaces and Interactions
Type of exam	Written or oral exam Note that if admittance to the exam or parts of the assessment is to be based on written work or exercises, a deadline is stipulated for when the work must be handed in.
ECTS	5
Permitted aids	With certain aids: See semester description
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	Realtids interfaces og interaktioner
Module code	MSNMEDB6174
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Location of the lecture	Campus Aalborg, Campus Copenhagen
Responsible for the module	Claus Brøndgaard Madsen

ORGANISATION

Study Board	Study Board of Media Technology
Department	Department of Architecture, Design and Media Technology
Faculty	Technical Faculty of IT and Design

THEORY AND PRACTICE OF GAME DESIGN AND DEVELOPMENT

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module adds to knowledge obtained in 5th semester

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

Objectives:

This course provides students with the foundational knowledge and practices in the design and development of games such as the social and economic context of gaming and game production, the game industry, formal and dramatic elements of games, system dynamics of games, iterative game design through playtesting, completeness and balance of games, and game technologies. It is a hands-on course in which the students are expected to create actual prototypes, evaluate and iteratively redesign them.

LEARNING OBJECTIVES

KNOWLEDGE

Students who complete the module will obtain the following qualifications:

- Discuss the structure and formal elements of games – in particular players, objectives, procedures, rules, resources, conflict, boundaries and outcome – and dramatic elements of games – in particular challenge, play, premise, character, story, world building, and the dramatic arc (**understanding**)
- Review the context of games, game classifications and players (**understanding**)
- Explain game technologies including controllers, game engines (and their components such as render engines, audio engines, physics engines, etc.), and game development tools (**understanding**)
- Describe the game development pipeline from idea via iterative design and development to product launch (**understanding**)
- Describe the game industry and game entrepreneurship including platforms for distribution, independent developers, development studios, and publishers (**understanding**)

SKILLS

Students who complete the module will obtain the following qualifications:

- **Analyse** and summarize (**application**) system dynamics of existing games
- Create, present, critique and revise original game ideas (**evaluation**)
- Iteratively produce (**application**) and **evaluate** key game features through playtesting of physical and/or digital prototypes
- Judge completeness and balance (**evaluation**) and **evaluate** player experience of games and/or game prototypes with established metrics
- Produce pitch materials including game demos and design documents (**application**)

COMPETENCES

Students who complete the module will obtain the following qualifications:

- **Plan, organize** and **implement** a game (pre)production (**application**)

TYPE OF INSTRUCTION

Refer to the overview of instruction types listed in § 17. The types of instruction for this course are decided in accordance with the current Joint Programme Regulations and directions are decided and given by the Study Board for Media Technology.

EXAM

PREREQUISITE FOR ENROLLMENT FOR THE EXAM

- Handing in of written assignments or the like
- Completion of certain – or all – study activities

EXAMS

Name of exam	Theory and Practice of Game Design and Development
Type of exam	Written or oral exam Note that if admittance to the exam or parts of the assessment is to be based on written work or exercises, a deadline is stipulated for when the work must be handed in.
ECTS	5
Permitted aids	With certain aids: See semester description
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	Teori og praksis af spildesign og -udvikling
Module code	MSNMEDB6175
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Location of the lecture	Campus Aalborg, Campus Copenhagen
Responsible for the module	Claus Brøndgaard Madsen

ORGANISATION

Study Board	Study Board of Media Technology
Department	Department of Architecture, Design and Media Technology
Faculty	Technical Faculty of IT and Design

ARTIFICIAL INTELLIGENCE PROGRAMMING

2019/2020

PREREQUISITE/RECOMMENDED PREREQUISITE FOR PARTICIPATION IN THE MODULE

The module adds to knowledge obtained in Computer Graphics Programming

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

Objectives:

Concepts of artificial intelligence (AI) are central to the design and development of contemporary systems, e.g., database search and management, handheld devices (e.g., smartphones and tablets), games (e.g., chess), various adapting or learning systems, and so on. The objective of this course is to give students exposure to and an understanding of the fundamentals of AI programming, including: rational agents and their environment, knowledge representation, formal languages and logic, reasoning, basic graph theory, pathfinding algorithms, finite state automata, steering behaviors, and decision making. Students will develop practical skills in AI programming useful for the development and deployment of intelligent systems.

