Curriculum for the AP Graduate in Chemical and Biotechnical Science

2010

Erhvervsakademiuddannelsen inden for laboratorieområdet (laborant AK)
AP Graduate in Chemical and Biotechnical Science

February 2010

Contents

Part 1: Common section

1. Programme

1.1. Aim

The objective of the study programme is to provide the graduate with the qualifications to plan and perform tasks of a technical nature within the laboratory field in connection with production, development, consulting and control in technical laboratories in both the private and public sectors.

1.2. Scope

The programme is a full-time course of study corresponding to 150 ECTS points. 60 ECTS points correspond to one year of full-time study.
The programme must be completed no later than 4.5 years after the commencement of studies.

1.3. Educational objectives

The learning outcome goals include the knowledge, skills and competencies that must be acquired during the course of study, cf. Danish Ministry of Education, (*Uddannelsesbekendtgørelsen*) – ministerial order no. 976 of 19 October 2009.

Knowledge

Graduates possess:

- knowledge about the general principles for working in the laboratory, for maintaining a good working environment and for environmentally correct handling of chemicals and products
- knowledge about chemistry and biochemistry related to use in the laboratory
- knowledge about measurement principles, the function and setup of analysis equipment in relation to standard use, maintenance and troubleshooting
- knowledge about the structures of microorganisms, pathogenicity and function in natural and man-made environments
- knowledge about the structure and function of genes
- knowledge about proteins related to laboratory work, including in particular, enzymes and immunoglobulins
- knowledge about and an understanding of the principles for documenting laboratory work, as well as being acquainted with quality assurance in the laboratory
- knowledge about the organisation of the workplace, types of cooperation and interaction with the outside world

Skills

Graduates possess:

- the skills to select and use basic laboratory unit operations and methods of analysis
- the skills to make choices, operate, control and maintain all standard laboratory equipment and carry out elementary troubleshooting
- the skills to select and use relevant laboratory methods and techniques

- the skills to prepare and perform simple chemical syntheses and characterise the products as well as evaluate the results
- the skills to perform laboratory calculations and utilise statistical methods in the evaluation of results
- the skills to use instructions, directives and manuals written in both Danish and English
- the skills to use IT in connection with laboratory work and reporting
- the skills to communicate results and problems from the laboratory to colleagues and other stakeholders
- the skills to conduct simple method development and method validation, evaluate observations in the laboratory and document own work in relation to current quality assurance rules

Competencies

Graduates possess:

- competencies in planning, performing and documenting laboratory assignments, including suggesting changes, implementing optimisation procedures and localising errors
- competencies in the appropriate handling of laboratory work in terms of safety, health and environmental aspects
- competencies in professional and interdisciplinary cooperation, including working in research-oriented contexts
- competencies in acquiring in a structured manner new knowledge, skills and competencies relating to the laboratory field

1.4. Title

Graduates of the programme will be granted the Danish title: *Laborant (AK)*.
The English title is: *AP Graduate in Chemical and Biotechnical Science*

2. Content and structure of the programme

The structure of the study programme is described in the following models:

		1st & 2nd Semester ECTS	3rd Semester ECTS	4th & 5th Semesters ECTS
Core areas – Compulsory	Laboratory techniques and know-how	30		
	Biotechnology	15	10	
	Chemical technology	15	10	
Elective elements			10	
Internship				50
Final exam project				10

1st & 2nd Semesters:

Compulsory elements:

- Chemistry and biochemistry – 10 ECTS
- Laboratory techniques and calculations – 10 ECTS
- Quality assurance, communication and working environment – 10 ECTS
- Microbiology – 5 ECTS
- Fermentation, protein purification, protein characterisation and immunochemistry – 10 ECTS
- Spectrophotometric and potentiometric methods – 5 ECTS
- Chromatographic methods – 10 ECTS

3rd Semester:

Compulsory elements:

- Biotechnological laboratory methodologies and advanced techniques – 10 ECTS
- Chemical technological laboratory methodologies and advanced techniques – 10 ECTS

Elective elements:

- 10 ECTS

4th & 5th Semesters:

Internship:

- 50 ECTS

Final project exam:

- 10 ECTS

3. Educational objectives for core areas

3.1. Laboratory techniques and know-how (30 ECTS)

Content
Consists of the following compulsory elements:

- Chemistry and biochemistry
- Laboratory techniques and calculations
- Quality assurance, communication and working environment

Educational objectives

Knowledge
The students possess:

- knowledge about and an understanding of the general work techniques in the laboratory
- knowledge about the principles for maintaining a good working environment
- knowledge about the principles for environmentally correct handling of chemicals and products
- knowledge about chemistry and biochemistry as used in the laboratory
- knowledge about measurement principles, the function and setup of analysis equipment in relation to standard use
- knowledge about quality assurance in the laboratory field
- knowledge about various types of cooperation

