Curriculum for
Master of Information and
Communication Technologies

Aalborg University
September 2013
Foreword
Pursuant to Act 652 of June 24, 2012 on Universities (the University Act) including the later changes the following curriculum is laid down. The programme also follows the Framework Provisions and the connected Examination Policies and Procedures.

The master programme in Information and Communication Technologies (MICT) is a continuing education programme under the Study Board of Electronics and Information Technology at Aalborg University.

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Chapter 1: The curriculum’s legal basis, etc.

1.1 Ministerial order’s legal basis
The Master programme in Information and Communication Technologies (MICT) has been drawn up in accordance with the Ministry of Science, Technology and Innovation’s order no. 1188 from December 7 2009 (deltidsbekendtgørelsen), the order no. 1187 from December 7 2009 regarding master programmes the order no. 666 from June 24 2012 regarding exams and grading of university educations (Eksamensbekendtgørelsen) including the later changes. Furthermore, reference is made to the order no. 250 from March 15 2007 (Karakterbekendtgørelsen) including later changes. Former title for the education was Master in Mobile Internet Communications (MMIC).

As indicated in the order the education is a one-year’s master programme at Master of Science level, which is provided under the Open Education.

1.2 Relevant Faculty
The master programme belongs under The Faculty of Engineering and Science at Aalborg University.

1.3 Relevant Study boards
The master programme, 1st – 3rd trimester, belongs under the study board for Electronics and IT.

Chapter 2: Admission, title, duration and competence profile

2.1 Admission
Admission to the master programme in ICT (MICT) presupposes a relevant higher education at least at bachelor level and at least 2 years of relevant professional experience pursuant to the completion of a qualifying exam.

Relevant bachelor educations are:

- Bachelor of science (BSc) or Bachelor of Engineering (“diplomingeniør”) degree within the fields of IT, Communication or electronics,
- Bachelor degree within the area of Computer Science or Software Technologies,

or other relevant education within technical IT.

Aalborg University can provide access to the study for candidates who do not meet the academic conditions of access, but who are considered to have the necessary prerequisites to accomplish this. The requirement of relevant professional experience cannot be exempted.

2.2 The programme title in Danish, Latin and English
The master programme entitles students to the title:

- Master i informations- og kommunikationsteknologier /
- Master in Information and Communication Technologies.

2.3 The prescribed number of ECTS
The education is a one-year full-time study (60 ECTS) Offered both as a one year full time study and as a two years part time study
The study form consists of courses as well as project work, individually and in groups.

2.4 The diploma competence profile
The following competence profile will be evident from the diploma:

A graduate of the Master’s programme has competencies acquired through the course of an educational programme based in the integration of research results and practical experience.

The graduate of the Master’s programme can through scientifically grounded personal and professional competencies perform highly qualified functions in the labor market.

2.5 A description of the professional profile and competence profile of the programme:

The person obtaining a degree at this level:

Knowledge

- has knowledge on information and communication technologies (ICT) that is based on the highest level of international research
- has in-depth knowledge and understanding of issues within the areas: service development; ICT infrastructures; markets and business models;
- can understand and, on a scientific basis, reflect on the technical, organizational and market drivers in the convergence of ICT as well as the interplay between technology, market and user issues
- can reflect on the knowledge, theory, methodologies and practice within the field of ICT, and identify scientific issues
- understands the importance of innovation, creativity and entrepreneurship for ICT solutions and services
- 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
- has a holistic understanding of the environment of ICT services and solutions: Scenarios of use, target users, stakeholders, business aspects, etc.

Skills

- excels in scientific methods, tools and general skills within the field of communication technologies and markets,
- can evaluate and select among relevant scientific theories, methods, tools and general skills and, on a scientific basis, advance new analyses and solutions within the subject areas
- can communicate research-based knowledge and discuss professional and scientific problems with both peers and non-specialists
- excels in scientific writing: Articles, reports, documentation, etc.
- can identify and select among relevant standards, technologies and methods for development of ICT solutions and services
- can assess and compare different technologies for optimal technology selection, strategic decisions and business development
- can assess the market, ethical and regulatory framework for application of the technologies.
- can develop innovative services, applications and solutions at a conceptual level, which are relevant in a user perspective.
- can develop prototypes or demonstrators of viable ICT solutions and services, based on in-depth analysis of user requirements, technology and market issues and using state-of-the-art methods, technologies and tools
• can assess the implications and business potential of new ICT solutions and services and develop viable business models

