Curriculum for the Bachelors of Science Program in IT, Communication and New Media

2012

Version 3 – februar 2014

Aalborg University

The programme is offered in Copenhagen
Preface:
Pursuant to Act 367 of March 25, 2013 on Universities (the University Act) with subsequent changes, the following curriculum for the Bachelor's program in IT, Communication and New Media is established. The program also follows the Framework Provisions and the Examination Policies and Procedures for the Faculty of Engineering and Science.

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Chapter 1: Legal Basis of the Curriculum, etc.

1.1 Basis in ministerial orders
The Bachelor’s program in IT, Communication and New Media is organized in accordance with the Ministry of Science, Technology and Innovation’s Ministerial Order no. 814 of June 29, 2010 on Bachelor’s and Master’s Programs at Universities (the Ministerial Order of the Study Programs) and Ministerial Order no. 666 of June 24, 2012 on University Examinations (the Examination Order) with subsequent changes. Further reference is made to Ministerial Order no. 240 of March 11, 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 Bachelor’s program falls under the Faculty of Engineering and Science, Aalborg University.

1.3 Study Board affiliation
The Bachelor’s program falls under the Study Board for Media Technology at School of Information and Communication Technology.

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

2.1 Admission
Admission to the Bachelor’s program in IT, Communication and New Media requires an upper secondary education.

The program’s specific entry requirements are:
- English B or an acceptable IELTS
- Mathematics A
- Physics B and Chemistry C - or Physics B and Biotechnology A;

cf. the Admission Order.

The University can stipulate requirements concerning conducting additional exams prior to the start of study.

The study board may limit admission or cancel the education or specific courses if the number of admitted students is too low.

2.2 Degree designation in Danish and English
The Bachelor’s program entitles the graduate to the designation:
- Bachelor (BSc) i teknisk videnskab (IT, kommunikations- og medieteknologi). The English designation is:
  Bachelor of Science (BSc) in Engineering (IT, Communication and New Media).
2.3 The program's specification in ECTS credits

The Bachelor's program is a 3-year, research-based, full-time study program. The program is set to 180 ECTS credits.

2.4 Competence profile on the diploma

The following will appear on the diploma:

- A graduate of the Bachelor's program has competencies acquired through an educational program that has taken place in a research environment.
- A graduate of the Bachelor's program has fundamental knowledge of and insight into his/her subject's methods and scientific foundation. These properties qualify the graduate of the Bachelor's program for further education in a relevant Master's program as well as for employment on the basis of the educational program.

2.5 Competence profile of the program:

Persons obtaining Bachelor's degrees:

Knowledge

- possess knowledge about theories, methodologies and practice in the areas of IT, communication and new media
- are able to understand and reflect on theories, methodologies and practice within these subject areas
- have knowledge in design and planning processes in relation to development of ICT applications

Skills

- are able to apply selected methodologies and tools within IT, communication and new media
- are able to analyse and evaluate theoretical and practical issues within IT, communication and new media in a broader socio-economic context
- are able to develop and implement ICT based services and applications using programming and system development skills
- are able to explain the reasons for and choose relevant solution models
- are able to communicate academic and technical issues and solution models to peers and non-specialists or collaboration partners and users from an interdisciplinary perspective

Competencies

- are able to handle complex and development-oriented situations in study or work contexts
- are able to solve problems using mathematical tools
- are able to combine technological, economic and policy perspectives
- are able to independently participate in discipline-specific and interdisciplinary cooperation with a professional approach
- are able to identify their own learning needs and organize their own learning in different learning environments
Chapter 3: Content and Organization of the Program

The program is structured in modules and organised as a problem-based study. A module is a program element or a group of program 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. The examinations are defined in the curriculum.

All projects are to be conducted in English. The study board may, in some cases, exempt from this.

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

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

The BSc education in IT, Communication and New Media is taught in English. All activities, including the above stated, are carried out in English. All exercise work and deliverables, project-work (as well as any documentation in connection to these) delivered by the student must be written in English and all exams are carried out in English. In accordance with the current Framework Provisions, The Study Board for Media Technology may choose to exempt from this rule in extraordinary cases, which in principle requires a well-documented application from the student and/or teacher.
Overview of the program:
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 assessment by the supervisor only).

