Curriculum 2014 – Joint National

Bachelor of Software Development

Professionsbachelor i softwareudvikling

Version 1.0
Revised 1 July 2014

Table of Contents – Joint National

1. Scope of the curriculum

1.1. Commencement of the curriculum

This is the joint national part of the curriculum for the top-up programme in Software Development (Bachelor of Software Development), Executive Order no. 975 of 19/10/2009. The curriculum is valid from 1 September 2014 and applies to the following institutions:

Business Academy Aarhus
www.baaa.dk

Københavns Erhvervsakademi
www.kea.dk

Erhvervsakademiet Lillebælt
www.eal.dk

cph business
www.cphbusiness.dk

Erhvervsakademi Sydvest
www.easv.dk

Professionshøjskolen University College Nordjylland
www.ucn.dk

1.2. Transitional scheme

This joint national part of the curriculum is valid from 1 September 2014 and applies to present and future students signing up for this programme and exams taking place on the mentioned date or later. This joint national part of the curriculum replaces the 2013 version, which will not be effective from 31 August 2014.

However, exams that have started before 1 September 2014 must be taken in accordance with this joint national part of the curriculum before 31 August 2014 + 2 semesters at the latest.

1.3. Core areas of the programme

This overview shows the interrelation of core areas, elective elements, internship and the main exam project:

		1st year	2nd year
Core areas	Development of large systems 10 ECTS	10 ECTS	
	Databases for developers 10 ECTS	10 ECTS	
	Contract-based development 10 ECTS	10 ECTS	
	System integration 10 ECTS	10 ECTS	
	Tests 10 ECTS	10 ECTS	
Elective elements		10 ECTS	
Internship			15 ECTS
Bachelor project			15 ECTS
ECTS total		**60 ECTS**	**30 ECTS**

2. Admission to the programme

2.1. Admission requirements and/or distribution of subjects and admission exams, if any

Admission is in accordance with Executive Order no. 1486 of 16 December 2013 on the admission to business academy programmes and academy profession bachelor programmes. This is available at retsinfo.dk.

2.2. Academic criteria for the selection of applicants

If admission to the programme is limited, one or more of the below randomly listed criteria will be prioritised:
- Average mark of the qualifying exam
- Study-relevant experience
- A personal interview to assess motivation and eligibility.

3. Core areas of the programme

The programme consists of the following core areas:
1. Development of large systems (10 ECTS)
2. Databases for developers (10 ECTS)
3. Contract-based development (10 ECTS)
4. System integration (10 ECTS)
5. Tests (10 ECTS)
   In total 50 ECTS

3.1. Content and learning objectives for the core area: Development of large systems

Weight: 10 ECTS

Content
The core area must ensure that students develop competencies that will enable them to work with the development of large systems. After having completed this area, the student should be able to plan and manage development activities involving many project participants as well as design and implement large systems that can be separated into smaller parts and developed by individual development groups.

Learning objectives

Knowledge and understanding
The student will gain knowledge about:
- Problems related to the management of large projects
- Management techniques for large projects
- The roles involved in large development projects

- The challenges of distributed development of systems across organisations or national borders
- Quality systems used to measure and assure the quality
- The different techniques in connection with rolling out large systems
- The implementation of a system in a technically distributed environment (from development environment to operation environment)

Skills
The student will get the skills to:
- Draw up requirements for and between sub-systems
- Assure the quality when implementing changes to requirements across the sub-systems through documentation, including traceability
- Use patterns and framework in the design and implementation of large systems at architectural level
- Divide a software system into smaller parts
- Apply and develop recyclable components
- Specify the collaboration of the parts at an abstract level
- Use techniques for configuration management (version, document, and release management)
- Apply a professional multi-user development environment
- Apply techniques for internal quality assessment between the development groups
- Apply techniques to manage changes to the requirements between the sub-systems

Competencies
The student will be able to:
- Take part in and perform a specific role
- Adapt a development method to the development of large systems
- Take part in cross-cultural global development projects

3.2. Content and learning objectives for the core area: Databases for developers

Weight: 10 ECTS

Content
The core area must ensure that the students develop skills that will enable them to take part in the development of IT systems with the relevant qualities in a professional and efficient way.
Furthermore, the core area must ensure that the students develop skills that will enable them to take part in the entire process from initial idea until final implementation, as well as systematically further develop and integrate IT systems through the application of situational, modern methods of system development and techniques.

