CURRICULUM FOR THE MASTER'S PROGRAMME IN DIGITALISATION AND APPLICATION DEVELOPMENT, 2022

MASTER OF SCIENCE (MSC) IN INFORMATION TECHNOLOGY
AALBORG

MODULES INCLUDED IN THE CURRICULUM
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COMPUTATIONAL THINKING

2022/2023

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

As an integrated part of the project work, the student must follow the Problem-Based Learning and project management workshop (1 ECTS)

A course on Computational Thinking is integrated into the project.

LEARNING OBJECTIVES

KNOWLEDGE

• Learn to solve problems through a subset of computational thinking concepts (algorithm design, automation, and abstraction)

• Understand agent-based techniques to computational thinking (formalization and simulation).

• Basic introduction to concepts of computational thinking (decomposition, pattern recognition, and data representation)

SKILLS

• Ability to read, understand, evaluate and potentially modify existing computational structures and data representations

• Ability to formulate and decompose a problem into a series of ordered steps (algorithmic thinking)

• Ability to read, understand, evaluate and potentially modify computational models/agent-based models

• Ability to use abstractions and pattern recognition to represent a problem in new and different ways

COMPETENCES

• Exercise computational-thinking-based problem-orientation by formulating problems in students’ bachelor domains with focus on problems, which can be addressed through computational thinking

• Design computational models to address identified problems using computational thinking techniques

TYPE OF INSTRUCTION

Project work, including:

• Formulation, analysis and contribution to the resolution of a relevant problem within the theme of the project module
EXTENT AND EXPECTED WORKLOAD

It is expected that the student uses 30 hours per ECTS, which for this activity means 300 hours

EXAM

EXAMS

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ADDITIONAL INFORMATION

Contact: The Study board for Computer Science at cs-en@cs.aau.dk or 9940 8854

FACTS ABOUT THE MODULE

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DEVELOPMENT OF SOFTWARE

2022/2023

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

The student must through the project work demonstrate:

- knowledge about foundational programming techniques in working with computational thinking and problem-solving through developing software
- experience with programming, testing, and evaluation of software that solves a well-defined problem

SKILLS

- Programming a software system given requirements and complete the development to a running software system that can be demonstrated
- Argue for choices in the programming including explain in which ways and to what extent the program solves the problem and relate to computational thinking
- Describe, plan and reflect on the project work

COMPETENCES

- Analyse own learning process and the project group’s organization in the group work in order to identify strengths and weaknesses
- Describe and explain the project’s results and work processes in a clear, coherent and precise manner by writing, modelling and speaking

TYPE OF INSTRUCTION

Project work

EXTENT AND EXPECTED WORKLOAD

It is expected that the student uses 30 hours per ECTS, which for this activity means 300 hours
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INFORMATION AND ORGANIZATION

2022/2023

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

The students must gain knowledge of

- different types of information systems and their role in modern organizing
- information systems’ organizational and business value creation
- practical problems with implementing new and improving existing information systems
- current research in information systems

SKILLS

- Can evaluate, analyse, and evaluate the impact of new information systems based on specific organizational and business-oriented conditions, possibilities, and limitations
- Can evaluate and select methods and techniques from research in information systems

COMPETENCES

- Can explain value of an information system in a given organization
- Can justify and evaluate an implementation process of an information system

TYPE OF INSTRUCTION

The type of instruction is organised in accordance with the general instruction methods of the programme, cf. § 17.

EXTENT AND EXPECTED WORKLOAD

It is expected that the student uses 30 hours per ECTS, which for this activity means 150 hours

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INTRODUCTION TO PROGRAMMING

2022/2023

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

• Understanding basics of computational (algorithmic) thinking and how it links to programming

• Understanding data types, structures (e.g., array, struct, list), and functions

• Basic introduction to concepts of access (e.g., public, private, protected) and encapsulation, resource management, memory allocation and security

• Understanding basics of web development

• Understanding the distinction between good and bad programming practices

SKILLS

• Ability to understand, evaluate, modify and create code

• Ability to apply programming fundamentals to a variety of problems

• Ability to plan and perform systematic tests of small programs (applications)

• Basic knowledge of selected programming language(s)

COMPETENCES

• Design, implement and evaluate programming solutions for specific small programming tasks

• Design, implement and evaluate web applications

TYPE OF INSTRUCTION

The type of instruction is organised in accordance with the general instruction methods of the programme, cf. § 17.

