Curriculum for the Master’s programme in Innovative Communication Technologies and Entrepreneurship (ICTE)

Aalborg University

October 2015
Preface

Pursuant to Act 960 of August 14, 2014 on Universities (the University Act) with subsequent changes, the following curriculum for the Master’s program in Innovative Communication Technologies and Entrepreneurship is stipulated. The program also follows the Framework Provisions and the Examination Policies and Procedures for the Faculties of Engineering, Science and Medicine.

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Chapter 1: Legal Basis of the Curriculum, etc.

1.1 Basis in ministerial orders
The Master's programme in Innovative Communication Technologies and Entrepreneurship is organised in accordance with the Ministry of Science, Innovation and Higher Education's Order no. 1520 of December 16, 2013 on Bachelor's and Master's Programs at Universities (the Ministerial Order of the Study Programs) and Ministerial Order no. 670 of June 19, 2014 on University Examinations (the Examination Order) with subsequent changes. Further reference is made to Ministerial Order no. 1488 of December 16, 2013 (the Admission Order) and Ministerial Order no. 250 of March 15, 2007 (the Grading Scale Order) with subsequent changes.

1.2 Faculty affiliation
The Master's programme falls under the Faculty of Engineering and Science, Aalborg University (AAU).

1.3 Board of Studies affiliation
The Master's programme falls under the Board of Studies for Electronics and Information Technology.

Chapter 2: Admission, Degree Designation, Programme Duration and Competence Profile

2.1 Admission
Admission to the Master's programme in IT, Communication and Entrepreneurship requires a Bachelor's degree in

- IT, Communication and New Media (AAU)
- Elektronik og IT (AAU)
- Internetteknologier og computersystemer (AAU)
- Software teknologi (DTU) (BSc or BEng)
- Netværksteknologi og IT (DTU) (BSc)
- IT-Elektronik (DTU) (BEng)
- IT og økonomi (DTU) (BEng)

All students must document English language qualifications comparable to an 'English B level' in the Danish upper secondary school (minimum average grade 02).

Students with another Bachelor's degree, upon application to the Board of Studies, will be admitted after a specific academic assessment, if the applicant is deemed to have comparable educational prerequisites. The University can stipulate requirements concerning conducting additional exams prior to the start of study.
2.2 Degree designation in Danish and English
The Master’s programme entitles the graduate to one of the designations depending on the specialisation:

- Civilingeniør, cand. polyt. (candidatus/candidata polytechnices) i innovativ kommunikationsteknik og entrepreneurskab med specialisering i serviceudvikling

The English designation is:

- Master of Science (MSc) in Engineering (Innovative Communication Technologies and Entrepreneurship) with specialisation in Service Development

or

- Civilingeniør, cand. polyt. (candidatus/candidata polytechnices) i innovativ kommunikationsteknik og entrepreneurskab med specialisering i forretningsudvikling

The English designation is:

- Master of Science (MSc) in Engineering (Innovative Communication Technologies and Entrepreneurship) with specialisation in Business Development

2.3 The programme’s specification in ECTS credits
The Master’s programme is a 2-year, research-based, full-time study programme. The programme is set to 120 ECTS credits.

2.4 Competence profile on the diploma
The following competence profile will appear on the diploma:

A Candidatus graduate has the following competency profile:
A Candidatus graduate has competencies that have been acquired via a course of study that has taken place in a research environment.

A Candidatus graduate is qualified for employment on the labour market on the basis of his or her academic discipline as well as for further research (PhD programmes). A Candidatus graduate has, compared to a Bachelor developed his or her academic knowledge and independence so as to be able to apply scientific theory and method on an independent basis within both an academic and a professional context.
2.5 Competence profile of the programme

The programme includes two specialisations (tracks):

- Service development (SD)
- Business development (BD)

Depending on the chosen specialisation, the graduate of the Master’s programme¹:

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>SD</th>
<th>BD</th>
</tr>
</thead>
<tbody>
<tr>
<td>has knowledge on information and communication technologies (ICT) that, in selected areas, is based on the highest international research</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>understands the relevance of the needs of the end users, their use of ICT, and the mechanisms that influence the user experience and the acceptance of new technologies</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>understands the importance of innovation, creativity and entrepreneurship for ICT solutions and services</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>understands and can reflect, on a scientific basis, on the technical, organizational and market-related drivers in the convergence of ICT, as well as the interplay between technology, market and user issues</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>has a holistic understanding of the environment of ICT services and solutions: Scenarios of use, target users, stakeholders, business aspects, and societal implications at large</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>has in-depth knowledge of service enablers, personalization and the use of context information for enrichment of services</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>has in-depth knowledge and understanding of principles and technologies related to privacy, trust, and identity and access management</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>has in-depth knowledge of content and media management, metadata and recommender systems</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>has knowledge on state-of-the-art network technologies, Internet technologies and service architectures, e.g. Internet of Things, cloud architectures, heterogeneous networks, RESTful² architectures, and Application Programming Interfaces (APIs)</td>
<td>x</td>
<td>(x)</td>
</tr>
<tr>
<td>has knowledge on ICT standards and standardization processes, and their significance from a commercialization and market perspective</td>
<td>(x)</td>
<td>x</td>
</tr>
<tr>
<td>has in-depth knowledge and understanding of ICT-related business models and cases</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>has in-depth knowledge on economic concepts and tools relevant for preparing a market analysis</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Skills</th>
<th>SD</th>
<th>BD</th>
</tr>
</thead>
<tbody>
<tr>
<td>can identify scientific problems within the field of ICT</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>can evaluate and select among scientific theories, methods and tools, and – on a scientific basis – advance new analyses and solutions within applied ICT</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>can efficiently communicate research-based knowledge and discuss professional and scientific problems with both peers and non-specialists</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>can produce scientific writing: Articles, reports, documentation, etc.</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>can apply scientific methods, tools and general skills related to employment within the field of ICT</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

¹ “(x)” indicates a less extensive, partial coverage of the learning objective, as compared to "x".