Learning objectives

Knowledge and understanding
The student will gain knowledge about:
- Various types of databases and underlying models
- Storage organisation and request execution of a concrete database system

- Optimisation potential of a concrete database system, including pros and cons and any 'trade-offs'
- Database-specific security issues and solutions
- An administration tool to monitor and optimise a concrete database
- Special issues with concurrent multiple transactions, for instance in connection with web and distributed databases.
- Relational algebra

Skills
The student will get the skills to:
- Transform logical data models into physical models using different types of databases
- Optimise databases
- Use the safety system of a concrete database system
- Use parts of an administration tool to optimise and tune the existing databases
- Apply the tools of a concrete database system to manage all transactions
- Apply the facilities and programming options made available by a modern DBMS
- Apply an object relational mapping tool
- Apply relational algebra to understand the optimisation options

Competencies
The student will be able to:
- Analyse the domain of an application for the purpose of choosing a type of database

3.3. Content and learning objectives for the core area: Contract-based development

Weight: 10 ECTS

Content
The core area must ensure that the students develop skills that will enable them to apply contracts to various levels of abstraction using different degrees of formalism in connection with the development of large systems.

Learning objectives

Knowledge and understanding
The student will gain knowledge about:
- The importance of separating specification and implementation
- The connection between contracts and verification of contract performance
- Practical programming with contracts
- Tools that support contract-based programming and design
- Fundamental mathematical structures (set, multi-sets, functions and relations)
- Mathematical techniques of proof
- Programme proposition, validity and correctness of programmes

Skills
The student will get the skills to:
- Draw up functional specifications
- Specify system parts as well as programme areas

- Apply contracts at model level
- Realise parts of a system based on contracts
- Apply contracts at different levels of abstraction and formalism and manage relation and transformation
- Draw up contracts expressed in predicate logic
- Apply contracts for programme element verification
- Apply contracts as an integrated part of the development process
- Apply contracts for the division, co-ordination and assembly of large systems
- Assess the right degree of formalism of the individual relations

Competencies
The student will be able to:
- Apply contracts in cross-cultural global development projects
- Take part in the implementation of contracts in development projects
- Gain knowledge and get skills in Software Development which require knowledge of mathematical terms and structures

3.4. Content and learning objectives for the core area: System integration

Weight: 10 ECTS

Content
The core area must ensure that the students develop skills that enable them to work with the technical integration of systems. After having completed this area, the student must be able to integrate existing systems, integrate existing systems in connection with the development of new systems and develop new systems that support future integration.

Learning

Knowledge and understanding
The student will gain knowledge about:
- Business considerations in relation to system integration
- Standards and standardisation organisations
- Techniques applied in data conversion and migration
- The concept of service and its connection to service-orientated architecture
- Technologies that can be used for the implementation of a service-orientated architecture
- Similarities and differences between object-orientated and service-orientated architecture
- Integration tools

Skills
The student will get the skills to:
- Apply an object-orientated system in a service-orientated architecture
- Design a system that is easily integrated with other systems and makes use of the existing services
- Transform or develop a system so that it can work in a service-orientated architecture
- Apply patterns that support system integration
- Develop additional areas for generic systems

- Integrate generic and non-generic systems

Competencies
The student will be able to:
- Choose between different integration models
- Turn elements in a business strategy into concrete requirements for system integration
- Adjust a system development method to ensure that it supports system integration
- Gain knowledge of the development in integration standards.