**Competencies**

• has competencies in business development in a holistic perspective, based on a thorough understanding of the interplay between technology, market and users in ICT and media

• can contribute creatively and innovatively to identify and propose new business opportunities and develop services/solutions, which can empower the users and assist them in solving their current and future tasks on a daily basis

• has competencies in project work and problem based learning in a global/multicultural environment

• can manage work and development situations that are complex, unpredictable and require new solutions

• can independently initiate and implement discipline-specific and interdisciplinary cooperation and assume professional responsibility

• can independently take responsibility for own professional development and specialization

• can mediate collaboration and exchange between development- and business-related functions in organizations.
Chapter 3: Content 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

Furthermore, in this programme advanced teaching and learning tools, including E-learning and video conferencing tools will be used intensively.

Overview of the programme:
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).

An overview of the curriculum is depicted in Table 1. The education is provided in 3 trimesters, where a trimester in the full time (one year) version of the education is equivalent to 4 months and in the part time (two years) version is equivalent to 8 months.

Through the education 3 main academic areas are covered:

- Networks and services
- Design and users
- Market and regulation

In addition, a 'general academic area' is defined, which includes courses of general / methodical nature.

These are depicted in the Table 1 at horizontal level.

Each trimester has a topic, which is depicted in Table 1 at vertical level. In the 3rd trimester the final project of 14 ECTS is carried out.

The project work in the 1st and 2nd trimester will be evaluated orally based on a written report. Each group member will be given an individual mark according to the 7-point scale.

The project work in the 3rd trimester of the education constitutes the final project work and has a workload of 14 ECTS points. The final thesis will be carried out either individually or in groups. If the final project is done in groups the preferable size for a group is 2 and the maximum size is 3. Each student will be given an individual mark according to the 7-point scale.
Individual examinations will take place in all courses. The examinations will be either oral or written exams. The evaluation form is indicated in the course descriptions.

The 60 ECTS include:

- 26 ECTS Courses
- 34 ECTS Projects

24 ECTS will be evaluated with external examiner. This includes the project in the first trimester and the project in the last trimester.

8 ECTS will be evaluated by pass/fail.

All courses and the project in the second trimester will be evaluated by an internal examiner.

<table>
<thead>
<tr>
<th></th>
<th>1st trimester</th>
<th>ECTS</th>
<th>Total</th>
<th>2nd trimester</th>
<th>ECTS</th>
<th>Total</th>
<th>3rd trimester</th>
<th>ECTS</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
<td>PBL and research methods</td>
<td>2</td>
<td>2</td>
<td>Requirement specification</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>Networks and services</strong></td>
<td>Communication and broadcast networks</td>
<td>3</td>
<td>6</td>
<td>Application security and identity management</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Internet technologies and service architectures</td>
<td>3</td>
<td>3</td>
<td>Development of ICT and media services</td>
<td>2</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Development of ICT and media services</td>
<td>2</td>
<td>2</td>
<td>Interaction design</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Interaction design</td>
<td>2</td>
<td>2</td>
<td>Creativity and ICT design</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Market and regulation</strong></td>
<td>Market and business models</td>
<td>2</td>
<td>2</td>
<td>ICT Managerial Economics</td>
<td>2</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>ICT Managerial Economics</td>
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<td></td>
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<td></td>
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<tr>
<td></td>
<td>Standardization Markets and regulation</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td>Markets and regulation</td>
<td>2</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Total courses (ECTS)</td>
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<td>6</td>
<td>10</td>
<td>10</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Project (ECTS)</td>
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<td>10</td>
<td>14</td>
<td>10</td>
<td>10</td>
<td>14</td>
<td></td>
<td></td>
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<tr>
<td>Total</td>
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<td>20</td>
<td>20</td>
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</tr>
</tbody>
</table>

Table 1: Overview of the MICT curriculum.
More details about the modules are depicted in Table 2.