² REST: REpresentational State Transfer, refers to a widely used programming model for the web.
<table>
<thead>
<tr>
<th>Competencies</th>
<th>x</th>
<th>x</th>
</tr>
</thead>
<tbody>
<tr>
<td>can identify and select among relevant standards, technologies and methods for development of ICT solutions and services</td>
<td></td>
<td></td>
</tr>
<tr>
<td>can assess the market, ethical and regulatory framework for application of the technologies</td>
<td>(x)</td>
<td>x</td>
</tr>
<tr>
<td>can develop innovative services, applications and solutions at a conceptual level, which are relevant in a user perspective</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>can develop prototypes or demonstrators of viable ICT solutions and services,</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>• based on an in-depth analysis of user requirements, technology and market issues,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• using state-of-the-art methods, technologies and tools, and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• addressing privacy protection and identity management</td>
<td></td>
<td></td>
</tr>
<tr>
<td>can develop advanced ICT solutions including one or more of the elements: Handling of digital content rights; acquisition and processing of sensor information (e.g. bios-signals); handling of large amounts of data to extract relevant information; recommender systems; advanced programming tools; resource management; and privacy protection</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>can assess the implications and business potential of new ICT solutions and services and develop viable business models and strategies</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>can prepare a business plan with a detailed financial analysis for introducing an ICT solution or service</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>can assess the role of existing and emerging ICT solutions and services in relation to sustainable development and evaluate the feasibility of sustainable technologies and solutions</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>can manage work and development situations that are complex, unpredictable and require new solutions</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>can independently initiate and implement discipline-specific and interdisciplinary cooperation and assume professional responsibility</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>can independently take responsibility for own professional development and specialisation</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>has competencies in project work and problem based learning in a global/multicultural environment</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>can mediate collaboration and information exchange between development- and business-related functions in organizations.</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>has an in-depth understanding of ICT technologies, enabling creative and innovative solutions and development of these</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>has competencies in innovation and entrepreneurship that can be used to transform the potentials of new ICT and media technologies into new solutions and services with an engineering approach</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>can contribute creatively and innovatively to propose and develop new ICT services/solutions respecting and challenging established legal rules and design principles.</td>
<td>x</td>
<td>(x)</td>
</tr>
<tr>
<td>has competencies in business development with a holistic perspective, based on a thorough understanding of the interplay between technology, market and users in ICT and media</td>
<td>(x)</td>
<td>x</td>
</tr>
<tr>
<td>has competencies in innovation and entrepreneurship that can be used to formulate strategies exploiting the potentials of new ICT and media technologies with an engineering approach</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>

5
Chapter 3: Content and Organisation of the Programme

The programme is structured in modules and organized as a problem-based study. A module is a programme element or a group of programme elements, which aims to give students a set of professional skills within a fixed time frame specified in ECTS credits, and concluding with one or more examinations within specific exam periods. Examinations are defined in the curriculum.

The programme is based on a combination of academic, problem-oriented and interdisciplinary approaches and organized based on the following work and evaluation methods that combine skills and reflection:

- lectures
- classroom instruction
- project work
- workshops
- exercises (individually and in groups)
- teacher feedback
- reflection
- portfolio work

Problem-based learning and scientific methods

In order to ensure a common basis for all students, the first semester project includes a mandatory part on project-organized problem-based learning (POPBL) and scientific methods.

IMPORTANT: The sub-module “POPBL and scientific methods” is a mandatory part of the semester project for all students on their 1st semester. Students MUST complete and pass a partial exam in this sub-module before taking the final exam in the semester project. In total, the semester project accounts for 15 ECTS.

Overview of the programme

The programme includes two specialisations:

- Service development
- Business development

The first semester is common. During this semester students must choose one of the two specialisations, and depending on the specialisation different sets of courses are mandatory and elective on 2nd and 3rd semester. This gives students the freedom to compose their studies, even though they are obliged to choose one of the specialisations. Semester projects and themes will also depend on the chosen specialisation.

All modules are assessed through individual grading according to the 7-point scale or Pass/Fail. All modules are assessed by external examination (external grading) or internal examination (internal grading or by assessment by the supervisor only).

Elective courses may generally be chosen from the programme or from other related MSc programmes within the School of ICT, after consultation with the programme coordinator and approval from the Board of Studies.

The curriculum contains the following number of elective courses:

- 1st semester: No elective courses
- 2nd semester: 1 course, 5 ECTS
- 3rd semester: 2 courses, 10 ECTS
The semester structure with an overview of the ECTS credit breakdown for the various semesters by modules is shown in Table 1. The first semester on “Services and platforms” consists of mandatory courses only, while the following semesters give room for elective courses as shown.

<table>
<thead>
<tr>
<th>Semester</th>
<th>Module</th>
<th>Service development</th>
<th>Business development</th>
<th>ECTS</th>
<th>Assessment</th>
<th>Exam</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>Communication and Broadcast Networks</td>
<td>Mandatory</td>
<td></td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Entrepreneurship, Innovation and Business Models</td>
<td>Mandatory</td>
<td></td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Internet Technologies and Service Architectures</td>
<td>Mandatory</td>
<td></td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Services and Platforms</td>
<td>Mandatory</td>
<td></td>
<td>15</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td>Development of ICT and Media Services</td>
<td>Mandatory</td>
<td>Elective</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Identity and Access Management</td>
<td>Mandatory</td>
<td>Elective</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Green ICT – Sustainable Business Development</td>
<td>Elective</td>
<td>Mandatory</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Managerial Economics</td>
<td>Elective</td>
<td>Mandatory</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Interaction Design</td>
<td>Elective</td>
<td>Elective</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Application Development</td>
<td>Mandatory</td>
<td></td>
<td>15</td>
<td>7-point scale</td>
<td>External</td>
</tr>
<tr>
<td></td>
<td>Design and Markets</td>
<td>Mandatory</td>
<td></td>
<td>15</td>
<td>7-point scale</td>
<td>External</td>
</tr>
<tr>
<td>3&lt;sup&gt;rd&lt;/sup&gt;</td>
<td>Content and Media Management</td>
<td>Mandatory</td>
<td>Elective</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Internet Economics and Governance</td>
<td>Elective</td>
<td>Mandatory&lt;sup&gt;3&lt;/sup&gt;</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Standardization</td>
<td>Elective</td>
<td>Mandatory&lt;sup&gt;3&lt;/sup&gt;</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Cyber Security and Trust</td>
<td>Elective</td>
<td>Elective</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Smart Sensor Data Processing</td>
<td>Elective</td>
<td>Elective</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Advanced ICT Solutions</td>
<td>Mandatory</td>
<td></td>
<td>15</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Governance and Strategies</td>
<td>Mandatory</td>
<td></td>
<td>15</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td>4&lt;sup&gt;th&lt;/sup&gt;</td>
<td>Master's Thesis</td>
<td>Mandatory</td>
<td>Mandatory</td>
<td>30-55</td>
<td>7-point scale</td>
<td>External</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td>120</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1. Complete semester structure.