3.5. Content and learning objectives for the core area: Tests

Weight: 10 ECTS

Content
This core area must ensure that the students develop skills that enable them to work with planning and implementation of tests. Furthermore, students should be able to see the strategic role of the test in the entire development process and be responsible for the internal quality control of a project.

Learning objectives

Knowledge and understanding
The student will gain knowledge about:
- Important test strategies and models and their role in system development
- Tests as integrated parts of a development project
- Various tests and their application

Skills
The student will get the skills to:
- Plan a test course based on a test model
- Apply black box as well as white box tests
- Apply verification and validation techniques
- Ensure traceability between system requirements and tests at all levels
- Apply tests as part of the quality assurance of a project
- Prepare tests that can be used for the verification of contract performance, including internal contracts between sub-systems
- Apply techniques and tools for the automation of different types of test
- Create systems for the management of tests and fault finding in development projects

Competencies
The student will be able to:
- Select and apply a test strategy, a test model and test techniques that fit the development model in question
- Plan and run internal and external system tests
- Design a test with a relevant scope
- Establish principles for system design that will allow for system testing

4. Compulsory programme elements

The compulsory programme elements are:
1. Development of large systems (10 ECTS)
2. Databases for developers (10 ECTS)
3. Contract-based development (10 ECTS)
4. System integration (10 ECTS)
5. Tests (10 ECTS)

In total 50 ECTS

The five compulsory programme elements are the same as the five core areas, their title, content, ECTS weight and learning objectives.

The five compulsory programme elements are completed with an exam.

Assessment
The individual exam is assessed on the basis of the 7-point scale and has a total of 10 ECTS.

The learning objectives for the programme element is identical to the learning objectives for the exam. For further information on exam form and organisation, etc., see the institutional part of the curriculum.

4.1. Number of exams in the compulsory programme elements

The five compulsory programme elements are each completed with an exam. See section 7 for an overview of the programme exams.

ECTS overview and connection between core areas and compulsory programme elements:

Compulsory programme elements	Development of large systems	Database for developers	Contract-based development	System integration	Tests	ECTS In all
Core areas						
Development of large systems	10 ECTS					10 ECTS
Database for developers		10 ECTS				10 ECTS
Contract-based development			10 ECTS			10 ECTS
System integration				10 ECTS		10 ECTS
Tests					10 ECTS	10 ECTS
In all	10 ECTS	10 ECTS	10 ECTS	10 ECTS	10 ECTS	50 ECTS

5. Internship

Weight: 15 ECTS

Content
The internship is planned so as to contribute to students' developing practical skills in combination with the other parts of the programme. The purpose of the internship is to enable the student to apply the methods, theories and tools of the programme to solve concrete, practical tasks within Software Development.

Learning objectives

Knowledge and understanding
The student will gain knowledge about:
- Day-to-day management of the internship company

Skills
The student will get the skills to:
- Apply versatile technical and analytical working methods related to the business in question
- Assess real-life problems and come up with solutions
- Provide real-life problems and well-founded solutions

Competencies
The student will be able to:
- Manage development-orientated practical and technical situations in relation to the business
- Acquire new knowledge, skills and competencies in relation to the business
- Take part in technical and interdisciplinary collaboration with a professional approach
- Manage the structuring and planning of the daily work of the business

The internship is completed with an exam.

The learning objectives for the programme element are identical to the learning objectives for the exam.

For information on examination form and organisation, etc., see the institutional part of the curriculum.

6. Bachelor project

Weight: 15 ECTS

Requirements for the bachelor project
Through the use of analysis and methodology, the students must document their ability to solve a complex, real-life situation in relation to a concrete task within the IT area. The thesis statement must be essential to the programme and the business and

should be outlined by the student, possibly in collaboration with a private or a public company. The Academy must approve the thesis statement.

Students must hand in a project report and a product, if required.