<table>
<thead>
<tr>
<th>Trimester</th>
<th>Module</th>
<th>ECTS</th>
<th>Assessment</th>
<th>Exam</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>PBL and Research Methods</td>
<td>2</td>
<td>Pass/Fail</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Communication and Broadcast Networks</td>
<td>3</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Internet Technologies and Service Architectures</td>
<td>3</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Market and Business Models</td>
<td>2</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Services and Platforms</td>
<td>10</td>
<td>7-point scale</td>
<td>External</td>
</tr>
<tr>
<td>2ndt</td>
<td>Requirement Specification</td>
<td>2</td>
<td>Pass/Fail</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Application Security and Identity Management</td>
<td>2</td>
<td>Pass/Fail</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Development of ICT and Media Services</td>
<td>2</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Interaction Design</td>
<td>2</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Creativity and ICT Design</td>
<td>2</td>
<td>Pass/Fail</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Application Development</td>
<td>10</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td>3rd</td>
<td>ICT Managerial Economics</td>
<td>2</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Standardization</td>
<td>2</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Markets and Regulation</td>
<td>2</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Master’s Thesis</td>
<td>14</td>
<td>7-point scale</td>
<td>External</td>
</tr>
</tbody>
</table>

Table 2: Overview of the course modules.
### 3.1 1\textsuperscript{st} trimester

#### 3.1.1 Project Unit 1\textsuperscript{st} trimester

<table>
<thead>
<tr>
<th>Trimester project:</th>
<th>Services and Platforms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Services og platforme)</td>
</tr>
</tbody>
</table>

| Prerequisites:     | None                   |

| Objectives:        | Students who complete the module: |

**Knowledge**
- Must have knowledge about the key technologies and standards for networks and systems
- 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 discuss the technical and business-related aspects of service architectures
- Must be able to carry out a detailed analysis of a service, an application or a technical design and develop a well-founded requirement specification for the service
- Must be able to conceptually construct relevant business models
- Must be able to assess networks characteristics and limitations
- Must be able to identify relevant service enablers and the specific requirements imposed by the service(s)

**Competencies**
- Must have competencies within at least one of the following areas:
  - be able to transform an identified user need into a conceptual design of a realistic ICT service
  - be able to analyse the viability and potential of different technologies, applications and services in order to make well-founded choices of technologies and strategies
- Must be able to take advantage of combining networks and technologies in innovative ways for development of services and solutions

<table>
<thead>
<tr>
<th>Type of instruction:</th>
<th>Project work.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exam format:</td>
<td>Individual oral examination based on a written report.</td>
</tr>
</tbody>
</table>
3.1.2 Courses at 1st trimester

**Title:**
PBL and Research Methods  
(PBL og forskningsmetoder)

**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, amongst others
- 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:**
Lectures, exercises (individually and in groups), reflection, feedback, self-study.

**Assessment:**
Individual oral or written examination.

**Assessment criteria:**
Are mentioned in the Framework Provisions
### Course module:
**Communication and Broadcast Networks**
(Kommunikations- og broadcast-net)

### Prerequisites:
None

### Objectives:
Students who complete the module:

**Knowledge**
- Must be able to understand spectrum limitations and spectral efficiency
- Must have knowledge about broadband networks:
  - Wired, wireless and mobile
- Must have knowledge about short-range technologies:
  - Bluetooth, RFID, Near Field Communication
- Must have knowledge about digital broadcast networks (radio and TV):
  - Cable, satellite and terrestrial, Mobile TV
- 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 mobile and wireless 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 mobile networks, technologies and services and help develop new solutions and initiatives

### Type of instruction:
Traditional lectures and exercises.

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

### Evaluation criteria:
Are stated in the Framework Provisions.
Course module:  
**Internet technologies and Service Architectures**  
(Internet-teknologier og tjenestearkitekturen)

**Prerequisites:**  
None

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

**Knowledge**
- Must have knowledge about the structure of the Internet and Internet design principles
- Must have knowledge about the key Internet technologies for representation, identification and transport of digital content
- Must have knowledge about the protocols, data structures and programming models for Internet services, e.g. REST, SOAP
- Must have knowledge of session initiation and management, and real-time content delivery
- Must have knowledge of mark-up languages, e.g. XML, HTML5
- Must be able to explain the concepts of “service”, “service enablers” and “service architectures” and be able to classify services
- Must have knowledge of the main standardization bodies and the process of developing specifications and standards for Internet technologies
- Must be able to understand the principles of Web 2.0 and their implications for services
- Must have knowledge of and be able to reflect on methods for "enrichment" of services: involvement of users, personalization, use of context, etc.