LEARNING OBJECTIVES

KNOWLEDGE

Students who complete the module will obtain the following qualifications:

- **Understand** different levels of intelligent agent architectures, environments, and their application domains
- **Understand** basic graph theory
- **Understand** finite state machines, decision trees, and behaviour trees, and their implementation
- **Understand** different search strategies, and their implementation and underlying data-structures
- **Understand** different pathfinding algorithms and their implementation
- **Understand** steering algorithms and their implementation
- **Understand** classical planning approaches
- **Understand** knowledge representation, formal logic, and reasoning
- **Understand** basic fuzzy logic

SKILLS

Students who complete the module will obtain the following qualifications:

- **Apply** the above knowledge to construct an intelligent system using available technologies
- Choose appropriate methods and technologies for a given problem (**analysis**)
- Interpret and **evaluate** AI systems and their behaviour
- Use agent simulation systems for prototyping system behaviour (**apply**)

COMPETENCES

Students who complete the module will obtain the following qualifications:

- Ability to **synthesise** knowledge, methodology or techniques concerning a problem centred around intelligent systems
- Ability to integrate AI-based libraries into larger projects (**apply**)
- Ability to learn the use of AI tools like agent-based simulators, planning systems, network simulators, etc. (**apply**)

TYPE OF INSTRUCTION

Refer to the overview of instruction types listed in § 17. The types of instruction for this course are decided in accordance with the current Joint Programme Regulations and directions are decided and given by the Study Board for Media Technology.

EXAM

PREREQUISITE FOR ENROLLMENT FOR THE EXAM

- Handing in of written assignments or the like
- Completion of certain – or all – study activities

EXAMS

Name of exam	Artificial Intelligence Programming
Type of exam	Written or oral exam Note that if admittance to the exam or parts of the assessment is to be based on written work or exercises, a deadline is stipulated for when the work must be handed in.
ECTS	5
Permitted aids	With certain aids: See semester description
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	Programmering af kunstig intelligens
Module code	MSNMEDB6172
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Location of the lecture	Campus Aalborg, Campus Copenhagen
Responsible for the module	Claus Brøndgaard Madsen

ORGANISATION

Study Board	Study Board of Media Technology
Department	Department of Architecture, Design and Media Technology
Faculty	Technical Faculty of IT and Design

INTERNET OF THINGS

2019/2020

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge of sensor node technology
- Must have knowledge of hardware architectures for wireless sensor networks.
- Must have knowledge of operating systems for wireless sensor networks and their respective design issues
- Must have knowledge of IEEE 802.15 standard and communication technologies associated with it Low Energy Bluetooth, ZigBee, Z-wave, etc.
- Must have an understanding of short range communication standards like – Radio-frequency identification (RFID) and Near Field Communication (NFC)
- Must have detailed knowledge of protocols used in different layers, eg., Medium Access Control (MAC) protocols, routing protocols, transport control protocols
- Must have knowledge of Network management for Wireless Sensor Networks
- Must have knowledge of different security mechanisms used today for maintaining the confidentiality, integrity and authenticity of the data, sensor nodes and the networks

SKILLS

- Must have skills to design sensor networks based on requirements
- Must be able to monitor and manage sensor data
- Must be able to identify vulnerabilities in the system
- Must be able to propose efficient techniques for routing and handling of data

COMPETENCES

- Must be able to successfully combine hardware, embedded software, web services and create systems that are interactive and practical
- Must be able to apply the theories and tools for Internet of Thing (IoT) in specific application areas
- Must have competencies to set some design rules, protocols for IoT architecture

TYPE OF INSTRUCTION

Types of instruction are listed at the start of §17; Structure and contents of the programme.

The types of instruction for this course are decided according to the current Joint Programme Regulations and directions are decided and given by The Study Board of Electronics and IT.

Notice: This elective course might not be offered if less than 10 students sign up.