<table>
<thead>
<tr>
<th>Semester</th>
<th>Module</th>
<th>ECTS</th>
<th>Assessment</th>
<th>Exam</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>P0: Project in Conceptual Design of an ICT Application</td>
<td>5</td>
<td>Pass/Fail</td>
<td>Internal</td>
<td>Mandatory</td>
</tr>
<tr>
<td>1st</td>
<td>P1: Project in Object-oriented Programming</td>
<td>10</td>
<td>7-point scale</td>
<td>Internal</td>
<td>Mandatory</td>
</tr>
<tr>
<td>1st</td>
<td>Problem Based Learning in Science, Technology and Society</td>
<td>5</td>
<td>Pass/Fail</td>
<td>Internal</td>
<td>Mandatory</td>
</tr>
<tr>
<td>1st</td>
<td>Linear Algebra</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
<td>Mandatory</td>
</tr>
<tr>
<td>1st</td>
<td>Object-oriented Programming 1</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
<td>Mandatory</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Semester</th>
<th>Module</th>
<th>ECTS</th>
<th>Assessment</th>
<th>Exam</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd</td>
<td>Project in System Development and User Interaction</td>
<td>15</td>
<td>7-point scale</td>
<td>External</td>
<td>Mandatory</td>
</tr>
<tr>
<td>2nd</td>
<td>Requirements Specification, Systems Design and User Involvement</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
<td>Mandatory</td>
</tr>
<tr>
<td>2nd</td>
<td>Discrete Mathematics</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
<td>Mandatory</td>
</tr>
<tr>
<td>2nd</td>
<td>Object-oriented Programming 2</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
<td>Mandatory</td>
</tr>
</tbody>
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<tr>
<th>Semester</th>
<th>Module</th>
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<th>Exam</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>3rd</td>
<td>Project in Distributed Systems and Communities</td>
<td>15</td>
<td>7-point scale</td>
<td>Internal</td>
<td>Mandatory</td>
</tr>
<tr>
<td>3rd</td>
<td>IT in Distributed Organizations</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
<td>Mandatory</td>
</tr>
<tr>
<td>3rd</td>
<td>Computer Networks and the Internet</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
<td>Mandatory</td>
</tr>
<tr>
<td>3rd</td>
<td>Distributed Systems</td>
<td>5</td>
<td>7-point scale</td>
<td>External</td>
<td>Mandatory</td>
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<tr>
<th>Semester</th>
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<th>ECTS</th>
<th>Assessment</th>
<th>Exam</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>4th</td>
<td>Project in Communications and Media Technologies</td>
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<td>7-point scale</td>
<td>External</td>
<td>Mandatory</td>
</tr>
<tr>
<td>4th</td>
<td>Communication and Media Technologies</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
<td>Mandatory</td>
</tr>
<tr>
<td>4th</td>
<td>Introduction to Economics</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
<td>Mandatory</td>
</tr>
<tr>
<td>4th</td>
<td>Introduction to Probability and Applied Statistics</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
<td>Mandatory</td>
</tr>
<tr>
<td>Semester</td>
<td>Module</td>
<td>ECTS</td>
<td>Assessment</td>
<td>Exam</td>
<td>Type</td>
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<tr>
<td>5th</td>
<td>Project in Application Development and Security</td>
<td>15</td>
<td>7-point scale</td>
<td>Internal</td>
<td>Mandatory</td>
</tr>
<tr>
<td>5th</td>
<td>Development of Mobile Applications</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
<td>Mandatory</td>
</tr>
<tr>
<td>5th</td>
<td>Network and Application Security</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
<td>Mandatory</td>
</tr>
<tr>
<td>5th</td>
<td>Databases</td>
<td>5</td>
<td>7-point scale</td>
<td>External</td>
<td>Mandatory</td>
</tr>
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<thead>
<tr>
<th>Semester</th>
<th>Module</th>
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<th>Assessment</th>
<th>Exam</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>6th</td>
<td>BSc Project</td>
<td>20</td>
<td>7-point scale</td>
<td>External</td>
<td>Mandatory</td>
</tr>
<tr>
<td>6th</td>
<td>Next Generation Networks</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
<td>Elective</td>
</tr>
<tr>
<td>6th</td>
<td>Technology and Society</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
<td>Elective</td>
</tr>
<tr>
<td>6th</td>
<td>Business Law</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
<td>Elective</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>180</td>
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</table>

The 6th semester students must choose 2 out of 3 elective courses.

Most courses introduce scientific methods, which are specific to the topic of the course. For instance are mathematical methods introduced in the courses Linear Algebra and Calculus, methods for programming in object-oriented programming etc. Scientific theory and scientific methods in general are included in the course Problem based learning in science, technology and society. Moreover, the students develop their skills in this area in their project work, where they will apply scientific methods in practice and reflect on their applicability in the subsequent process evaluation.
### 3.1 1st semester

| **Title:** | P0: Project in Conceptual Design of an ICT Application  
(P0: Projekt i konceptuelt design af en IKT-applikation) |
<table>
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<tbody>
<tr>
<td><strong>Prerequisites:</strong></td>
<td>No special prerequisites for the module.</td>
</tr>
<tr>
<td><strong>Objectives:</strong></td>
<td>Students who complete the module:</td>
</tr>
</tbody>
</table>
| **Knowledge:** | - Knowledge about typical work processes in a problem based project  
- Knowledge about the basic principles in scientific work e.g. academic honesty  
- Must have knowledge of what the subject of IT, Communication and New Media includes  
- Must have knowledge about the concept of user friendliness  
- Must be able to understand the concept of problem based learning |
| **Skills:** | - Analyse individual as well as organizational learning processes  
- Organize a short period (less than a moth) of collaboration in-group and with supervisor  
- Communicate the reflections and results of the problem based project work; orally, graphically and in writing  
- Must be able to apply problem based learning in group work  
- Must be able to perform a simple SWOT analysis |
| **Type of instruction:** | Students will do their project work in groups. The groups will receive instruction and feedback from the teacher. |
| **Exam format:** | Internal. Oral examination based on a written project report. |
| **Evaluation criteria:** | Are mentioned in the framework provisions. |
Title:
**P1: Project in Object-oriented Programming**
(P1: Projekt i objektorienteret programmering)

Prerequisites:
The students should have completed the module in P0: Project in Conceptual design of an ICT application (Projekt i konceptuelt design af en IKT-applikation).

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

Students who complete the module:

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

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

Competencies:
- Take responsibility of one’s own learning during a longer-termed project period and be able to generalize the gained experiences
- Must have competencies in using object oriented programming in solving programming tasks, especially programming tasks related to communication and new media
• Must have competences in document and discuss the wider market related implications of a real life application

**Type of instruction:**
Students will do their project work in groups. The groups will receive instruction and feedback from the teacher. Students have to prepare a written P1 process analysis. Students will get support to identify relevant contextual perspectives by consultancy; a group meeting, and commenting on papers and presentation at the status seminar. Students will get support to transfer project management theory to the projects by a PBL-seminar and related to this comments on papers as well as presentations in order to secure action on a mid-term process-analysis. A written comment to the group’s process analysis will be provided to support project-examination.

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

**Evaluation criteria:** Are mentioned in the framework provisions.
Title:
Problem Based Learning in Science, Technology and Society
(Problembaseret læring i videnskab, teknologi og samfund (PBL))

Prerequisites:
No special prerequisites for the module.

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

Students who complete the module:

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

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

Competencies:

- Must be able to apply knowledge (application) and understanding regarding being part of a team-based project work
- Must be able to understand and communicate project work (application)
- Must be able to analyse own learning processes
- Must be able to analyse and document learning processes within the group (analysis)
- Must be able to create optimal collaborative learning processes (application)
- Must be able to apply knowledge and understanding of science, technology and society (application); from a technological perspective (including competencies on applying different technology assessment methods), and from a holistic perspective (including competencies on life style, consumption, and technology development, different contexts and forms of communication, innovative and creative processes)

**Type of instruction:**
Refer to the overview of instruction types listed in the start of chapter 3. The types of instruction for this course are decided according to the current Framework Provisions and directions are decided and given by The Study Board for Media Technology.