Skills
The students possess:

- skills in selecting and using basic laboratory unit operations and analytical methods
- skills in making choices, operating and controlling basic laboratory equipment
- skills in preparing and performing simple chemical syntheses and characterising the products as well as evaluating the results
- skills in performing laboratory calculations and utilising statistical methods in the evaluation of results
- skills in using instructions, directives and manuals written in both Danish and English
- skills in using IT in connection with laboratory work and reporting

Competencies
The students possess:

- competencies in planning and performing basic laboratory work in an appropriate manner in terms of safety, health and environmental aspects
- competencies in documenting and presenting own work in relation to current quality assurance rules
- competencies in selecting statistical methods by evaluating results
- competencies in cooperating with students with a corresponding level of education

3.2. Biotechnology (25 ECTS)

Content
Consists of the following compulsory elements:

- Microbiology
- Fermentation, protein purification, protein characterisation and immunochemistry
- Molecular biology techniques, cell culture techniques and method optimisation

Educational objectives

Knowledge
The students possess:

- knowledge about microbiological processes and methods
- knowledge about biotechnology and molecular biological methods
- knowledge about legislation within the fields of microbiology and biotechnology

Skills
The students possess:

- skills in selecting and using basic microbiological techniques
- skills in using biotechnology and molecular biological techniques
- skills in carrying out method optimisation of selected biotechnological techniques
- skills in performing quality assurance of and evaluating the results of microbiological and biotechnology analyses
- skills in planning own work over an extended period of time

Competencies
The students possess:

- competencies in planning, quality assurance of and performing tasks in a microbiology and biotechnological laboratory in a safe manner
- competencies in documenting, evaluating and communicating the results achieved in microbiological and biotechnological laboratory

3.3. Chemical technology (25 ECTS)

Content
Consists of the following compulsory elements:

- Spectrophotometric and potentiometric methods
- Chromatographic methods
- Laboratory methodologies and advanced techniques

Educational objectives

Knowledge
The students possess:

- knowledge about methods and techniques in chemical analysis
- knowledge about quality assurance of equipment, methods and results in a chemical laboratory

Skills
The students possess:

- skills in selecting and using basic analysis equipment
- skills in performing chemical analyses
- skills in performing quality assurance of and evaluating the results of chemical analyses
- skills in carrying out method optimisation and method validation
- skills in planning own work over an extended period of time

Competencies
The students possess:

- competencies in planning, quality assurance of and performing tasks in a chemical laboratory in a safe manner
- competencies in documenting, evaluating and communicating the results achieved in a chemical laboratory

4. The programme's compulsory elements

The programme consists of compulsory elements corresponding to a total of 80 ECTS points.

4.1. Educational objectives and content of the compulsory elements in the 1st + 2nd semesters

4.1.1. Chemistry and biochemistry (10 ETCS)

Content

Salts and molecules, intermolecular forces and polarity, material states and transitions, types of reactions, equilibriums, solubility, pH calculations, chemical unit operations. Hydrocarbons, halogen substitution, hydroxyl substitution and amino substitution of hydrocarbons, oxo compounds, carboxylic acids and derivatives, lipids, carbohydrates, amino acids and peptides.

Educational objectives

Knowledge

The students possess:

- Basic knowledge about chemistry and chemical reactions in relation to use of chemicals in the laboratory
- Basic knowledge about biochemistry and biochemical reactions in relation to use in the laboratory

Skills

The students possess:

- skills in writing and balancing chemical reaction schemes
- skills in using his or her elementary knowledge of chemicals in connection with producing substrates and reagents
- skills in using his or her elementary knowledge of chemicals in relation of analysis principles

Competencies

The students possess:

- competencies in acquiring knowledge and skills within chemical technology and biotechnology

4.1.2. Laboratory techniques and calculations (10 ETCS)

Content
Sterilisation and disinfection, aseptic work processes, substrate production, culturing, cultivating and counting microorganisms and microscopy.
The SI system, units, atomic and molar mass, stoichiometric calculations, significant figures. Acid-base, precipitation, redox and complexometric titration, purity determination, reagent production, dilutions and synthesis techniques and calculations.
Use of scales and volumetric equipment, basic methods of characterising pure substances and solutions, pH and potentiometric determinations.