**Skills**
- Must be able to analyse the requirements that a given service imposes on servers, networks and terminals
- Must be able to evaluate QoS requirements for Internet applications and services
- Must be able to make a qualified choice of technologies, methods, platforms and service architecture in order to realize a given service
- Must be able to design services for real-time messaging and content distribution, including streaming media, over IP networks

**Competencies**
- Must be able to analyse and design a realistic ICT service (on a conceptual level) to address an identified user need
- Must be able to apply user-centric service development and stakeholder analysis in setting up the requirements specification for a service

**Type of instruction:**  
Lectures, exercises, self-study, reflection.

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

**Evaluation criteria:**  
Are stated in the Framework Provisions.
| **Course module:** | Markets and Business Models  
(Markeder og forretningsmodeller) |
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Prerequisites:</strong></td>
<td>None</td>
</tr>
</tbody>
</table>
| **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, and transaction costs analysis  
- Must be able to understand theories on innovation  
**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 abilities regarding the combination of 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 offering communication, media and information (CMI) services and products and using CMI solutions in their business operations |
| **Type of instruction:** | Lectures, exercises and group work.  
**Exam format:** | Individual oral or written examination.  
**Evaluation criteria:** | Are stated in the Framework Provisions. |
### 3.2 2nd trimester

#### 3.2.1 Project Unit 2nd trimester

<table>
<thead>
<tr>
<th>Trimester project:</th>
<th>Application Development (Applikationsudvikling)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prerequisites:</strong></td>
<td>None</td>
</tr>
<tr>
<td><strong>Objectives:</strong></td>
<td>Students who complete the module:</td>
</tr>
</tbody>
</table>

**Knowledge**
- Must have knowledge about appropriate methods for design, test and analysis of applications or services based on current or future ICT platforms
- Must have knowledge about the necessary tools to develop ICT or media applications/services
- Must have knowledge of the implications that mobile platforms, devices, applications and services provide to Interaction Design and to the user interface of the application/services

**Skills**
- Must be able to analyse and assess user needs and ICT impact in relation to the design of new applications, software, mobile devices, etc.
- Must be able to reflect on the application development process and to characterize the process in relation to existing life cycle models
- Must be able to analyse, design, develop and test applications and services that can be deployed on ICT and media platforms and infrastructures
- Must be able to carry out the technical development process with a constant focus on target users, usage scenarios, stakeholders and business aspects to ensure the validity of approaches
- Must be able to identify and apply relevant theories and methods for synthesis and evaluation of the user interaction
- Must be capable of exploring and applying the potential of ICT to address a wide variety of private and professional user needs

**Competencies**
- Must have the competency to analyse a technical service design and develop one or more of the applications necessary to provide the service based on a specific user need.
- Must have the competency to follow a design process with use of scenarios, use cases, requirement specification and the final prototype design.
- Must be able to assess and develop (conceptually and paper based) a Graphical User Interface (GUI) for a specific application or a service prototype

<table>
<thead>
<tr>
<th>Type of instruction:</th>
<th>Project work, self-study and reflection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exam format:</td>
<td>Individual oral examination based on a written report.</td>
</tr>
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</table>
### 3.2.2 Courses at 2nd trimester