**Exam format:** Individual written report with internal censor.

**Evaluation criteria:** Are mentioned in the framework provisions.
Title:
Linear Algebra
(Lineær algebra)

Prerequisites: No special prerequisites for the module.

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

Students who complete the module:

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

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

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

Contents:

Type of instruction:
Refer to the overview of instruction types listed in the start of chapter 3. The types of instruction for this course are decided according to the current Framework Provisions and directions are decided and given by The Study Board for Media Technology.

Exam format:
Internal. Oral or written examination.

Evaluation criteria: Are mentioned in the framework provisions.
**Title:**  
**Object-oriented Programming 1**  
*(Objektorienteret programmering 1)*

**Prerequisites:**  
No special prerequisites for the module.

**Objectives:**  
To provide the student with a foundation for the systematic development of programs using object oriented modelling and programming. The student should acquire an understanding of basic concepts and mechanisms in an object oriented programming language such that the student is able to use the language and associated class library to implement small programs.

Students who complete the module:

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

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

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

**Contents:**  
- Introduction to programs and machines  
- Fundamental sequential programming  
- Introduction to object oriented programming  
- Test and debugging  
- Basic data structures and algorithms  
- Introduction software system documentation  
- Development of simple graphical user interfaces

**Type of instruction:**  
Classroom teaching with programming assignments and deliverable compulsory assignments.
<table>
<thead>
<tr>
<th><strong>Exam format:</strong></th>
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</thead>
<tbody>
<tr>
<td>Internal. Oral examination based upon mandatory assignments.</td>
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</tr>
<tr>
<td>Before the examination: Each member is allocated approximately 5 minutes to give a well-prepared presentation of the product. The team members are required to coordinate their presentations in such a way that the major aspects of the project are covered, that the presentations are different and that each individual presentation has a good technical span.</td>
<td></td>
</tr>
</tbody>
</table>

| **Evaluation criteria:** | Are mentioned in the framework provisions. |
### Title:
**Project in System Development and User Interaction**  
(Projekt i systemudvikling og brugerinteraktion)

### Prerequisites:
The students should have basic programming experience.

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

Students who complete the project:

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

#### Skills:
- Analyse and model individual as well as organizational learning processes based on experiences from P0 and P1
- Must be able to apply IT development models to an actual case
- Must be able to apply user interaction models as a basis for requirements specifications
- Must be able to apply advanced object-oriented system development
- Must be able to develop a requirement specification for a given IT product
- Must be able to link user requirements with the requirement specification for a given product
- Must be able to evaluate an IT development project based on requirements
- Reflect on the construction and reconstruction of science and technology in a user and society perspective
- Relate the professional practice within the discipline to the needs of humans and different societies
- Analyse technical or natural scientific problems by use of social science methodology
- Assess the impacts on human and society from the proposed solutions
## Competencies:
- Manage a longer termed project independently
- Generalize the gained experiences with project management and put them into perspective of the future course of study
- Reflect on the ethical perspective of engineering and science and discuss implications of a responsible professional practice
- Must have competencies in development of a requirements specification
- Must have competencies in elicitation of user requirements and to translate these into the requirement specification for a specific product
- Must have competencies in user interaction models
- Must have competencies in IT development (to for example a mobile application) by use of the System Development Process

## Type of instruction:
Students will do their project work in groups. In the groups the students will get support to identify, analyse and assess relevant contextual perspectives through co-supervision.

## Exam format:
External. Oral examination based on a written project report.

## Evaluation criteria:
Are mentioned in the framework provisions.
<table>
<thead>
<tr>
<th>Title: Requirements Specification, Systems Design and User Involvement (Kravspecifikation, systemdesign og brugerinvolvering)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prerequisites:</strong> The students should have basic programming experiences.</td>
</tr>
<tr>
<td><strong>Objectives:</strong> To provide students with the ability to develop requirements specifications for new system design (primarily software design). Furthermore, the objectives are for the students to be able to link specific user requirements with technical requirements to give a full requirement specification to be used for programming.</td>
</tr>
<tr>
<td>Students who complete the module:</td>
</tr>
<tr>
<td><strong>Knowledge:</strong></td>
</tr>
<tr>
<td>• Must have knowledge about requirements specification and system design</td>
</tr>
<tr>
<td>• Must have knowledge about newer methods for development of requirement specifications based on user involvement</td>
</tr>
<tr>
<td>• Must have knowledge about the link between user requirements and technical requirements and the methods for deriving these</td>
</tr>
<tr>
<td><strong>Skills:</strong></td>
</tr>
<tr>
<td>• Must be able to identify, analyse and compare different use situations for a particular IT product (for example a mobile application)</td>
</tr>
<tr>
<td>• Must be able to identify, analyse and compare different methodologies for elicitation of requirements</td>
</tr>
<tr>
<td>• Must be able to evaluate different IT development solutions</td>
</tr>
<tr>
<td>• Must be able to provide constructive criticism on own as well as others work in requirements specifications</td>
</tr>
<tr>
<td>• Must be able to design and conclude on a requirement specification for a given application or software</td>
</tr>
<tr>
<td><strong>Competencies:</strong></td>
</tr>
<tr>
<td>• Must have competencies in development of requirement specifications for a particular IT product</td>
</tr>
<tr>
<td>• Must have competencies in documenting and discussing different approaches to development of requirement specifications</td>
</tr>
<tr>
<td>• Must have competencies in linking user requirements with technical requirements</td>
</tr>
<tr>
<td><strong>Type of instruction:</strong> Students will do their project work in groups. The groups will receive instruction and feedback from the teacher.</td>
</tr>
<tr>
<td><strong>Exam format:</strong> Internal. Oral examination based on a written project report.</td>
</tr>
<tr>
<td>Evaluation criteria:</td>
</tr>
</tbody>
</table>
| **Title:** | **Discrete Mathematics**  
\(\text{(Diskret matematik)}\) |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prerequisites:</strong></td>
<td>The students should have followed the module Linear Algebra</td>
</tr>
<tr>
<td><strong>Objectives:</strong></td>
<td>Students who complete the module:</td>
</tr>
</tbody>
</table>
| **Knowledge:** | • Set theory: Sets, relations, functions, partial orderings, equivalence relations.  
• Countability of the rational numbers.  
• Recursive/iterative algorithms.  
• Time complexity: Asymptotic notation. Big-O notation.  
• Logarithm and exponential functions with base 2.  
• Combinatorics. The binomial formula.  
• Recursive functions. Recurrence relations.  
• Proof techniques: Weak and strong induction. Proof by contradiction, by contraposition and constructive.  
• Logic: Propositional logics, quantifiers.  
• Graph theory: Directed and undirected graphs. Path, simple path, trees.  
  Graph algorithms: search in graphs, shortest path. |
| **Skills** | • Ability to construct proofs (using the proof techniques of the course) for results within the course.  
• Ability for formulate in writing mathematical results related to the course. |
<p>| <strong>Competencies:</strong> | • Ability to use the concepts and techniques of discrete mathematics, including in connection with algorithms. |
| <strong>Type of instruction:</strong> | The teaching in Discrete mathematics is a combination of sessions with lectures, exercises, and miniprojects. |
| <strong>Exam format:</strong> | Internal. Four-hour written examination without use of computer algebra tools. |
| <strong>Evaluation criteria:</strong> | Are mentioned in the framework provisions. Marks according to the seven scale. |</p>
<table>
<thead>
<tr>
<th><strong>Title:</strong></th>
</tr>
</thead>
</table>
| **Object-oriented Programming 2**  
**Objektorienteret programmering 2)** |