Depending on student demand and staff availability, not all specialisations or elective courses may be offered in a given semester.

<sup>3</sup> Students on the business development track MUST choose at least one of these 2 courses.
Students may choose between different options for the 3rd and 4th semester:

<table>
<thead>
<tr>
<th></th>
<th>3rd semester</th>
<th>4th semester</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Option 1</strong></td>
<td>A regular semester with 3 courses and a 15 ECTS semester project</td>
<td>30 ECTS thesis project</td>
</tr>
<tr>
<td><strong>Option 2</strong></td>
<td>Academic internship in Denmark or abroad (25 ECTS) + 1 mandatory course (5 ECTS).</td>
<td>30 ECTS thesis project</td>
</tr>
<tr>
<td><strong>Option 3</strong></td>
<td>Study abroad (30 ECTS). In this case the 5 ECTS mandatory course may be waived.</td>
<td>30 ECTS thesis project</td>
</tr>
<tr>
<td><strong>Option 4</strong></td>
<td>The following combinations are possible:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Thesis project (55 ECTS) + 1 mandatory course (5 ECTS) on the 3rd semester</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Thesis project (50 ECTS) + 1 mandatory course (5 ECTS) + 1 elective course (5 ECTS) on the 3rd semester</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Thesis project (45 ECTS) + 1 mandatory course (5 ECTS) + 2 elective courses (2 x 5 ECTS) on the 3rd semester</td>
<td></td>
</tr>
<tr>
<td><strong>Option 5</strong></td>
<td>Entrepreneurship thesis project (55 ECTS) + 1 mandatory course (5 ECTS) on the 3rd semester.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The entrepreneurship thesis project must include service as well as business development. This type of project requires that 2 students, either on the same track or on each their track, form a group to carry out the thesis project.</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Options for 3rd and 4th semester of the programme.

Different sizes of thesis projects share the same learning objectives, but if the number of ECTS exceeds the default size (30 ECTS), the increased workload must be clearly reflected in the report, e.g. in terms of the complexity, the scientific level, the experimental work and documentation details.

For long thesis projects the student must supplement the thesis learning objectives according to the additional credits. The modified description must be approved by the programme coordinator and the Board of Studies.

If 2 students choose to do a long thesis project according to Option 5, the project must include BOTH the development of a functional prototype/demo of a service or solution AND the business analysis needed to mature the service/solution and start a company to launch it on the market.

Other options are possible, e.g. choosing elective courses from other programmes or universities and other sizes of the thesis project, but these must also be approved by the programme coordinator and the Board of Studies.
Module: POPBL and Scientific Methods (POPBL og videnskabelige metoder)

IMPORTANT: This module is a mandatory part of the semester project for all students on their 1st semester!

Prerequisites: None

Objectives:
Students who complete the module:

Knowledge
- Must have knowledge about Problem Based Learning
- Must have knowledge about conflict handling
- Must be able to understand the challenges of inter-cultural group work
- Must be able to plan group work using project planning tools (such as Gantt chart)
- Must have knowledge about the concept of process analysis
- Must have knowledge about different learning styles
- Must have knowledge about scientific methods and the applicability in engineering educations
- Must have knowledge about science theory in relation to hypothesis, theories, inductivism vs. deductivism, models vs. reality
- Must understand the difference between qualitative and quantitative methods
- Must understand the principles for citing other people’s work properly and understand the consequences of plagiarism

Skills
- Must be able to apply the principles of Problem Based Learning in practice
- Must be able to apply a Gantt chart to the first semester project
- Must be able to prepare a process analysis and use it for evaluation of the group work
- Must be able to discuss the concept of scientific methods
- Must be able to cite other people’s work properly
- Must be able to structure a project report
- Must be able to apply different scientific methods for a particular problem

Competencies
- Must have competencies in group work and project-organized learning
- Must have competencies in communication in a group
- Must have competencies in use of scientific methods
- Must have competencies in setting up a report as a scientific document

Type of instruction:
Types of instruction are listed at the start of Chapter 3.
An integral part of the semester project on the 1st semester.

Exam format:
Individual oral or written examination.

All students on their 1st semester MUST complete and pass the sub-module in “POPBL and scientific methods” as a partial exam before the final exam in the semester project.

| **Semester project:** | Services and Platforms  
(Services og platforme) |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prerequisites:</strong></td>
<td>All students on their 1st semester MUST pass the partial exam in “POPBL and scientific methods” before the final exam in the semester project.</td>
</tr>
<tr>
<td><strong>Objectives:</strong></td>
<td>Students who complete the module:</td>
</tr>
</tbody>
</table>
| **Knowledge**        | Must have a holistic understanding of the ICT environment, i.e. the heterogeneous networks, Internet technologies and business models, on which ICT solutions and services rely  
Must have knowledge about the key Internet technologies and standards for content networking: representation, identification and transport  
Must have knowledge about the characteristics of different networks and the technologies that are important to provide a good user experience for a service  
Must be able to understand the service architectures, platforms and business models that are needed to provide future services and applications |
| **Skills**           | Must be able to specify requirements for innovative applications, services, solutions or service architectures based on a thorough analysis of the ICT environment and the needs of the target users  
Must be able to assess the network characteristics and limitations, which affect the delivery of content and services to the end users  
Must be able to discuss the technical and business-related aspects of services and service architectures  
Must be able to conceptually construct relevant business models |
| **Competencies**     | Must have the competency to assess the viability and potential of new ICT-related technologies, frameworks and concepts  
Must have the competency to identify new business opportunities in relation to ICT services and service architectures |
| **Type of instruction:** | Project work. |
| **Exam format:**     | Oral examination based on a written report. |
| **Evaluation criteria:** | Are stated in the Framework Provisions. |
Course module: Communication and Broadcast Networks (Kommunikations- og broadcast-net)

Prerequisites: None

Objectives: Students who complete the module:

Knowledge
- Must have knowledge about digital broadcast networks (radio and TV):
  - Cable, satellite and terrestrial
- Must have knowledge about wired (broadband) networks:
  - xDSL, cable TV- and fibre-based infrastructures
- Must have knowledge about mobile and wireless networks:
  - 3G, 4G and beyond 4G
- Must have knowledge about development of networks leading to ‘future networks’ and ‘future Internet’
  - Including SDN, ICN, CDN
- Must be able to understand spectrum limitations and spectral efficiency
- Must have knowledge about advanced modulation and multiplexing techniques
- Must have knowledge about channel capacity, channel coding and compression techniques
- Must be able to understand converged infrastructures:
  - Combinations of distributive and communicative network platforms
- Must be able to understand the structural and service-oriented parameters that influence the development

Skills
- Must be able to explain the technical parameters, which drive the development of future networks
- Must be able to evaluate to what extent the future mobile and fixed networks complement or substitute each other
- Must be able to evaluate the strengths and weaknesses in the use of traditional mobile networks, wireless or broadcast networks for mobile TV/radio transmission.

Competencies
- Must have the competency to identify and discuss the key technologies and standards for broadband and broadcast networks and the properties of networks that are essential for supporting services
- Must have the competency to analyse and assess the potential and limitations of existing and future broadband and broadcast networks, technologies and services and help develop new solutions and initiatives

Type of instruction: Types of instruction are listed at the start of Chapter 3.

Exam format: Individual oral or written examination.

Course module:
Entrepreneurship, Innovation and Business Models
(Entrepreneurskab, innovation og forretningsmodeller)

Prerequisites: None

Objectives:
Students who complete the module:

Knowledge
- Must have knowledge on theories regarding business development based on communication, media and information technologies, including network economics, information economics, transaction costs analysis, and business ecosystems
- Must be able to understand theories on innovation and entrepreneurship

Skills
- Must be able to apply theories and methodological tools on specific company and technology cases
- Must be able to evaluate the application of business models in different business areas

Competencies
- Must have the competencies to discuss the links between different design elements of business models: customer value, organization, technology and financial issues
- Must have acquired the knowledge and skills to explain the key linkages between the different theories of the course, and use these critically in an analysis of market trends and business models
- Must have acquired the ability to combine knowledge on technological solutions with business development and business potential
- Must master theories and methodological tools to analyse and suggest appropriate and innovative business models for companies, which are offering communication, media and information services and products and using these solutions in their business operations

Type of instruction: Types of instruction are listed at the start of Chapter 3.

Exam format: Individual oral or written examination.

Course module:  
Internet Technologies and Service Architectures  
(Internet-teknologier og tjenestearkitekturer)

Prerequisites: None

Objectives:  
Students who complete the module:

Knowledge
- Must have knowledge about the structure of the Internet and its design principles
- Must have knowledge about the key Internet technologies for content networking: representation, identification and transport
- Must have knowledge of mark-up languages and AJAX technologies, e.g. XML, JSON, HTML5, and JavaScript
- Must have knowledge about programming models and interfaces for Internet services, in particular REST, SOAP and Web Services
- Must have knowledge about the main protocols for messaging and streaming media, including session initiation and management
- Must be able to explain the concepts of “service”, “service enablers” and “service architectures”
- Must be able to understand the principles of Web 2.0 and their implications for services
- Must have knowledge of different methods for "enrichment" of services: User involvement, personalization, use of context information, extracting value from large amounts of data, etc.
- Must have knowledge of the main standardization bodies and the process of developing specifications and standards for Internet technologies
- Must have knowledge of common service architectures, e.g. Service Delivery Platforms, Service-Oriented Architecture (SOA), and cloud architectures

Skills
- Must be able to analyse and discuss the relation between user needs and different types of services
- Must be able to analyse the requirements that a given service imposes on servers, networks and terminals and their relation to the user experience provided by the service
- Must be able to design ICT services with distributed content, including controlled exposure of resources and access to these, and making use of state-of-the-art Internet technologies
- Must be able to design services for real-time messaging and streaming media
- Must be able to analyse and discuss the characteristics of different service architectures

Competencies
- Must have the competency to assess the potential and applicability of state-of-the-art Internet technologies, programming models and architectures in order to realize a given functionality

Type of instruction: Types of instruction are listed at the start of Chapter 3.

Exam format: Individual oral or written examination.

Semester project: Application Development (Applikationsudvikling)
Specialisation in Service Development

Prerequisites:
Degree students must have completed the first semester project. Other students must have acquired similar knowledge, skills and competences otherwise.

Objectives:
Students who complete the module:

Knowledge
- Must have knowledge about appropriate methods for analysis, design, development and test of applications or services based on current or future ICT platforms
- Must understand how to develop application/services providing a good user experience
- Must have knowledge of the capabilities and functionalities of relevant software and hardware tools for application development

Skills
- Must have knowledge about mobile platforms, devices, and peripherals (sensors, tags, etc.) and their connectivity
- Must be able to make a well-founded requirement specification for an ICT service or solution, taking into account the target users, stakeholders, business aspects, state-of-the-art technologies and technical constraints
- Must be able to design a full-scale service and realize a more limited prototype of proof-of-concept in the project
- Must be able to reflect on the application development process and the final outcome
- Must be able to develop and test applications and services that can be deployed on ICT and media platforms and infrastructures
- Must be able to develop services with mobile and interactive media and context awareness
- Must be able to develop services including security and handling of personal data

Competencies
- Must have the competency to identify user needs and system requirements in a wide variety of contexts
- Must have the competency to turn them into innovative applications and services building on state-of-the-art within the field of ICT

Type of instruction: Project work.
Exam format: Oral examination based on a written report.
**Semester project:** Design and Markets (Design og markeder)
Specialisation in Business Development

**Prerequisites:**
Degree students must have completed the first semester project. Other students must have acquired similar knowledge, skills and competences otherwise.