**Course module:**

**Requirement Specification**  
(Kravspecifikation)

<table>
<thead>
<tr>
<th>Prerequisites:</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objectives:</strong></td>
<td>Students who have completed the module:</td>
</tr>
</tbody>
</table>
| **Knowledge:** | - must be able to understand the elements and structure of a requirement specification  
- must understand the concepts of use cases and scenarios  
- must be able to understand different life cycle models for software development  
- must be able to understand the differences between different life cycle models  
- must be able to understand the difference between different types of requirements  
- must be able to understand the requirement elicitation process |
| **Skills:** | - will be able to apply central concepts from software engineering in practice  
- will be able to identify and write use cases and scenarios  
- will be able to discuss and argue for a selection of life cycle model  
- will be able to develop a requirement specification for a given software  
- will be able to use the requirement elicitation process for identification of different types of requirement |
| **Competences:** | - will be able to analyse and elucidate different elements for a requirement specification  
- will be able to translate and link use cases and scenarios to a requirement specification  
- will be able to reflect on the use of life cycle models  
- will be able to combine different life cycle models to special needs  
- will have competences in elicitation of different types of requirements for a specification  
- will have competences in understanding the strengths of the requirement specification in relation to not having any in a given software development process |
<p>| <strong>Type of instruction:</strong> | Lectures, exercises, self-study, reflection |
| <strong>Form of examination:</strong> | Individual written or oral examination, details will be decided at semester start |
| <strong>Assessment criteria:</strong> | Are mentioned in the framework provisions. |</p>
<table>
<thead>
<tr>
<th>Course module: Application Security and Identity Management (Applikationssikkerhed og identity management)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prerequisites:</strong> None</td>
</tr>
<tr>
<td><strong>Objectives:</strong> Students who complete the module:</td>
</tr>
</tbody>
</table>

**Knowledge**
- Must have knowledge of the basic requirements for secure applications
- Must have knowledge of key management, certificates, tokens and secure elements
- Must have knowledge of security standards for end-to-end application/service security
- Must have knowledge of network, application and data security principles and methods
- Must have knowledge about security architectures, including policies and policy management
- Must be able to understand the principles and methods for authentication, authorization and identification
- Must be able to understand the concepts of digital, virtual and partial identities
- Must have knowledge of the key concepts of identity management and major identity management frameworks
- Must be able to explain the concepts of security, trust, assertion and privacy
- Must be able to understand the concepts of linkability and unlinkability

**Skills**
- Must be able to analyse risks and security requirements for an application at different levels
- Must be able to apply privacy by design principles and related methods for privacy, authentication and authorization
- Must be able to analyse and select the most relevant security technologies in a practical application
- Must be able to design and implement secure services with different levels of security

**Competencies**
- Must be able to design secure services and security architectures with controlled exchange of attributes between stakeholders and minimal disclosure of personal information
- Must be able to design applications and services incorporating security elements (e.g. payment, authentication) and management of user identities (authentication, authorization, privacy protection)
- Must be able to discuss management of personal information for access to resources and for personalization of services

<table>
<thead>
<tr>
<th><strong>Type of instruction:</strong></th>
<th>Lectures, exercises, self-study, reflection.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exam format:</strong></td>
<td>Individual oral or written examination.</td>
</tr>
<tr>
<td><strong>Evaluation criteria:</strong></td>
<td>Are stated in the Framework Provisions.</td>
</tr>
</tbody>
</table>
Course module:
Development of ICT and Media Services
(Udvikling af IKT- og medietjenester)
Specialization in Converging Media Technologies, Copenhagen

Prerequisites: None

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 ‘context triggers’, sensors, NFC, etc.
- Must have knowledge about a range of software technologies (e.g. Qt, Python, AJAX, SOAP, HTML5, CSS3, JavaScript, XML, SQL)
- Must have knowledge about different Software Development Toolkits (SDK), simulators, emulators and Integrated Development Environment (IDE)
- Must have knowledge about automatic verification of properties in a formal model
- Must have knowledge about agile methods for system development

Skills
- Must be able to design and implement mobile services/applications using programming / scripting languages
- Must be able to apply understanding of services and service platforms to develop a concrete and viable ICT solution or service
- Must be able to design, develop and evaluate the software components
- Must be able to produce technical documentation based on structured methods
- Must be able to use a lifecycle model in a development process
- Must be able to build / use software interfaces for sensors.

Competencies
- Must have the competency to design and develop ICT and media services and applications

Type of instruction: Traditional lectures and exercises.

Exam format: Individual oral or written examination.