EXTENT AND EXPECTED WORKLOAD

It is expected that the student uses 30 hours per ECTS, which for this activity means 150 hours
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DEVELOPMENT OF AN INTERACTIVE DESIGN

2022/2023

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

- analyse and model the requirements within the object-oriented paradigm
- design a software architecture of an interactive design in a multi-layer architecture using current program designs, realize and test the interactive design in an object-oriented paradigm

SKILLS

- understand and use object-oriented concepts and features and on this basis construct an interactive design of high internal and external quality
- implement systematic testing of the interactive design and demonstrate that it corresponds to the intentions and needs of users
- implement systematic evaluation of the user interface
- argue for the choices made in all the development process activities, including explaining requirements, architecture and how users are linked

COMPETENCES

- develop a running interactive design that solves the users’ problem
- describe and reflect on the methods used in the development project

TYPE OF INSTRUCTION

Project work

EXTENT AND EXPECTED WORKLOAD

It is expected that the student uses 30 hours per ECTS, which for this activity means 450 hours

EXAM

PREREQUISITE FOR ENROLLMENT FOR THE EXAM

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

2022/2023

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

The student should gain knowledge of the following theories and methods:

Object-oriented modelling in analysis and design:

• modelling of context (application domain and problem domain)
• object-oriented concepts: class, object, event, structure, function, use patterns, component, component architecture
• UML: class diagram, state chart diagram, sequence diagram, diagram for use patterns

Modelling with patterns:

• patterns for modelling application and problem domains
• patterns for composing components
• specifically the patterns for analysis: object-descriptor, hierarchy, stepwise-role, materials, procedure
• specifically the patterns for design: collection, layered, observer, client-server, model-view-controller

System development methods:

• waterfall method and model-driven development
• iterative method and prototype-driven development
• activities in systems development and relations between activities

Systems practices:

• techniques to determine the specific method
• the relation between methodology and practice
• strengths and weaknesses of model-driven and prototype-driven development

SKILLS

• be able to explain accurately, using the concepts and modelling language of the discipline

• be able to model the requirements to a system, its context and all its various parts (model, features and interfaces)

• be able to model a system design at component level and describe relations between components

COMPETENCES

• able to apply concepts, patterns and modelling language to describe a specific system that solves a well-defined task

TYPE OF INSTRUCTION

The type of instruction is organised in accordance with the general instruction methods of the programme, cf. § 17.
EXTENT AND EXPECTED WORKLOAD

It is expected that the student uses 30 hours per ECTS, which for this activity means 150 hours.

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DESIGN AND EVALUATION OF USER INTERFACES

2022/2023

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

Fundamentals of human-computer interaction:

- interaction design
- usability and user experience
- design principles
- interaction forms
- human cognition, perception and memory

Interaction design process:

- activities in interaction design
- user-centered design
- contextual design, participatory design
- different lifecycle models for interaction design

Use context and users:

- understand needs and requirements: e.g. interview, observation, questionnaire, probes, card sorting
- task analysis: e.g. hierarchical task analysis, objectives, tasks, actions
- scenarios and personas
- use patterns

Design of interfaces:

- visual design principles
- Gestalt laws
- sketching and prototyping
- conceptual and physical interface design

Usability evaluation:

- activities
- roles and tasks
- identification of usability problems

SKILLS

- understand basic and advanced concepts and theories of human-computer interaction

- be able to explain the activities in the design of an interface accurately

- be able to explain the activities of a usability evaluation

COMPETENCES

- be able to apply concepts, techniques and methods to design and evaluate a specific system that solves a well-defined task and discuss relations between concepts, techniques and methods in the subject.
TYPE OF INSTRUCTION

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EXTENT AND EXPECTED WORKLOAD

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FOUNDATIONAL OBJECT-ORIENTED PROGRAMMING

2022/2023

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

The student must gain an understanding of methods within the object-oriented programming paradigm. This covers the following aspects:

- Concepts and conceptualisation
- Classes and objects
- Variables and methods
- Encapsulation and visibility
- Data abstraction
- Method signature, parameters, return value, method body
- Aggregated classes
- Application of central class libraries and collection classes
- Specialisation and inheritance
- Exceptions
- Systematic documentation of public interfaces
- Systematic test of public interfaces