**Objectives:**
Students who complete the module:

### Knowledge
- Must be able to understand technology as socio-technical systems where the context of use is pivotal for the value of communication, media and information (CMI) technologies
- Must have knowledge on new organizational forms, new business concepts and changes in the market conditions together with new methods for involving users in the design of communication, media and information technology solutions

### Skills
- Must be able to identify and apply relevant theories for the synthesis and evaluation of the studied situation
- Must be able to apply knowledge of green ICT and managerial economics as presented in the mandatory semester courses
- Must be able to identify situations of CMI technology related implications for the market
- Must be able to analyse the conditions and implications of use of communication, media and information technologies for individual users, groups, organizations and society by drawing on technical, organizational and techno-economic perspectives

### Competencies
- Must have the competencies to distinguish between design and market implications at individual, group, organizational or societal level
- Must have the competencies to perform and analysis of the conditions and implications of communication, media and information technologies in a specific market context
- Must have the competencies to combine theories from different technology, organizational and socio-technical areas to create a multi-faceted understanding of the “problem”
- Must have the competencies to focus on a particular situation of use or a new phenomenon related to new CMI technologies; it could be the conditions and implications related to an organization engaging in outsourcing, or it could be the conditions and needs for new standards

**Type of instruction:** Project work.

**Exam format:** Oral examination based on a written report.

**Evaluation criteria:** Are stated in the Framework Provisions.
**Prerequisites:** Knowledge on object-oriented programming.

**Objectives:**
Students who complete the module:

**Knowledge**
- Must be able to understand architectural issues such as the division of functions between terminal, server and networks.
- Must have knowledge about low-level service enablers in relation to Internet of Things, sensors, and smart actuators.
- Must have knowledge about development platforms and environments, such as Software Development Kits (SDK), simulators, emulators, and Integrated Development Environment (IDE).
- Must have knowledge of web development tools, e.g. MEAN (MongoDB, Express.js, Angular.js and Node.js), RESTful programming models and JSP (Java Server Pages)/servlets.
- Must have knowledge about basic artificial intelligence and pattern recognition algorithms and principles.
- Must have knowledge about platform programming and scripting, e.g. tablets, Raspberry Pi, Arduino, or Smart TV.
- Must understand interface and communication concepts in relation to external servers, databases, and cloud-based services.

**Skills**
- Must be able to design and implement platform services/applications using high-level programming languages and development platforms.
- Must be able to perform platform programming and scripting (Raspberry Pi, Arduino, IoS, Smart TV, etc.).
- Must be able to use sensors and actuators to implement Internet of Things-related systems and devices.
- Must be able to use simple artificial intelligence algorithms in platform services and applications.
- Must be able to apply programming interfaces to communicate with and use external servers, databases, and cloud-based services.
- Must be able to design, develop and evaluate platform software components.
- Must be able to produce technical documentation.

**Competencies**
- Must have the competency to design and develop viable ICT and media services that can address a wide range of user needs and provide a good user experience.
- Must have the competency to compose more advanced service functionality using state-of-the-art software tools, Internet of Things, cloud architectures, sensors and simple artificial intelligence algorithms.

**Type of instruction:** Types of instruction are listed at the start of Chapter 3.

**Exam format:** Individual oral or written examination.

**Evaluation criteria:** Are stated in the Framework Provisions.
## Course module:
**Identity and Access Management**
(Identitets- og adgangshåndtering)

## Prerequisites:
The course on "Internet technologies and service architectures" or similar qualifications. Knowledge on basic security principles is desirable.

## Objectives:
Students who complete the module:

**Knowledge**
- Must be able to explain the concepts of security, privacy and trust
- Must be able to explain the concepts of attributes, claims, assertion and claims-based identities
- Must have knowledge about the principles and methods for access control, authentication, authorization and identification
- Must be able to explain the key concepts and principles of identity management
- Must have knowledge of key management, certificates, tokens and credentials
- Must have knowledge about state-of-the-art principles and guidelines for protecting users’ privacy
- Must have knowledge of state-of-the-art technologies and frameworks for fine-grained management of personal attributes
- Must be able to understand the concepts of linkability and unlinkability and state-of-the-art principles for establishing trust
- Must have knowledge about security architectures, including policies and policy management
- Must have knowledge of national identity management frameworks such as NemID

**Skills**
- Must be able to discuss the differences between physical identities and online digital, virtual and partial identities
- Must be able to identify the personal attributes that are needed to perform a given task
- Must be able to apply methods for privacy protection, encryption, access control, authentication and authorization as a part of service development, including privacy by design principles
- Must be able to apply state-of-the-art technologies for realizing advanced services with privacy protection, e.g. OAuth and OpenID Connect
- Must be able to analyse and design information flow and architectures for secure ICT services and solutions
- Must be able to design applications and services incorporating security elements (e.g. payment, authentication), different assurance levels, and management of user identities (authentication, authorization, privacy protection)

**Competencies**
- Must have the competency to design secure services and security architectures with controlled exchange of attributes between stakeholders and minimal disclosure of personal information
- Must be able to discuss and reflect on management of personal information for access to resources and for personalization of services

## Type of instruction:
Types of instruction are listed at the start of Chapter 3.

## Exam format:
Individual oral or written examination.

## Evaluation criteria:
Are stated in the Framework Provisions.
| Course module: | Interaction Design  
(Interaktionsdesign) |
<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>Prerequisites:</strong></td>
<td>Basic understanding of human-computer interaction.</td>
</tr>
<tr>
<td><strong>Objectives:</strong></td>
<td>Students who complete the module:</td>
</tr>
</tbody>
</table>
| **Knowledge** | Must understand the concepts of human computer interaction, interaction design and user experience and the relation between them  
Must have knowledge of different input and output modes for interactive systems, also in a historical perspective  
Must have knowledge of different methods for designing interaction of ICT systems  
Must have knowledge of different strategies for planning the interaction design of ICT systems |
| **Skills** | Must be able to apply the concepts of usability and user experience both to screen-based and non-screen-based interactive systems  
Must master different design methods and techniques for creating and testing interactive systems, including non-screen-based systems  
Must be able to identify tensions between different visions for — and interests in — the design of an interactive system  
Must be able to discuss user cognitive models and other descriptions of users  
Must be able to analyse different types of data from and about users  
Must be able to design the interaction of a given system based on data from and about users  
Must be able to reflect critically on methodological challenges in data from and about users as a source for design  
Must be able to evaluate interactive systems using techniques from interaction design and Human Computer Interaction |
| **Competencies** | Must have the competency to reflect on the implications of using different methods and techniques for interaction design, including user involvement, and for evaluating systems  
Must have the competency to analyse the social context in which the use of ICT takes place  
Must have the competency to discuss concepts of privacy, user sovereignty and personalization in relation to design dilemmas involved the design of interactive systems  
Must have the competency to position the field of interaction design in the professional context of ICT development |
| **Type of instruction:** | Types of instruction are listed at the start of Chapter 3. |
| **Exam format:** | Individual oral or written examination. |
| **Evaluation criteria:** | Are stated in the Framework Provisions. |
**Course module:**
**Green ICT – Sustainable Business Development**  
(Grøn IKT – Bæredygtig forretningsudvikling)