EXAM

EXAMS

Name of exam	Internet of Things
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
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FACTS ABOUT THE MODULE

Danish title	Internet of Things
Module code	ESNITCOB6K1
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Location of the lecture	Campus Copenhagen
Responsible for the module	Ove Kjeld Andersen

ORGANISATION

Study Board	Study Board of Electronics and IT
Department	Department of Electronic Systems
Faculty	Technical Faculty of IT and Design

TECHNOLOGY AND SOCIETY

2019/2020

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

The purpose of this module is for the students to acquire a basic theoretical understanding and empirical knowledge regarding the social conditions for technology development and the broader societal implications of technology implementation and use specifically with respect to communication and media technologies.

Contents:

This module concerns the relationships between technology and societal developments primarily from a macro perspective. It provides the students with a historic and contemporary overview of technology developments in the information and communication technology area. It, furthermore, provides the students with theoretical approaches to understanding such technology developments.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have knowledge of theories concerning the drivers of technology development, technology innovation and technology paths
- Must have knowledge of theories concerning the relationship between technology, economy and policy developments
- Must have knowledge of theories concerning invention, innovation and diffusion
- Must have knowledge of theories regarding technological paradigms
- Must have knowledge of theories regarding the social construction of technologies and stakeholder analysis
- Must have knowledge of the history of technology development specifically in the field of transport and communication technologies

SKILLS

- Must have skills in identifying the relationships between technology, economic and policy developments regarding specific technology developments
- Must have skills in performing a basic technology assessment analysis
- Must have skills in performing a stakeholder analysis

COMPETENCES

- Must demonstrate competences in identifying different theoretical approaches to the analysis of technology developments in a societal framework
- Must have competences in choosing and combining relevant theoretical frameworks for the analysis of technology developments at a micro and macro level
- Must have competences in differentiating between social conditions for technology developments and implications of technology development

TYPE OF INSTRUCTION

Types of instruction are listed at the start of §17; Structure and contents of the programme.

The types of instruction for this course are decided according to the current Joint Programme Regulations and directions are decided and given by The Study Board of Electronics and IT.

Notice: This elective course might not be offered if less than 10 students sign up.

EXAM

EXAMS

Name of exam	Technology and Society
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	Teknologi og samfund
Module code	ESNITCOB6K2
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Location of the lecture	Campus Copenhagen
Responsible for the module	Ove Kjeld Andersen

ORGANISATION

Study Board	Study Board of Electronics and IT
Department	Department of Electronic Systems
Faculty	Technical Faculty of IT and Design

BUSINESS LAW

2019/2020

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

To give the students an introduction to the Danish/ EU legal instruments and law relevant for the IT, communication and media industry and other businesses, so they can identify and deal with legal issues in a timely manner.

LEARNING OBJECTIVES

KNOWLEDGE

- Must have insight at overview level in selected Danish/ EU laws
- Must have basic knowledge about the legal aspects of setting up a business or a public limited liability company in Denmark
- Must have basic knowledge about the relation between Danish and EU law
- Must have knowledge about commercial law, company law, and the sale of goods act
- Must have knowledge about public procurement law and marketing law
- Must have knowledge about IT contract and regulation of intellectual property rights (IPR)

SKILLS

- Must be able to present basic legal problems related to the laws above
- Must be able to present relevant contractual documents in company including employee contracts and contracts between business partners
- Must be able to understand public procurement procedures

COMPETENCES

- Must be able to identify the relevant legal aspects related to development and market introduction of a given communication, media and information technology and other businesses

TYPE OF INSTRUCTION

Types of instruction are listed at the start of §17; Structure and contents of the programme.

The types of instruction for this course are decided according to the current Joint Programme Regulations and directions are decided and given by The Study Board of Electronics and IT.

Notice: This elective course might not be offered if less than 10 students sign up.

EXAM

EXAMS

Name of exam	Business Law
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	Forretningsjura
Module code	ESNITCOB6K3
Module type	Course
Duration	1 semester
Semester	Spring
ECTS	5
Language of instruction	English
Location of the lecture	Campus Copenhagen
Responsible for the module	Ove Kjeld Andersen

ORGANISATION

Study Board	Study Board of Electronics and IT
Department	Department of Electronic Systems
Faculty	Technical Faculty of IT and Design