Educational objectives

Knowledge
The students possess:

- knowledge about and an understanding of the general work techniques in the laboratory, including carefulness, uniformity, objectivity and basic safety
- knowledge about the basic techniques in the laboratory, including handling samples, aseptic techniques, reagent and substrate production and use of standard laboratory equipment
- knowledge about measurement principles, the function and design of analysis equipment in relation to standard use

Skills
The students possess:

- skills in making choices and operating basic laboratory equipment
- skills in producing reagents and substrates
- skills in selecting and using basic laboratory unit operations and analytical methods in microbiological as well as chemical laboratories
- skills in applying laboratory calculations in connection with substrate and reagent production and results processing
- skills in using a variety of unit operations to perform simple chemical syntheses and purifications
- skills in characterising synthesis products and evaluating the results of chemical syntheses
- skills in applying instructions, directives and manuals written in both Danish and English

Competencies
The students possess:

- competencies in planning and performing basic tasks in a chemical and microbiological laboratory in a safe manner
- competencies in performing calculations in connection with basic tasks in a chemical and microbiological laboratory

4.1.3. Quality assurance, communication and working environment (10 ETCS)

Content
An introduction to international standards, quality assurance of analysis results, traceability and control charts.
Laboratory-relevant statistics, normal distribution, confidence interval, tests of one or more variables.
Use of spreadsheet functions and graphs.
General laboratory safety rules, safety equipment in the laboratory and personal protective equipment, first aid, classification and labelling of chemicals and products, handling waste, the Danish Working Environment Act (*Arbejdsmiljøloven*) and workplace manuals.
Writing laboratory journals and reports, project and group work, literature searches and technical English.

Educational objectives

Knowledge
The students possess:

- knowledge about and an understanding of the principles of a good working environment and of environmentally correct handling of chemicals and products
- knowledge about and an understanding of the principles of documenting laboratory work
- knowledge about current quality assurance rules
- knowledge about statistics and simple statistical methods
- knowledge about various types of cooperation

Skills
The students possess:

- skills in classifying and labelling laboratory reagents in accordance with current regulations
- skills in handling waste in accordance with current regulations
- skills in performing quality assurance of the results of analyses with complete documentation and control
- skills in inspecting basic laboratory equipment
- skills in using statistics, statistically methods and simple tests to evaluate results
- skills in reporting laboratory results
- skills in using IT in connection with laboratory work and reporting
- skills in cooperating with others

Competencies
The students possess:

- competencies in documenting and presenting own work in relation to current quality assurance rules
- competencies in presenting and discussing own data
- competencies in planning and performing laboratory work in an appropriate manner in terms of safety, health and environmental aspects

4.1.4. Microbiology (5 ECTS)

Content
Eukaryotic and prokaryotic cells, nutrition, metabolism and growth.
Systematic bacteriology, fungi and viruses, the prevalence, importance and use of bacteria, culture and identification principles.
Standard procedures, statistics, risk assessment, quality assurance of microbiological work.

Educational objectives

Knowledge
The students possess:

- knowledge about work and safety in a microbiological laboratory
- knowledge about the structure, metabolism, growth conditions and importance of microorganisms
- knowledge about the systematic of bacteria and fungi
- knowledge about the prevalence and importance of pathogenic microorganisms
- knowledge about the principles of substrates
- knowledge about the use of rapid methods

Skills
The students possess:

- skills in selecting and using microbiological culture techniques to detect and identify microorganisms
- skills in performing microbiological analyses according to standard procedures
- skills in performing quality assurance of and evaluating the results of microbiological analyses

Competencies
The students possess:

- competencies in planning, quality assurance of and performing tasks in a microbiological laboratory in a safe manner
- competencies in documenting, evaluating and communicating the results achieved in a microbiological laboratory

4.1.5. Fermentation, protein purification, protein characterisation and immunochemistry (10 ECTS)

Content

Propagation, fermentation types, fermentation equipment and product isolation.

The structure and function of proteins and protein determination.

Enzyme catalysis, activity, kinetics, inhibition and enzyme assays.

Methods for protein purification and characterisation of the properties of proteins, e.g. salt precipitation, dialysis, column chromatography and gel electrophoresis.

The immune system and antibody production, antigens, immunoglobulins, immunochemical analysis methods, e.g. ELISA, agglutination tests, precipitation techniques and immunoblotting.

Educational objectives

Knowledge

The students possess:

- knowledge about fermentation types as well as related upstream and downstream processes
- knowledge about proteins, including enzymes, related to laboratory characterisation and use
- knowledge about protein purification and characterisation methods
- knowledge about the immune system, immunoglobulins as well as immunochemical methods

Skills

The students possess:

- skills in performing fermentation and quantification of the product
- skills in performing enzyme kinetic measurements
- skills in performing protein purification and characterisation and in evaluating the results
- skills in using immunochemical methods, evaluating the results and performing elementary troubleshooting

Competencies

The students possess:

- competencies in planning, quality assurance of and performing tasks in a biotechnological laboratory
- competencies in documenting, evaluating and communicating the results achieved in a biotechnological laboratory

4.1.6. Spectrophotometric and potentiometric methods (5 ECTS)

Content
UV/VIS, AAS and IR equipment and electrodes: instrumentation, use, calibration, sample handling, control, evaluation of results, documentation.