**Prerequisites:**
The course on "Entrepreneurship, Innovation and Business Models" or similar qualifications.

**Objectives:**
Students who complete the module:

**Knowledge**
- Must be able to understand the concept of sustainability
- Must be able to define the concept of “Green ICT” and be able to identify existing, new and emerging hardware, software and communication technologies for energy saving
- Must have knowledge about various levels of ICT effects on the environment
- Must have knowledge and understanding of "linked life cycles concept"
- Must have knowledge about the role of ICT in energy consumption and energy efficiency
- Must have knowledge about methods for assessing the potential environmental impacts of ICT products and services

**Skills**
- Must be able to recognize the possible application area in which the deployment of ICT is expected to lead to better energy efficiency and to estimate their relative importance
- Must be able to apply the green ICT strategies
- Must be able to evaluate the rebound and induction effect within the ICT field
- Must be able to determine which ICT products/services are relevant for inducing energy efficiency in other economic sectors
- Must be able to judge the usefulness of the used different scientific methods for analysis of the ICT related energy efficient systems

**Competencies**
- Must have the competency to apply and integrate sustainability in an interdisciplinary way, considering user, technology and market aspects.
- Must have the competency to independently define and analyse scientific problems within the area of Green ICT

**Type of instruction:**
Types of instruction are listed at the start of Chapter 3.

**Exam format:**
Individual oral or written examination.

**Evaluation criteria:**
Are stated in the Framework Provisions.
<table>
<thead>
<tr>
<th>Course module:</th>
<th>Managerial Economics (Erhvervsøkonomi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisites:</td>
<td>None</td>
</tr>
<tr>
<td>Objectives:</td>
<td>Students who complete the module:</td>
</tr>
<tr>
<td></td>
<td><strong>Knowledge</strong></td>
</tr>
<tr>
<td></td>
<td>- Must have knowledge about the basic elements in a business plan</td>
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<td></td>
<td>- Must be able to understand different cost concepts and different methods for investment analysis</td>
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<tr>
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<td>- Must be able to understand how a pricing strategy can be prepared</td>
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<td></td>
<td>- Must have knowledge about the specific cost elements in an ICT project</td>
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<td></td>
<td>- Must have knowledge about the cost elements in a communication network</td>
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<tr>
<td></td>
<td><strong>Skills</strong></td>
</tr>
<tr>
<td></td>
<td>- Must be able to apply a life-cycle cost analysis of a specific ICT project</td>
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<td></td>
<td>- Must be able to explain and apply different cost estimation methods for hardware and software</td>
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<td></td>
<td>- Must be able to evaluate cost and benefits of an ICT service in a specific context</td>
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<tr>
<td></td>
<td>- Must be able to apply economic analysis as a tool for investment decisions and preparation of a business plan</td>
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<tr>
<td></td>
<td><strong>Competencies</strong></td>
</tr>
<tr>
<td></td>
<td>- Must have competencies in preparing a business plan including a detailed financial analysis of a project</td>
</tr>
</tbody>
</table>

| Type of instruction: | Types of instruction are listed at the start of Chapter 3. |
| Exam format:        | Individual oral or written examination. |
Semester project: Advanced ICT Solutions (Avancerede IKT-løsninger)  
Specialisation in Service Development

Prerequisites:  
Degree students must have completed their first two semester projects. Other students must have acquired similar knowledge, skills and competences otherwise.

Objectives:  
Students who complete the module:

Knowledge
- Must have knowledge about design and development of advanced ICT solutions, including knowledge about how the institutional and market-related circumstances interact with technology development, to take it into account in the design process
- Must have knowledge of algorithms for data processing and semantic analysis
- Must have knowledge about how ICT applications and solutions can be deployed in order to address specific needs and improve efficiency in different application areas

Skills
- Must be able to design and develop an ICT service or solution, including one or more of the following elements:
  o Handling of converged media content and digital rights management (DRM)
  o Acquisition and processing of sensor information, e.g. bio-signals
  o Handling of large amounts of data to extract relevant information, e.g. latent semantic analysis, machine learning techniques, or cluster analysis
  o Recommender systems
  o Advanced programming tools, e.g. graph databases, Ruby on Rails, or Hadoop
  o Complex usage scenarios including access control, resource management and privacy protection
- Must be able to develop advanced ICT services and solutions targeting a specific application domain and considering scalability, state-of-the-art technologies and the use of different devices, networks and platforms.
- Must be able to identify, select and apply suitable programming languages and software development strategies and justify their choices
- Must be able to undertake a thorough analysis of the chosen solution with respect to technology choices, strategic decisions, innovation and entrepreneurship

Competencies
- Must have the competency to clearly identify relevant problems within different application areas, which can be solved by the use of ICT technologies and methods
- Must have the competency to develop innovative and viable services/solutions based on solid engineering knowledge and skills and involving both technical, commercial and user aspects

Type of instruction: Project work.

Exam format: Oral examination based on a written report.

**Semester project:**  
**Governance and Strategies**  
*(Regulering og strategier)*  
Specialisation in Business Development

**Prerequisites:**  
Degree students must have completed their first two semester projects. Other students must have acquired similar knowledge, skills and competences otherwise.