<table>
<thead>
<tr>
<th><strong>Prerequisites:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>The students should have followed Linear Algebra and Object-oriented Programming 1</td>
</tr>
</tbody>
</table>
Objectives:
To provide the student with an understanding of the basic concepts in object-oriented analysis and design so he/she becomes capable of creating models for a required object-oriented program. To provide the student with better capabilities in object-oriented programming using Java.

Students who complete the module:

Knowledge:
- Must have knowledge about common UML diagrams
- Must have knowledge about concepts and principles common in object-oriented analysis and design
- Must have knowledge about common architectures and design patterns
- Must be able to understand multithreaded programs, typical synchronization problems and common solutions to these

Skills:
- Must be able to explain typical examples of UML diagrams
- Must be able to use common architectures and design patterns
- Must be able to use UML to model software systems
- Must be able to use Java API classes to input and output binary data and objects
- Must be able to use Java API classes to program “attractive” GUIs, including using custom dialog boxes, and to draw 2D graphics
- Must be able to discuss and evaluate the design and quality of object-oriented programs

Competencies:
- Must have the competencies to apply object-oriented programming and the related concepts in analysis and design of IT, communication and new media services.

Contents:
- Modelling object-oriented systems using UML
- Object-oriented analysis and design
- Advanced object-oriented programming, using well-known principles, architectures and design patterns
- Advanced GUI-programming, including programming custom dialog boxes and drawing 2D graphics
- Input and output of binary data and objects (serialization)
- Introduction to multithreaded programming

Type of instruction:
Classroom teaching with programming assignments.

Exam format:
Internal censor. Oral examination based on mandatory course assignments.

Evaluation criteria: Are mentioned in the framework provisions.
### 3.3 3rd semester

| **Title:** 
| *Project in Distributed Systems and Communities*  
| *(Projekt i distribuerede systemer og communities)* |
| **Prerequisites:** 
| No special requirements for this project module. |
| **Objectives:** 
| The purpose of this project module is to acquire knowledge, skills and competencies regarding the implementation and use of distributed information technology systems in distributed organizations and communities. Emphasis in the project can be on computer networks and distributed systems or on the organizational aspects. |
| Students who complete the project: |
| **Knowledge:** |
| • Must have knowledge about computer networks  
| • Must have knowledge about distributed information technology systems including protocol design and system architecture  
| • Must have knowledge about the implementation and use of information technology systems in distributed organizations and communities  
| • Must have knowledge about theories on knowledge sharing, knowledge management and computer supported cooperative work |
| **Skills:** |
| • Must be able to set up a requirements specification based on identified user and communication needs in an organizational context  
| • Must have skills in describing and analysing an organizational problem issue  
| • Must have basic skills in implementing network technologies and distributed information technology systems, including intranet and groupware |
| **Competencies:** |
| • Must demonstrate competences in performing analyses of organizational requirements for information and knowledge  
| • Must have competences in presenting user scenarios based on user needs  
| • Must have competences in choosing relevant computer networks and information technology systems meeting organizational needs for knowledge and information sharing  
| • Must have competences in identifying drivers and barriers regarding the implementation and use of information technology systems in organizations |
| **Type of instruction:** 
| Students will do their project work in groups. The groups will receive instruction and feedback from the teacher. |
| **Exam format:** 
| Internal. Oral examination based on a written project report. |
| Evaluation criteria: | Are mentioned in the framework provisions. |
Title:
IT in Distributed Organizations
(IT i distribuerede organisationer)

Prerequisites:
No special prerequisites for the module.

Objectives:
The purpose of this module is for the students to develop a theoretical understanding and practical skills and competences concerning the implementation and use of information technologies as a means in managing and organizing distributed organizations and communities.