<table>
<thead>
<tr>
<th>Course module:</th>
<th>Interaction Design (Interaktionsdesign)</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>Knowledge</td>
</tr>
<tr>
<td></td>
<td>• Must be able to understand the concepts of and relation between: human computer interaction, interaction design and user experience</td>
</tr>
<tr>
<td></td>
<td>• Must know different techniques and methods for elucidating user requirements</td>
</tr>
<tr>
<td></td>
<td>• Must be able to transform user requirements into interaction design</td>
</tr>
<tr>
<td></td>
<td>• Must know different techniques and methods for evaluation of various ICT products</td>
</tr>
<tr>
<td></td>
<td>• Must be able to use theories and methods applied in professional interaction design</td>
</tr>
<tr>
<td></td>
<td>• Must have knowledge of the implications that mobile platforms and devices provide to interaction design</td>
</tr>
<tr>
<td></td>
<td>Skills</td>
</tr>
<tr>
<td></td>
<td>• Must be able to apply the concept of user experience to mobile platforms and devices</td>
</tr>
<tr>
<td></td>
<td>• Must be able to evaluate a particular software, application or ICT product using techniques from interaction design and Human Computer Interaction</td>
</tr>
<tr>
<td></td>
<td>• Must be able to elucidate user requirements by involvement of user and application of a techniques (such as “think-aloud” test, and interviews)</td>
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<tr>
<td></td>
<td>• Must be able to reflect on user involvement</td>
</tr>
<tr>
<td></td>
<td>Competencies</td>
</tr>
<tr>
<td></td>
<td>• Must have competencies in evaluation of ICT products (software, applications or a device)</td>
</tr>
<tr>
<td></td>
<td>• Must be able to analyse the social context in which the use of ICT takes place</td>
</tr>
<tr>
<td></td>
<td>• Must have competencies in involvement of users in an ICT development process</td>
</tr>
<tr>
<td></td>
<td>• Must have competencies in interaction design theories as basis for general analyses of ICT related products</td>
</tr>
<tr>
<td></td>
<td>• Must have competencies in techniques for elucidation of user requirements</td>
</tr>
<tr>
<td>Type of instruction:</td>
<td>Lectures, exercises (individually and in groups), workshops, self-study, reflection.</td>
</tr>
<tr>
<td>Form of examination:</td>
<td>Written or oral, details will be decided on at semester start</td>
</tr>
<tr>
<td>Assessment criteria:</td>
<td>Are mentioned in the framework provisions.</td>
</tr>
<tr>
<td>Course module: Creativity and ICT Design (Kreativitet og IKT-design)</td>
<td></td>
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<tr>
<td>Prerequisites: None</td>
<td></td>
</tr>
<tr>
<td>Objectives: Students who complete the module:</td>
<td></td>
</tr>
</tbody>
</table>

**Knowledge**
- Must have knowledge about different types of ICT design processes
- Must be able to understand the concept of creativity
- Must be able to understand the creative process
- Must have knowledge about different creativity techniques and their application areas
- Must be able to understand the phrase of user driven innovation
- Must have knowledge about the link between creativity and innovations

**Skills**
- Must be able to apply creativity techniques in relation to an ICT product (device, software, application, service, etc.)
- Must be able to evaluate an ICT design process
- Must be able to apply a design process to the development of an idea
- Must be able to evaluate different creativity techniques to judge their applicability in a given situation
- Must be able to work theoretically with the notion of creativity

**Competencies**
- Must have competencies use, understanding and analysis of different creativity techniques
- Must have competencies in understanding different design processes
- Must have competencies in linking creativity into a design process

**Type of instruction:** Lectures, exercises (individually and in groups), self-study, reflection, teacher feedback.

**Form of examination:** Written or oral examination based on deliveries of exercises during and after the classes. Since the course takes a relatively practical approach to obtaining the objectives, class participation is required (presence and participation is required for a minimum of 80% of the classes).