The project report, which is the written part of the exam, must include the following as a minimum:

- Front page with title
- Table of contents (TOC)
- Introduction including thesis statement
- Method
- Analysis
- Solution, if any
- Conclusion
- Bibliography (including all sources which have been referenced in the project)
- Appendices (only include documents central to the report)

The project report must not exceed 20 standard pages + 20 standard pages per student.
Front page, table of contents, bibliography and appendix are not included in the required number of pages. Appendices will not be assessed.

A standard page consists of 2,400 characters including spaces and footnotes.

Spelling and formulation skills
Spelling and formulation skills form part of the main exam project. It is an overall assessment of the academic content as well as the student's spelling and formulation skills.

Students who can document a relevant, specific disability can apply for dispensation from the spelling and formulation requirements. The application must be sent to the educational institution no later than four weeks before the exam takes place.

Learning objectives
The exam project must document that graduation level has been obtained, c.f. Appendix 1 of the Executive Order for the Bachelor of Software Development programme.

Knowledge and understanding
The graduate must have knowledge about:

- The strategic role of testing in system development
- Globalisation of software production
- System architecture and understanding of its strategic importance for the business activities
- Knowledge about applied theory and method and the prevailing technologies in the domain in question
- The connection between applied theory, method and technology and reflections on their applicability in different situations.

Skills
The graduate must have the skills to:

- Integrate IT-systems and develop systems that support future integration
- Apply contracts as a management and co-ordination mechanism in the development process

- Assess and choose database systems and design, redesign and optimise database operation
- Plan and manage development courses with many project participants in different geographical locations
- Establish and use the right degree of formalism in connection with the internal communication and coordination of the development projects.

Competencies
The graduate has learnt to:
- Plan and run tests of large IT systems
- Enter professional collaboration on the development of large systems through the application of prevailing methods and technologies
- Familiarise themselves with new technology and standards for the management of system integration
- Develop their own competency profile through practice from primarily backend development profile to handling tasks as a system architect
- Handle the establishment and realisation of an appropriate architecture for large systems technologically and in relation to the business

Assessment
The exam is external and will be assessed according to the 7-point scale.

The exam consists of a project and an oral part. The student receives one mark for both performances. The exam can only take place when the student has passed the main internship exam and the other programme exams.

For information on the examination form and organisation, etc. of the exam; see the institutional part of the curriculum.

7. Overview of examinations and their timing

Overview of all examinations and their timing:

Exam	90 ECTS distributed on the exams	Assessment
1. Development of large systems	10	7-point scale
2. Databases for developers	10	7-point scale
3. Contract based development	10	7-point scale
4. System integration	10	7-point scale
5. Tests	10	7-point scale
6. Elective area exam/s[1]	10	7-point scale
7. Internship exam	15	7-point scale
8. Main exam project	15	7-point scale

1. Elective areas and accompanying exam(s) are described in the institutional curriculum.

8. Credit

Programme elements that have been passed are equivalent to similar programme elements at other educational institutions where the programme is offered.

Students are obligated to supply information about programme elements they have passed at other Danish or foreign institutions of higher education and any employment assumed to give credits. The educational institution approves credits individually on the basis of passed programme elements and employment that equal the subjects, programme parts and internship elements. The decision is based on an academic evaluation.

8.1. Credit for elective programme elements

Elective elements that have been passed are equivalent to similar programme elements at other educational institutions that offer the programme as well as other programmes.

8.2. Prior credit approval

Students can apply for prior credit approval. With prior credit approval of studies in Denmark or abroad, students are required to document each approved and completed programme component. In connection with applying for prior credit approval, the students give the institution permission to obtain the necessary information after completion.

Upon approval of the prior credit approval, the programme component is considered completed if it is passed according to the rules of the programme.

8.3. Credit schemes

See the institution website.

8.4. Rules of exemption

The educational institution can deviate from what the institution or the institutions have stated in the curriculum if this is justified by exceptional circumstances. The various institutions must cooperate in order to have a homogenous dispensation policy.

9. Approval

This institutional part of the curriculum has been enacted and approved by the educational network for the Software Development programme.

On behalf of the network:

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Head of Department Gert Simonsen
For Business Academy Aarhus