Students who complete the module:

Knowledge:
- Must have knowledge about theories on distributed organizations and communities
- Must have knowledge about theories regarding the management of distributed organizations and communities
- Must have knowledge about theories on knowledge sharing and management
- Must have knowledge about drivers and barriers concerning the implementation of information technology systems in organizations
- Must have knowledge about theories regarding computer-mediated communications and computer supported cooperative work

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

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

Contents:
This module concerns the implementation and use of information technology in distributed organizations and communities. This includes computer-mediated communications broadly speaking and computer supported cooperative work more specifically. It also includes knowledge sharing and knowledge management. It puts focus on the organizational and human drivers and barriers to the implementation of information technology systems in organizations in general and more specifically in distributed organizations. It examines the different technology systems and their application.
<table>
<thead>
<tr>
<th><strong>Type of instruction:</strong></th>
<th>Lectures, external lecturers (from business companies), external visits, group work, presentations by students, exercises.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exam format:</strong></td>
<td>Internal. Oral exam based on synopsis.</td>
</tr>
<tr>
<td><strong>Evaluation criteria:</strong></td>
<td>Are mentioned in the framework provisions.</td>
</tr>
</tbody>
</table>
| Title:  
| Computer Networks and the Internet  
| (Computer-net og Internettet)  
| Prerequisites:  
| Basic programming experience in one programming language (C, C++, Java.....) |
Objectives:
To enable the student to analyse network architectures, define protocols and analyse network traffic using protocol analysers like Wireshark / Ethereal.

Students who complete the module:

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

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

Competencies:
- Must have the ability to use network principles and methods for design of protocols to analyse subjects related to computer networks

Contents:
Basic architecture: Computer Networks and the Internet
Application layer: HTTP, FTP, SMTP, POP3, DNS and socket programming.
Transport layer: TCP and UDP.
Network layer: IP, ICMP, NAT, Routing Algorithms and Routers.
Data Link Layer: Ethernet, Wireless LAN, Bridges, Switches and Hubs.

Type of instruction:
Class teaching, lab-exercises. Approximately 40% of the time will be spent on lab-exercises.
**Exam format:**
Internal. Oral examination based on a specified project and probing of the students' knowledge about the theoretical background.

**Evaluation criteria:**
Are mentioned in the framework provisions.
Title:  
**Distributed Systems**  
*(Distribuerede systemer)*

**Prerequisites:**  
Documented knowledge corresponding to passing second semester.

**Objectives:**  
To introduce the student to a number of different techniques used for development of distributed systems.

Students who complete the module:

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

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

**Competencies:**
- Must be able to apply distributed technologies in design development of IT applications

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

**Exam format:**  
External. Oral examination based on assignments.

**Evaluation criteria:**  
Are mentioned in the framework provisions.
### 3.4 4th semester

| Title: | Project in Communications and Media Technologies  
(Projekt i kommunikations- og medieteknologier) |
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Prerequisites:</td>
<td>P0 and P1.</td>
</tr>
<tr>
<td>Objectives:</td>
<td>The purpose of this project is to give the students an understanding of the technologies behind ICTs and media technologies. The students must use the theories and methods learned from the course “Communication and media technologies” on a specific case within ICT and media technologies.</td>
</tr>
<tr>
<td>Students who complete the module:</td>
<td></td>
</tr>
</tbody>
</table>
| Knowledge: | • Must have knowledge about the key technologies and standards for fixed, mobile and wireless networks  
• Must have knowledge about the structure, architecture and topologies deployed in the communication networks  
• Must have knowledge about the key technologies and standards for the major media technologies  
• Must have knowledge about QoS parameters for different service classes in different networks |
| Skills: | • Must be able to discuss the advantages and disadvantages of different network types in relation to specific services and applications  
• Must be able to identify the QoS parameters related to specific service classes and evaluate their role in design of communication and media networks infrastructures |
| Competencies: | • Must have competencies in applying project- and team-based learning to complete a team project, including preparation of problem definition, coherent analysis and writing of a technical report with clear formulation of results and conclusions, and with proper use of source references  
• Must have competencies in assessing the usefulness of different media and communication technologies in relation to different services and applications  
• Must have the competencies in deploying the knowledge, skills and competencies acquired in the course “Communication and media technologies” developing this project. |
<p>| Type of instruction: | Students will do their project work in groups. The groups will receive instruction and feedback from the teacher. In this project the groups choose either to implement a communication service or to analyse a concrete problem related to communication technologies. |</p>
<table>
<thead>
<tr>
<th><strong>Exam format:</strong></th>
<th>External. Oral examination based on a written project report.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Evaluation criteria:</strong></td>
<td>Are mentioned in the framework provisions.</td>
</tr>
</tbody>
</table>
Title:
**Communication and Media Technologies**
(Kommunikations- og medieteknologier)

Prerequisites:
No special prerequisites for the module.

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

Students who complete the module:

Knowledge:
- Must have knowledge about the structure of a communication network, including the specific characteristics of communicative versus distributive networks
- Must have knowledge about different network topologies and architectures and their advantages and disadvantages in relation to specific applications
- Must have knowledge about what a protocol is and describe the main protocols in a communication network
- Must have knowledge about different modulation technologies
- Must have knowledge about different multiplexing technologies
- Must have knowledge about the main fixed, mobile and wireless communication standards
- Must have knowledge about the major media infrastructure technologies, including digital TV and radio
- Must have knowledge about the OSI and TCP/IP models
- Must have knowledge about different transmission and transport technologies
- Must have knowledge of real-time protocols that are used to distribute different types of content over networks, e.g. RTSP, RTP, RTMP and FLUTE/ALC

Skills:
- Must be able to discuss the role of different levels of OSI model and the interface between these levels
- Must be able to specify the major technological components used in different levels of OSI model
- Must be able to evaluate and discuss the advantages and disadvantages of different network technologies, including IP, ATM and MPLS
- Must be able to specify the parameters influencing the coverage and capacity of communication networks

Competencies:
- Must have competencies in analysing complex network environments and combine the acquired knowledge and skills to develop a technical analysis related to a specific network
<table>
<thead>
<tr>
<th>Type of instruction:</th>
<th>Classroom lectures with exercises.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exam format:</td>
<td>Internal. Oral examination based on mandatory exercises.</td>
</tr>
<tr>
<td>Evaluation criteria:</td>
<td>Are mentioned in the framework provisions.</td>
</tr>
</tbody>
</table>
## Title:
**Introduction to Economics**  
*(Indledende økonomi)*

## Prerequisites:
No special prerequisites for the module

## Objectives:
The overall objective is to provide a basic understanding of key concepts in economic theory with emphasis on macroeconomics.