SKILLS

- can implement smaller programs in an object-oriented language utilizing central features
- ability to create an object-oriented program in a bottom-up manner
- can implement simple user interfaces in an object-oriented manner
- explain and argue for elements and relationships in a small object-oriented program
- can perform systematic testing of central parts of an object-oriented program
- can document central parts of an object-oriented program

COMPETENCES

- can implement, document and test an object-oriented program to ensure that it runs and that it is understandable, readable, and accessible for other programmers

TYPE OF INSTRUCTION

A mix of lectures, smaller exercises and a larger assignment. In the larger assignment, the students, alone or in smaller groups, must develop an object-oriented program that will solve a pre-defined and delimited task
EXTENT AND EXPECTED WORKLOAD

It is expected that the student uses 30 hours per ECTS, which for this activity means 150 hours

EXAM

EXAMS

<table>
<thead>
<tr>
<th>Name of exam</th>
<th>Foundational Object-Oriented Programming</th>
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ADDITIONAL INFORMATION

Contact: The Study board for Computer Science at cs-en@cs.aau.dk or 9940 8854

FACTS ABOUT THE MODULE

Danish title: Grundlæggende objektorienteret programmering
Module code: DSNIDAK224
Module type: Course
Duration: 1 semester
Semester: Spring
ECTS: 5
Language of instruction: Danish and English
Empty-place Scheme: Yes
Location of the lecture: Campus Aalborg
Responsible for the module: Lone Leth Thomsen

ORGANISATION

Study Board: Study Board of Computer Science
Department: Department of Computer Science
Faculty: The Technical Faculty of IT and Design
AGILE SOFTWARE ENGINEERING

2022/2023

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

• The student should gain knowledge of leading paradigms (e.g. traditional and agile) in professional development of software

• The student should also gain knowledge of theories, methods and techniques involved in these paradigms (e.g. process modelling, management of requirements, design, project management, testing, process improvement) as well as an overview of theory of science for software engineering

SKILLS

• the ability to explain course concepts precisely using the terminology of the discipline, and be able to distinguish between and compare the software engineering paradigms

• be able to explain accurately and using the terminology of the discipline, the theories, methods and techniques of software engineering paradigms and their application in the professional development of software intensive systems

COMPETENCES

• be able to select, justify and use appropriate paradigms, theories, methods and techniques in their own development contexts.

TYPE OF INSTRUCTION

The type of instruction is organised in accordance with the general instruction methods of the programme, cf. § 17.

EXTENT AND EXPECTED WORKLOAD

It is expected that the student uses 30 hours per ECTS, which for this activity means 150 hours

EXAM

EXAMS

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<thead>
<tr>
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ADDENDUM INFORMATION

Contact: The Study board for Computer Science at cs-sn@cs.aau.dk or 9940 8854

FACTS ABOUT THE MODULE

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DATABASE DEVELOPMENT
2022/2023

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

- the relational data model and its concepts
- data modelling (ERD / UML)
- concept of operations
- integrity constraints including primary keys, promoting keys, checks and not null
- SQL language for defining databases, basic and advanced data extraction and modification of data
- extracting information from a DBMS from a programming language such as PHP, Java or C#
- "best practice" for good design and use of DBMS and SQL
- Understand and use the advanced queries using more than two tables, e.g., for inner join, outer join, and the set operators

SKILLS

- be able to construct and evaluate a database design and database scheme
- demonstrate understanding of the relational data model and how to evaluate the model
- construct and evaluate complex queries in SQL and other relevant query languages
- constructing transactions that comply with relevant technical and commercial criteria
- Informally argue for the goodness/quality of the database design using knowledge on unnecessary repetition of information plus first and third normal form

COMPETENCES

- use a database management system (DBMS) to store and retrieve information
- use SQL from a conventional programming language

TYPE OF INSTRUCTION

The type of instruction is organised in accordance with the general instruction methods of the programme, cf. § 17.

EXTENT AND EXPECTED WORKLOAD

It is expected that the student uses 30 hours per ECTS, which for this activity means 150 hours

EXAM

EXAMS

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ADDITIONAL INFORMATION

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ENTREPRENEURSHIP

2022/2023

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

The student should achieve knowledge about entrepreneurship and business development related to software (information and communication technologies) including typically:

• different scientific approaches to entrepreneurship, including effectuation
• intra-/entrepreneurship
• competition and market conditions
• business models and business plans
• intellectual property rights
• market development and marketing
• growth strategies
• open entrepreneurship

SKILLS

• the ability to explain course concepts precisely using the professional terminology of the discipline
• the ability to use those concepts to explain practical and empirical (case based) contexts

COMPETENCES

• should be able to formulate, develop and present their own software-related business ideas to a qualified audience.