**Objectives:**  
Students who complete the module:

**Knowledge**
- Must have knowledge about the importance of the social and business environment in which technologies are used
- Must be able to understand the role of standardization processes for innovation and in market developments

**Skills**
- Must be able to apply theories, methodologies and empirical knowledge for analysing market developments and governance
- Must be able to apply knowledge on technology, business and regulatory developments for analysing and developing appropriate business models and business strategies
- Must be able to analyse industry sectors and markets using and producing communication, media and information technologies
- Must be able to assess the main regulatory issues in relation to ICT infrastructures, services, and content

**Competencies**
- Must have competencies in applying an interdisciplinary approach using theories, methodologies and empirical knowledge for analysing specific issues with relation to communication, media and information technologies
- Must have the competency to analyse the interaction between technologies, institutions, organisations and markets in a system perspective

**Type of instruction:**  
Project work.

**Exam format:**  
Oral examination based on a written report.

**Evaluation criteria:**  
Are stated in the Framework Provisions.
**Course module:**
*Content and Media Management*  
*(Indholds- og medieorganisation)*

**Prerequisites:**
The courses on “Internet technologies and service architectures” and “Development of ICT and media services” or similar qualifications.

**Objectives:**
Students who complete the module:

**Knowledge**
- Must have knowledge of the key standards of media formats and representation of digital content
- Must have knowledge of standards for metadata and annotation
- Must have knowledge of methods for dealing with Digital Rights Management (DRM)
- Must have knowledge of methods for indexing and handling of unstructured content, e.g. user generated content, in combination with structured media content
- Must be able to understand how to manage and optimize content adaptation and delivery to meet the limitations of various types of networks and terminals and dynamic context

**Skills**
- Must be able to discuss strategies for organising and searching in large quantities of digital content
- Must be able to prepare and integrate multimedia content in a service, including associated metadata
- Must be able to analyse the role and interests of content producers, aggregators and providers in the value chain or value network of a service
- Must be able to analyse problems and solutions for the distribution of digital media content and select appropriate strategies for media distribution

**Competencies**
- Must have the competency to analyse and evaluate systems and solutions for content and media management
- Must have the competency to advice content providers and non-technical persons on content and media management systems
- Must have the competency to analyse technical aspects of content and media management in a larger political-social-economical context

**Type of instruction:**
Types of instruction are listed at the start of Chapter 3.

**Exam format:**
Individual oral or written examination.

**Evaluation criteria:**
Are stated in the Framework Provisions.
Course module: Internet Economics and Governance (Internet-økonomi og regulering)

Prerequisites: None

Objectives:
The student shall have knowledge about the economics of electronic communication infrastructures and how they are governed.

Students who complete the module:

Knowledge
- Must have knowledge about the techno-economics of Internet infrastructures
- Must be able to demonstrate insight into governance structures of the Internet
- Must have knowledge about convergence and its impact on regulation and governance
- Must have knowledge about regulation of competition, user access, and scarce resources
- Must have knowledge about Internet organisations and the standardization process for Internet technologies
- Must have knowledge about unbundling and vertical separation of Internet infrastructures
- Must have knowledge about consumer issues in relation to provision of Internet infrastructures
- Must be able to understand the importance and implications of different governance models for the Internet

Skills
- Must be able to analyse the economic and technological conditions which influence governance and market structure of electronic communication infrastructures
- Must be able to apply economic theory for analysis of market conditions for provision of Internet services
- Must be able to analyse drivers and barriers towards investments in electronic infrastructures
- Must be able to discuss and evaluate Internet policies at the national and international level

Competencies
- Must be able to demonstrate development of his/her knowledge, understanding, and ability to make use of socio-economic methods within the fields of Internet economics and governance

Type of instruction: Types of instruction are listed at the start of Chapter 3.

Exam format: Individual oral or written examination.

<table>
<thead>
<tr>
<th>Course module:</th>
<th>Standardization (Standardiseren)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisites:</td>
<td>The course on “Entrepreneurship, Innovation and Business Models” or similar qualifications.</td>
</tr>
<tr>
<td>Objectives:</td>
<td>Students who complete the module:</td>
</tr>
</tbody>
</table>
| Knowledge     | • Must have knowledge on different types of standards, including open and closed standards and de facto and de jure standards  
                • Must be able to understand the importance and role of standards, standardization strategies, and standardization processes  
                • Must have knowledge on standardization organizations in the area of communication, media and information technologies  
                • Must have knowledge on the relationships between innovation and standardization |
| Skills        | • Must be able to apply theories on network economics, information economics, and transaction costs analysis on standardization issues  
                • Must be able to analyse and evaluate the importance and role of standards, particularly within the area of communication, media and information technologies  
                • Must be able to appraise the role of standards in relation to processes of transaction between market players |
| Competencies  | • Must have competency to interpret the interests which underlie the development of standards  
                • Must have competency to outline the role of standards in business development for companies in the communication, media and information technology area as well as companies using these technologies  
                • Must have competency to compare standardization strategies |
| Type of instruction: | Types of instruction are listed at the start of Chapter 3. |
| Exam format:   | Individual oral or written examination. |
### Course module:
**Cyber Security and Trust**  
*(Cyber-sikkerhed og tillid)*

### Prerequisites:
Basic understanding of network security.

### Objectives:
Students who complete the module:

#### Knowledge
- Must have knowledge of standards addressing top cyber security challenges
- Must have knowledge of effective measures that cyber security programs should take
- Must have knowledge of trusted and open architectures
- Must have an understanding of device security trends and threats associated with “Bring your own device” (BYOD)
- Must have knowledge of (mobile) device management and integrity factors for trusted and untrusted devices
- Must have knowledge of strong user and machine authentication based on valuable assets
- Must have knowledge of hardware-based encryption (“Security on chip”) for higher performance
- Must have a knowledge of technologies already embedded in enterprise endpoints
- Must have knowledge of cyber attacks
- Must have knowledge of behavioural profiling and intrusion prevention tools for layer defences
- Must have knowledge of security services and policies within public and private cloud networks

#### Skills
- Must be able to identify requirements and create policies to establish a consistent architecture
- Must be able to monitor, detect and respond to anomalies in the cyber-space
- Must be able to analyse the integrity of the platform to ensure that no unauthorized use has occurred.
- Must be able to design and implement different levels of trust in open architectures.

#### Competencies
- Must have the competency to design cyber security measures for enterprises
- Must have the competency to discuss end-to-end standards to enable seamless security in an open ecosystem.
- Must have the competency to discuss the business potential and implications of trusted ecosystems

### Type of instruction:
Types of instruction are listed at the start of Chapter 3.

### Exam format:
Individual oral or written examination.

### Evaluation criteria:
Are stated in the Framework Provisions.
**Course module:**
**Smart Sensor Data Processing**  
*(Databehandling for smart sensors)*

**Prerequisites:**
Basic knowledge of linear algebra and statistics.  
Course on “Development of ICT and media services” or similar qualifications.