Students who complete the module:

### Knowledge:
- Must have knowledge about the type of problems addressed by economic theory
- Must have knowledge about the concept of the market
- Must have knowledge about the main cost concepts incl. short and long term aspects

### Skills:
- Must be able to apply national account figures for a description of economic development
- Must be able to explain wage and price determination in an open economy

### Competencies:
- Must understand the role of the competitive process
- Must understand the role of technical development in economic theory

## Type of instruction:
Class room teaching and project work. Students will do their project work in groups. The groups will receive instruction and feedback from the teacher.

## Exam format:
Internal. Oral examination based on a written project report.

## Evaluation criteria:
Are mentioned in the framework provisions.
**Title:**
*Introduction to Probability and Applied Statistics*
*(Introduktion til sandsynlighedsregning og anvendt statistik)*

**Prerequisites:**
Calculus and linear algebra as taught at 1st and 2nd semester.

**Objectives:**
To introduce the student to concepts and ideas within statistics and how statistics can be applied to problems relevant to engineers in “ITCOM”.

Students who complete the course module will obtain the following qualifications:

**Knowledge:**
- Fundamental concepts in probability, including conditional probability and independence.
- Discrete and continuous random variables and relevant properties of these.
- Various examples of descriptive statistics, e.g. histograms and scatterplots.
- Statistical inference, including estimation, confidence intervals and hypothesis testing.
- Important statistical models, like linear regression (simple and multiple), analysis of variance, logistic regression and log-linear models (in particular contingency tables).

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

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

**Type of instruction:**
- Lectures in combination with practical exercises and self-study or similar.

**Exam format:**
Internal. Oral or written examination.

**Evaluation criteria:**
Are mentioned in the framework provisions.
3.5 5th semester

<table>
<thead>
<tr>
<th>Title:</th>
<th>Project in Application Development and Security (Projekt i applikationsudvikling og sikkerhed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisites:</td>
<td>The students should have significant programming experience.</td>
</tr>
<tr>
<td>Objectives:</td>
<td>To enable students to develop advanced mobile applications and services based on state-of-the-art technologies and the knowledge and skills acquired during the previous semesters. The project should make use of solid skills in software engineering, network and media technologies, databases and analysis of user requirements.</td>
</tr>
<tr>
<td>Students who complete the module:</td>
<td>Knowledge:</td>
</tr>
<tr>
<td></td>
<td>• Must have knowledge about protocols, APIs and enabling technologies for mobile applications</td>
</tr>
<tr>
<td></td>
<td>• Must have knowledge of user interface design for mobile devices</td>
</tr>
<tr>
<td></td>
<td>• Must have knowledge of the functionality of SIM cards and state-of-the-art integrated devices, modules, sensors and peripherals</td>
</tr>
<tr>
<td></td>
<td>• Must have knowledge of media formats and streaming media</td>
</tr>
<tr>
<td></td>
<td>• Must have knowledge of security concepts</td>
</tr>
<tr>
<td>Skills:</td>
<td>• Must be able to understand and overcome limitations of servers, networks and mobile terminals</td>
</tr>
<tr>
<td></td>
<td>• Must be able to develop mobile applications using context information and media distribution</td>
</tr>
<tr>
<td></td>
<td>• Must be able to make qualified decisions on client-server issues and choice of networks</td>
</tr>
<tr>
<td></td>
<td>• Must be able to include security elements in mobile and web-based applications, e.g. for mobile payment</td>
</tr>
<tr>
<td>Competencies:</td>
<td>• Must have competencies in combining a wide range of networks, technologies and devices in order to realize advanced and non-trivial applications and solutions</td>
</tr>
<tr>
<td></td>
<td>• Must have competencies in comparing and assessing the potential of different technologies, methods and approaches in order to make the proper design choices for optimum functionality</td>
</tr>
<tr>
<td>Type of instruction:</td>
<td>Students will do their project work in groups. The groups will receive instruction and feedback from the teacher.</td>
</tr>
<tr>
<td><strong>Exam format:</strong></td>
<td>Internal. Oral examination based on a written project report.</td>
</tr>
<tr>
<td>-----------------</td>
<td>---------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Evaluation criteria:</strong></td>
<td>Are mentioned in the framework provisions.</td>
</tr>
</tbody>
</table>
### Title:
**Development of Mobile Applications**  
(Udvikling af mobile applikationer)

### Prerequisites:
The students should have significant programming experience.

### Objectives:
Students who complete the module:

**Knowledge:**
- Must have knowledge of protocols, APIs and support technologies for mobile applications
- Must have knowledge of device profiles
- Must have knowledge of SIM cards and their functionality
- Must have knowledge of media formats and standards, e.g. H.264, MPEG-4 AVC, SVC, and HTML5

**Skills:**
- Must be able to design mobile user interfaces, which are adapted to a given purpose, are user-friendly and provide a good user experience
- Must be able to understand limitations of servers, networks and terminals
- Must be able to understand communication with integrated or external devices: accelerometers, touch screens, GPS, bar code devices, NFC/RFID devices and other sensors
- Must be able to develop mobile applications using context information, e.g. based on RFID tags
- Must be able to explain the principles behind the most common coding schemes
- Must be able to explain the principles of content scalability
- Must be able to understand and apply state-of-the-art technologies and components for development of advanced functionality of mobile applications
- Must be able to implement and compare simple solutions for distribution of audio and video over networks (streaming, podcasts, etc.)
- Must be able to assess subjective media quality using different approaches