**Assessment criteria:** Are mentioned in the framework provisions.
3.3 3\textsuperscript{rd} trimester

3.3.1 Project Unit 3\textsuperscript{rd} trimester

<table>
<thead>
<tr>
<th>Trimester project:</th>
<th>Master’s Thesis (Master-projekt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisites:</td>
<td>1\textsuperscript{st} and 2\textsuperscript{nd} trimester courses and projects must be completed.</td>
</tr>
<tr>
<td>Objectives:</td>
<td>Students who complete the module:</td>
</tr>
<tr>
<td>Knowledge</td>
<td>- Must be able to understand the relevance of the chosen problem in relation to telecommunication, infrastructure, entrepreneurship and innovation including specific knowledge on the core of the problem and the technical context</td>
</tr>
<tr>
<td></td>
<td>- Must be able to understand at synthesis level relevant theories and methods in a way that underlines important properties, and thus document the knowledge about the applied theories, methods and delimitations within the problem field</td>
</tr>
<tr>
<td>Skills</td>
<td>- Must be able to design, develop or analyse a comprehensive service or solution that is solidly technical founded, meets end-user requirements and is validated from a market and business perspective</td>
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<tr>
<td></td>
<td>- Must be able to undertake a thorough analysis of specific applications for technology choices, strategic decisions and innovation</td>
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<tr>
<td></td>
<td>- Must be able to analyze the possible methods to solve the problem, describe and assess the application of the chosen methods and how this influences the project results</td>
</tr>
<tr>
<td>Competencies</td>
<td>- Must be able to synthesize and describe the chosen problem and apply relevant theories, methods and experimental data</td>
</tr>
<tr>
<td></td>
<td>- Must have competencies in innovation and entrepreneurship within the field of ICT</td>
</tr>
<tr>
<td></td>
<td>- Must be able to contribute to the creative use of technologies to resolve user needs and improve organizational processes</td>
</tr>
<tr>
<td>Type of instruction:</td>
<td>The project is performed individually or in small groups of a maximum of 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.</td>
</tr>
<tr>
<td>Exam format:</td>
<td>Individual oral examination based on a written thesis.</td>
</tr>
</tbody>
</table>
3.3.2 Courses at 3rd trimester