TYPE OF INSTRUCTION

The type of instruction is organised in accordance with the general instruction methods of the programme, cf. § 17.

EXTENT AND EXPECTED WORKLOAD

It is expected that the student uses 30 hours per ECTS, which for this activity means 150 hours

EXAM

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ADDITIONAL INFORMATION

Contact: The Study board for Computer Science at cs-sn@cs.aau.dk or 9940 8854

FACTS ABOUT THE MODULE

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MASTER’S THESIS

2022/2023

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

• Must have knowledge about the use of concepts, processes and theories of software application design and development

• Knowledge about development of human-centered computing and how it relates to application development

SKILLS

• Must be able to identify, formulate and analyse a development of human-centered computing problem in context

• Must be able to relate the problem definition to empirical research processes in the development of human-centered computing and argue for the relevance of the problem in a wider context

• Must be able to identify, explain and argue for the relevance and rigour of the chosen empirical research processes to address the defined problem

• Must be able to report on the findings of the empirical research processes and explain the contributions to research and practice

• Must be able to perform a literature review relevant to the defined problem

COMPETENCES

• Must document experience with empirical research processes to address knowledge creation in development of human-centered computing

• Must have experience with research processes and research setting

TYPE OF INSTRUCTION

Project work

• The project is supported by an integrated utilization of digital learning materials in research methods and reading key research literature in a study group

EXTENT AND EXPECTED WORKLOAD

It is expected that the student uses 27,5 hours per ECTS, which for this activity means 825 hours
## EXAM

### EXAMS

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## ADDITIONAL INFORMATION

Contact: The Study board for Computer Science at cs-en@cs.aau.dk or 9940 8854

## FACTS ABOUT THE MODULE

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DEVELOPMENT OF INTERACTIVE SYSTEMS

2022/2023

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

• Formulate a specific problem in an organization (private or public) and how different interactive systems can contribute to solving the formulated problem

• Systematic design and evaluation of value creation through interactive systems

• Practical challenges in organizational implementation of interactive systems

SKILLS

• The student can evaluate, analyse, and value the impact of as well as develop new solutions starting with the organizational challenges

• Can evaluate and select methods and techniques to empirically investigate IT applications and software in organisations

COMPETENCES

• Can plan and manage the implementation of interactive systems in an organizational context

• Can justify and evaluate a specific implementation process in an organisation

TYPE OF INSTRUCTION

The type of instruction is organised in accordance with the general instruction methods of the programme, cf. § 17.

EXTENT AND EXPECTED WORKLOAD

It is expected that the student uses 30 hours per ECTS, which for this activity means 450 hours

EXAM

EXAMS

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### 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

### ADDITIONAL INFORMATION
Contact: The Study board for Computer Science at cs-sn@cs.aau.dk or 9940 8854

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THEORETICAL INVESTIGATION OF INTERACTIVE SYSTEMS

2022/2023

CONTENT, PROGRESS AND PEDAGOGY OF THE MODULE

LEARNING OBJECTIVES

KNOWLEDGE

The student should gain knowledge of:

• Formulate a theoretical problem within IT development and how different investigations can contribute to solving the formulated problem
• Systematic investigation of value creation through interactive systems
• Challenges in organizational implementation of interactive systems

SKILLS

• The student can evaluate, analyse, and value the impact of new solutions
• Can evaluate and select methods and techniques to empirically investigate IT applications and software in organisations

COMPETENCES

• Can plan and manage the implementation of interactive systems in an organizational context
• Can justify and evaluate an implementation process in an organisation

TYPE OF INSTRUCTION

The type of instruction is organised in accordance with the general instruction methods of the programme, cf. § 17.

EXTENT AND EXPECTED WORKLOAD

It is expected that the student uses 30 hours per ECTS, which for this activity means 450 hours

EXAM

EXAMS

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ADDITIONAL INFORMATION

Contact: The Study board for Computer Science at cs-sn@cs.aau.dk or 9940 8854

FACTS ABOUT THE MODULE

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