**Competencies:**
- Must have competencies in designing and developing different types of mobile applications, e.g. for payment, communication, context awareness and content distribution
- Must have competencies in combining mobile devices and peripherals for realizing applications with a desired functionality.
<table>
<thead>
<tr>
<th>Contents:</th>
<th></th>
</tr>
</thead>
</table>

| Type of instruction:          | Lectures, group work and lab exercises.                                                                                                                                                                                                 |
| Evaluation criteria:         | Are mentioned in the framework provisions.                                                                                                                                                                                               |
| Title: | Network and Application Security  
(Netværks- og applikationssikkerhed) |
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Prerequisites:</td>
<td>No special prerequisites for the module.</td>
</tr>
<tr>
<td>Objectives:</td>
<td>Today any computer professional must have a basic knowledge about network security. This course will present a practical and theoretical survey of the basic concepts, principles and practice of cryptography and network security.</td>
</tr>
<tr>
<td>Students who complete the module:</td>
<td></td>
</tr>
</tbody>
</table>
| Knowledge: | • Must be able to understand the basic concepts, principles and practice of cryptography and network security  
• Must be able to understand professional articles and documentation concerning security issues  
• Must have knowledge about where to get more information concerning security issues  
• Must be able to understand the various threats, vulnerabilities and attack methods and the function and application of network components and applications used for countering threats  
• Must be able to understand the various classes of cryptographic algorithms, explain their relative properties and the interplay of algorithms in network security applications and protocols  
• Must be able to understand the methods for authentication of people, network traffic and systems in the covered protocols and applications  
• Must be able to understand the typical content and best practices in a company’s security policy |
| Skills: | • Must be able to design, realize and document a security solution in a network  
• Must be able to apply tools for analyzing and generating network traffic to study security protocols and to test, verify and document the implemented solution  
• Must have the ability to take security issues into account when developing IT-systems |
| Competencies: | • Must have competencies in implementing security systems based on current best practices |
### Contents:

### Type of instruction:
Class teaching, lab exercises and one group project.
Approximately 60% of the time will be spent on lab exercises and the group project.

### Exam format:
Internal. Oral examination based on project.

### Evaluation criteria:
Are mentioned in the framework provisions.
<table>
<thead>
<tr>
<th>Title:</th>
<th>Databases (Databaser)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisites:</td>
<td>No special prerequisites for the module.</td>
</tr>
<tr>
<td>Objectives:</td>
<td>To provide the student with theory and practice about construction of a logical and physical data model based on simple systems, and how to implement the systems with support from database tools and generating input/output data.</td>
</tr>
<tr>
<td>Students who complete the module:</td>
<td></td>
</tr>
<tr>
<td>Knowledge:</td>
<td></td>
</tr>
<tr>
<td>• Must be able to understand normalization algorithm dependencies, consistency preservation and the conception of primary/foreign keys</td>
<td></td>
</tr>
<tr>
<td>• Must have knowledge about Database Application Programs</td>
<td></td>
</tr>
<tr>
<td>Skills:</td>
<td></td>
</tr>
<tr>
<td>• Must be able to use database tools</td>
<td></td>
</tr>
<tr>
<td>• Must be able to design databases with entity sets and relationship types together with ER-diagrams</td>
<td></td>
</tr>
<tr>
<td>• Must be able to use the SQL standard for creating and manipulating schemas</td>
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</tr>
<tr>
<td>• Must be able to use Database Application Programs with JDBC</td>
<td></td>
</tr>
<tr>
<td>• Must be able to use Basic Transaction Processing</td>
<td></td>
</tr>
<tr>
<td>• Must be able to use Web applications in connection with databases</td>
<td></td>
</tr>
<tr>
<td>Competencies:</td>
<td></td>
</tr>
<tr>
<td>• Must have the ability to design, develop and use databases</td>
<td></td>
</tr>
<tr>
<td>Contents:</td>
<td></td>
</tr>
<tr>
<td>• Introduction to database tools</td>
<td></td>
</tr>
<tr>
<td>• Introduction to databases with entity sets and relationship types together with ER-diagrams</td>
<td></td>
</tr>
<tr>
<td>• Database normalization algorithm dependencies, consistency preservation and the conception of primary/foreign keys</td>
<td></td>
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<tr>
<td>• Information analyses, database design, metadata and data modelling</td>
<td></td>
</tr>
<tr>
<td>• Queries and updating with SQL standard</td>
<td></td>
</tr>
<tr>
<td>• Database Applications Programming with JDBC</td>
<td></td>
</tr>
<tr>
<td>• Basic Transaction Processing</td>
<td></td>
</tr>
<tr>
<td>• Web applications</td>
<td></td>
</tr>
<tr>
<td>Type of instruction:</td>
<td>Classroom teaching with programming assignments and deliverable compulsory assignments.</td>
</tr>
<tr>
<td><strong>Exam format:</strong></td>
<td>External oral examination based on assignments.</td>
</tr>
<tr>
<td>-----------------</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td><strong>Evaluation criteria:</strong></td>
<td>Are mentioned in the framework provisions.</td>
</tr>
</tbody>
</table>
3.6 6th semester

<table>
<thead>
<tr>
<th>Title:</th>
<th>BSc Project (Bachelorprojekt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisites:</td>
<td>The students should have followed the semesters 1-5.</td>
</tr>
<tr>
<td>Objectives:</td>
<td>To demonstrate the totally acquired knowledge, skills and competencies as described for this bachelor study program (cf. chapter 2 and 3 of this document).</td>
</tr>
<tr>
<td>Students who complete the project:</td>
<td></td>
</tr>
<tr>
<td>Knowledge:</td>
<td>• Must have knowledge of how to design and develop a solution to an ICT related problem serving the needs of the end user</td>
</tr>
<tr>
<td>Skills:</td>
<td>• Must be able to identify organizational, market and legal implications of a given solution to a problem</td>
</tr>
<tr>
<td>Competencies:</td>
<td>• Must show command of the competencies acquired in the semesters 1-5</td>
</tr>
<tr>
<td>Type of instruction:</td>
<td>Students will work individually or in groups. The students will receive instruction and feedback from the teacher.</td>
</tr>
<tr>
<td>Exam format:</td>
<td>External. Assessment is based on a written report and oral presentation. If a project includes development of a prototype, this shall be demonstrated during the examination.</td>
</tr>
<tr>
<td>Evaluation criteria:</td>
<td>Are mentioned in the framework provisions.</td>
</tr>
</tbody>
</table>
**Title:**
*Next Generation Networks*  
*(Næste generations net)*

**Prerequisites:**
Communication and media technologies

**Objectives:**
The purpose of this course is to give students an understanding of the next generation network technologies, including an understanding of the structural differences between the current and the next generation network technologies.