<table>
<thead>
<tr>
<th>Course module:</th>
<th>ICT Managerial Economics (IKT 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>Knowledge</td>
</tr>
<tr>
<td></td>
<td>• Must have knowledge about the basic elements in a business plan</td>
</tr>
<tr>
<td></td>
<td>• Must be able to understand different cost concepts and different methods for investment analysis</td>
</tr>
<tr>
<td></td>
<td>• Must be able to understand the concept of cost based pricing</td>
</tr>
<tr>
<td></td>
<td>• Must have knowledge about the cost elements in a communication network</td>
</tr>
<tr>
<td></td>
<td>Skills</td>
</tr>
<tr>
<td></td>
<td>• Must be able to apply a life-cycle cost analysis of a specific ICT project</td>
</tr>
<tr>
<td></td>
<td>• Must be able to apply economic analysis as a tool for investment decisions and preparation of a business plan</td>
</tr>
<tr>
<td></td>
<td>Competencies</td>
</tr>
<tr>
<td></td>
<td>• Must have competencies in preparing a business plan including a detailed financial analysis of a project</td>
</tr>
<tr>
<td>Type of instruction:</td>
<td>Lectures and group work.</td>
</tr>
<tr>
<td>Exam format:</td>
<td>Individual oral or written examination.</td>
</tr>
<tr>
<td>Course module: Standardization (Standardisering)</td>
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<td>------------------------------------------------</td>
<td></td>
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<tr>
<td><strong>Prerequisites:</strong> None</td>
<td></td>
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<tr>
<td><strong>Objectives:</strong> Students who complete the module:</td>
<td></td>
</tr>
<tr>
<td><strong>Knowledge</strong></td>
<td></td>
</tr>
<tr>
<td>• Must have knowledge on different types of standards, including open and closed standards and de facto and de jure standards</td>
<td></td>
</tr>
<tr>
<td>• Must be able to understand the importance and role of standards, standardization strategies, and standardization processes</td>
<td></td>
</tr>
<tr>
<td>• Must have knowledge on standardization organizations in the area of communication, media and information technologies</td>
<td></td>
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<tr>
<td><strong>Skills</strong></td>
<td></td>
</tr>
<tr>
<td>• Must be able to apply theories on network economics, information economics, and transaction costs analysis on standardization issues</td>
<td></td>
</tr>
<tr>
<td>• Must be able to appraise the role of standards in relation to processes of transaction between market players</td>
<td></td>
</tr>
<tr>
<td><strong>Competencies</strong></td>
<td></td>
</tr>
<tr>
<td>• Must have competencies to interpret the interests which underlie the development of standards</td>
<td></td>
</tr>
<tr>
<td>• Must have competencies 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</td>
<td></td>
</tr>
<tr>
<td>• Must have competencies to compare standardization strategies</td>
<td></td>
</tr>
<tr>
<td><strong>Type of instruction:</strong> Lectures, exercises and group work.</td>
<td></td>
</tr>
<tr>
<td><strong>Exam format:</strong> Individual oral or written examination.</td>
<td></td>
</tr>
<tr>
<td><strong>Evaluation criteria:</strong> Are stated in the Framework Provisions.</td>
<td></td>
</tr>
<tr>
<td>Course module:</td>
<td>Markets and Regulation (Markeder og regulering)</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>Prerequisites:</td>
<td>None</td>
</tr>
<tr>
<td>Objectives:</td>
<td>Students who complete the module:</td>
</tr>
<tr>
<td></td>
<td>Knowledge</td>
</tr>
<tr>
<td></td>
<td>• Must have knowledge about spectrum management</td>
</tr>
<tr>
<td></td>
<td>• Must have knowledge about Universal Service</td>
</tr>
<tr>
<td></td>
<td>• Must have knowledge about interconnection of communication networks</td>
</tr>
<tr>
<td></td>
<td>• Must have knowledge about regulation of numbers and domain names and VoIP</td>
</tr>
<tr>
<td></td>
<td>• Must have knowledge about recent regulatory regimes</td>
</tr>
<tr>
<td></td>
<td>• Must have knowledge about roaming</td>
</tr>
<tr>
<td></td>
<td>Skills</td>
</tr>
<tr>
<td></td>
<td>• Must be able to explain and analyse principal objectives and approaches to telecom regulation</td>
</tr>
<tr>
<td></td>
<td>• Must be able to identify key regulatory areas and assess the need for a specific regulatory action</td>
</tr>
<tr>
<td></td>
<td>• Must be able to evaluate identify the need for spectrum regulation and assess different regulatory approaches</td>
</tr>
<tr>
<td></td>
<td>Competencies</td>
</tr>
<tr>
<td></td>
<td>• Must have competencies in understanding the market for ICT infrastructures, and how these are regulated at the national and international level.</td>
</tr>
<tr>
<td>Type of instruction:</td>
<td>Lectures and group work.</td>
</tr>
<tr>
<td>Exam format:</td>
<td>Individual oral or written examination.</td>
</tr>
</tbody>
</table>
Chapter 4: Effective date, interim regulations and revision

The curriculum adopted by the Study Board of Electronics and IT and approved by the Dean of the Faculty of Engineering and Science comes into force on September 1, 2013.

Students who wish to complete their studies under the previous curriculum from the Master in Information and Communication Technologies must conclude their education by the summer examination period September 2012 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 at Aalborg University, the curriculum must be revised no later than 5 years after its entry into force.

A valid version of the curriculum is published at www.sict.aau.dk.

Chapter 5: Other regulations

5.1 Rules for written assignments, including the master’s thesis project and its scope

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 should include a summary in a foreign language (English, French, Spanish or German with the approval of the study board). If the project is written in a foreign language (English, French, Spanish or German), the summary can be written in Danish with the approval of the study board. The summary should be at least 1 and at most 2 pages (not included in the possible fixed minimum and maximum number of pages per student). The summary is included in the overall evaluation of the project.

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

Students with other programme modules from other master programmes can earn credit/admission according to the study board’s assessment of the individual application (accreditation).

5.3 Examination rules

Examination rules are included in the faculty’s examination regulation which is published at the faculty’s website.

5.4 Exemption

The study board can in special circumstances grant exemption from those parts of the study board’s regulations, which are not laid down by law or ministerial order. Exemptions concerning examinations are valid from the following examination.

5.5 Rules for when the students should at the latest have completed their education after its commencement

The master programme should be completed at the latest 4 years, excluding leave of absence, after its commencement.