**Objectives:**
Students who complete the module:

**Knowledge**
- Must have knowledge about high level smart sensors (e.g. cameras, 3D sensors, EEG sensors)
- Must have knowledge about advanced artificial intelligence and pattern recognition algorithms (e.g. kernel methods, neural networks)
- Must have knowledge about artificial intelligence in the context of data mining
- Must have knowledge about hardware processing platforms (e.g. Arduino, Raspberry Pi) for sensor integration
- Must have a clear understanding of the smart sensor processing technology

**Skills**
- Must be able to use and integrate various high level smart sensors to acquire data
- Must be able to apply machine learning and pattern recognition techniques on acquired sensor data
- Must be able to design and develop smart sensor systems using hardware (e.g. Arduino, Raspberry Pi) for real-time data processing

**Competencies**
- Must have the competency to compare and choose the most relevant high-level smart sensors for a given application
- Must have the competency to assess the use of various artificial intelligence and pattern recognition techniques for a given application
- Must have the competency to compare and assess the use of various hardware platforms for data processing and sensor integration

**Type of instruction:**
Types of instruction are listed at the start of Chapter 3.

**Exam format:**
Individual oral or written examination.

**Evaluation criteria:**
Are stated in the Framework Provisions.
Semester project:
*Master’s Thesis (Kandidatspeciale)*

<table>
<thead>
<tr>
<th>Prerequisites:</th>
<th>3rd semester project must be completed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objectives:</td>
<td>Students who complete the module:</td>
</tr>
</tbody>
</table>
| Knowledge      | - Must have knowledge on state-of-the-art and prospective technology solutions within the ICT field, allowing for technology and service development, and understanding of the contexts in which technologies and services are conceived and developed, including user requirements, market circumstances, and policy and regulation.  
- Must have well-founded knowledge of relevant theories and methodologies at specific level as well as at synthesis level, forming the basis for the analysis and development of technology and service solutions that relate to application areas and social and business challenges. |
| Skills         | - Must be able to apply the mentioned knowledge and methods to analyse, design, develop and propose innovative applications, services and solutions within specific application areas of ICT, that  
  o are technologically well-founded,  
  o meet end-user requirements, and  
  o are validated from a market and business perspective  
- Must be able to analyse the potential and the implications of new technologies for the end users and stakeholders and contribute to ICT strategies and decision-making.  
- Must be able to analyse relevant methods to solve the problem, describe and assess the application of the chosen methods and discuss how the chosen methods influence the project results |
| Competencies   | - Must have competencies in innovation and entrepreneurship within the field of ICT  
- Must have the competency to identify and delimit relevant problems within ICT with an engineering approach and apply relevant theories, methods and experimental data  
- Must have the competency to contribute to the creative use of technologies to resolve user needs and improve organizational processes |
| If the project is carried out as a long thesis project, the learning objectives include those defined for the 3rd semester of the specialisation. |
| If the number of ECTS exceeds the default size (30 ECTS), the increased workload must be clearly reflected in the report, e.g. in terms of the amount of analysis, the scientific level, the obtained results, and the number of pages. |

**Type of instruction:**
The project is carried out individually or in a small group of maximum three members. At least one internal supervisor is assigned, who works with the primary subject within his/her research. Moreover, additional supervisors e.g. from industry can be involved in the project.

**Exam format:**
Oral examination based on a written thesis.

**Evaluation criteria:**
Are stated in the Framework Provisions.
Chapter 4: Entry into Force, Interim Provisions and Revision

The curriculum is approved by the Dean of the Faculty of Engineering and Science and enters into force as of September 2016.

Students who wish to complete their studies under the previous curriculum from ICTE (from February 2015) must conclude their education by the summer examination period 2017 at the latest, since examinations under the previous curriculum are not offered after this time.

In accordance with the Framework Provisions for the Faculty of Engineering and Science and The Faculty of Medicine at Aalborg University, the curriculum must be revised no later than 5 years after its entry into force.

Chapter 5: Other Provisions

5.1 Rules concerning written work, including the Master’s thesis
In the assessment of all written work, regardless of the language it is written in, weight is also given to the student’s spelling and formulation ability, in addition to the academic content. Orthographic and grammatical correctness as well as stylistic proficiency are taken as a basis for the evaluation of language performance. Language performance must always be included as an independent dimension of the total evaluation. However, no examination can be assessed as ‘Pass’ on the basis of good language performance alone; similarly, an examination normally cannot be assessed as ‘Fail’ on the basis of poor language performance alone. The Board of Studies can grant exemption from this in special cases (e.g., dyslexia or a native language other than Danish).

The Master’s thesis must include an English summary. If the project is written in English, the summary must be in Danish. The summary must be at least 1 page and not more than 2 pages. The summary is included in the evaluation of the project as a whole.

5.2 Rules concerning credit transfer (merit), including the possibility for choice of modules that are part of another programme at a university in Denmark or abroad
In the individual case, the Board of Studies can approve successfully completed (passed) program elements from other Master’s programs in lieu of program elements in this program (credit transfer). The Board of Studies can also approve successfully completed (passed) program elements from another Danish program or a program outside of Denmark at the same level in lieu of program elements within this curriculum. Decisions on credit transfer are made by the Board of Studies based on an academic assessment. See the Framework Provisions for the rules on credit transfer.

5.3 Rules for examinations
The rules for examinations are stated in the Examination Policies and Procedures published by the Faculties of Engineering, Science and Medicine on their website.

5.4 Exemption
In exceptional circumstances, the Board of Studies study can grant exemption from those parts of the curriculum that are not stipulated by law or ministerial order. Exemption regarding an examination applies to the immediate examination.

5.5 Additional information
The current version of the curriculum is published on the Board of Studies’ website, including more detailed information about the program, including exams.

4 Or another foreign language (upon approval from the Board of Studies.
5 The Board of Studies can grant exemption from this.
5.6 Completion of the Master's programme
The Master's program must be completed no later than four years after it was begun.

5.7 Rules and requirements concerning the reading of texts in foreign languages and a statement of the foreign language knowledge this assumes
It is assumed that the student can read academic texts in modern English and use reference works, etc., in other European languages.