Students who complete the module:

**Knowledge:**
- Must have knowledge about Next generation Core and Access networks
- Must have knowledge about the major broadband technologies, including fixed, wireless and mobile broadband technologies
- Must have knowledge about IMS and SIP protocols
- Must have knowledge about femtocells and their role as an enabler for convergence
- Must have knowledge about Unified Communication
- Must have knowledge about Fixed Mobile Convergence (FMC)

**Skills:**
- Must be able to identify the enabling parameters of the convergence process, in particular in relation to development of new generation network infrastructures
- Must be able to set up SIP-based IP services

**Competencies:**
- Must have competencies in coping with the state of art and complex network technologies, including the gains achieved when different network technologies are integrated/combined
- Must have competencies in assessing the strengths and weaknesses of converged IP networks compared to dedicated network technologies for specific uses
- Must have the competencies in combining theoretical knowledge and practical skills in solving problems related to development of network technologies

**Type of instruction:** Classroom lectures with exercises

**Exam format:** Oral examination based on mandatory exercises.

**Evaluation criteria:** Are mentioned in the framework provisions.
| **Title:** | **Technology and Society**  
| **(Teknologi og samfund)** |
| **Prerequisites:** | No special prerequisites for the module. |
| **Objectives:** | The purpose of this module is for the students to acquire a basic theoretical understanding and empirical knowledge regarding the social conditions for technology development and the broader societal implications of technology implementation and use specifically with respect to communication and media technologies. |
| **Students who complete the module:** | |
| **Knowledge:** | Must have knowledge of theories concerning the drivers of technology development, technology innovation and technology paths  
Must have knowledge of theories concerning the relationship between technology, economy and policy developments  
Must have knowledge of theories concerning invention, innovation and diffusion  
Must have knowledge of theories regarding technological paradigms  
Must have knowledge of theories regarding the social construction of technologies and stakeholder analysis  
Must have knowledge of the history of technology development specifically in the field of transport and communication technologies |
| **Skills:** | Must have skills in identifying the relationships between technology, economic and policy developments regarding specific technology developments  
Must have skills in performing a basic technology assessment analysis  
Must have skills in performing a stakeholder analysis |
| **Competencies:** | Must demonstrate competences in identifying different theoretical approaches to the analysis of technology developments in a societal framework  
Must have competences in choosing and combining relevant theoretical frameworks for the analysis of technology developments at a micro and macro level  
Must have competences in differentiating between social conditions for technology developments and implications of technology development |
<p>| <strong>Contents:</strong> | This module concerns the relationships between technology and societal developments primarily from a macro perspective. It provides the students with a historic and contemporary overview of technology developments in the information and communication technology area. It, furthermore, provides the students with theoretical approaches to understanding such technology developments. |</p>
<table>
<thead>
<tr>
<th><strong>Type of instruction:</strong></th>
<th>Lectures, external lecturers (from business companies), external visits, group work, presentations by students.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exam format:</strong></td>
<td>Internal. Oral exam based on synopsis.</td>
</tr>
</tbody>
</table>
Title: Business Law (Forretningsjura)

Prerequisites: None.

Objectives: To give the students an introduction to the Danish/ EU legal instruments and law relevant for the IT, communication and media industry.

Students who complete the module:

Knowledge:
- Insight at overview level in selected Danish/ EU laws

Skills:
- Must be able to present basic legal problems related to the laws above

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

Contents:
- Danish
  - Commercial Law
  - Company Law
  - Sale of Goods Act
  - IPR
- The relation between Danish and EU law.

Type of instruction: Classroom teaching; projects and group work.

Exam format: Internal. Oral examination based on a written project report.

Evaluation criteria: Are mentioned 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 February 2014.

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.

Chapter 5: Other Provisions

5.1 Rules concerning written work, including the Bachelor's project

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 writing 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 study board can grant exemption from this in special cases (e.g., dyslexia or a native language other than Danish).

The Bachelor's project must include an English summary. The summary must be at least 1 page and not more than 2 pages (this is not included in any fixed minimum and maximum number of pages per student). 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 program at a university in Denmark or abroad

In the individual case, the study board can approve successfully completed (passed) program elements from other Master's programs in lieu of program elements in this program (credit transfer). The study board 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 study board based on an academic assessment. See the Framework Provisions for the rules on credit transfer.

5.3 Rules concerning the progress and completion of the Bachelor's program

The student must participate in all first year examinations by the end of the first year of study in the Bachelor's program, in order to be able to continue the program. The first year of study must be passed by the end of the second year of study, in order that the student can continue his/her Bachelor's program.

In special cases, however, there may be exemption from the above if the student has been on a leave of absence. Leave is granted during first year of study only in the event of maternity, adoption, military service, UN service or where there are exceptional circumstances.

5.4 Rules concerning the completion of the Bachelor's program

The Bachelor’s program must be completed no later than six years after it was begun.
5.5 Special project process
In the 3rd, 4th and 5th semesters, the student can upon application, design an educational pro-
gram where the project work is replaced by other study activities; cf. the Framework Provisions
section 9.3.1.

5.6 Rules for examinations
The rules for examinations are stated in the Examination Policies and Procedures published by the
Faculty of Engineering and Science on their website.

5.7 Exemption
In exceptional circumstances, the study board can grant exemption from those parts of the curricu-
lum that are not stipulated by law or ministerial order. Exemption regarding an examination applies
to the immediate examination.

5.8 Rules and requirements for 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 and in modern English and use reference
works and similar.

5.9 Additional information
The current version of the curriculum is published on the study board’s website, including more
detailed information about the program, including exams.