Educational objectives

Knowledge
The students possess:

- basic knowledge about electromagnetic radiation
- knowledge about spectrophotometric equipment and analysis principles
- knowledge about potentiometric equipment and analysis principles

Skills
The students possess:

- skills in performing and quality assurance of quantitative determinations
- skills in preparing, operating and maintaining spectrophotometers, pH meters and electrodes and performing elementary troubleshooting
- skills in using spectrophotometric identification methods
- skills in performing simple equipment qualification

Competencies
The students possess:

- competencies in planning, quality assurance of and performing spectrophotometric and potentiometric analyses
- competencies in documenting, evaluating and communicating spectrophotometric and potentiometric analyses

4.1.7. Chromatographic methods (10 ECTS)

Content
LC and GC equipment: instrumentation, use, optimisation, calibration, sample handling, control, evaluation of results, documentation

Educational objectives

Knowledge
The students possess:

- knowledge about the principle of chromatography
- basic knowledge about the design and function of LC and GC equipment
- basic knowledge about the principles for regulating selectivity in chromatography: the chemistry and selectivity of stationary and mobile phases, pH and temperature
- knowledge about integration software

Skills
The students possess:

- skills in performing and quality assurance of qualitative and quantitative determinations
- skills in preparing, operating and optimising chromatography equipment and performing elementary troubleshooting
- skills in performing basic method development

Competencies
The students possess:

- competencies in planning, quality assurance of, performing and optimising chromatographic methods
- competencies in documenting, evaluating and communicating chromatographic results

4.2. Educational objectives and content of the compulsory elements in the 3rd semester

4.2.1. Biotechnological laboratory methodologies and advanced techniques (10 ECTS)

Content

DNA, RNA, structure and function, DNA/RNA techniques.
DNA polymerases, restriction enzymes and ligation – prevalence and applications. Standard PCR, detection of PCR products.
Cloning, genetic analysis, hybridisation and sequencing.
Cell cultures, legislation concerning working with GMOs, and laboratory classification procedures. Ethics.

Educational objectives

Knowledge

The students possess:

- knowledge about the structures and function of DNA and RNA as well as protein synthesis
- knowledge about molecular biological techniques
- knowledge about classification and declassification of laboratories for gene technological work in accordance with current legislation
- knowledge about simple cell culture techniques

Skills

The students possess:

- skills in using biotechnological/molecular biological techniques and possibly cell culture techniques
- skills in cloning of DNA in a microorganism
- skills in carrying out method optimisation
- skills in performing quality assurance of and evaluating the results of molecular biological analyses
- skills in planning and organising own work over an extended period of time, taking into account materials, equipment, quality assurance, safety and time consumption

Competencies

The students possess:

- competencies in planning, quality assurance of and performing tasks in a molecular biological laboratory in a safe manner
- competencies in documenting, evaluating and communicating results and suggesting changes to colleagues and other stakeholders
- competencies in using knowledge and methods in new contexts
- competencies in acquiring skills and new knowledge in a structured manner

4.2.2. Chemical technological laboratory methodologies and advanced techniques (10 ECTS)

Content
Qualification of equipment, validation of methods, method adjustment and development, planning of work over an extended period of time, and understanding of selected techniques, e.g. ICP, MS, NMR.

Educational objectives

Knowledge
The students possess:

- knowledge about selected advanced laboratory techniques
- basic knowledge about the qualification of laboratory equipment
- knowledge about the validation of analysis methods

Skills
The students possess:

- skills in choosing, using and optimising selected advanced analysis techniques
- skills in planning and organising own work over an extended period of time, taking into account materials, equipment, quality assurance, safety and time consumption

Competencies
The students possess:

- competencies in planning and performing complex laboratory assignments
- competencies in participating in qualification and validation tasks
- competencies in documenting, evaluating and communicating results and suggesting changes to colleagues and other stakeholders
- competencies in using knowledge and methods in new contexts
- competencies in acquiring skills and new knowledge in a structured manner

5. Internship (50 ECTS)

The Chemical and Biotechnical Science programme's internship takes place at a company. The internship corresponds to 50 ECTS points and must take place in 4-5 semesters and before the final project exam.
The internship is carried out as a paid position in one or more Danish or foreign companies cf. Danish Ministry of Education, ministerial order no. 976 of 19 October 2009. (*Uddannelsesbekendtgørelsen*).

Content

Educational element	ECTS points
Workplace organization and culture	5
Health and safety at work	5
Quality assurance systems	5
Laboratory technical methods	35

5.1. Educational objectives

5.1.1. Workplace organisation and culture

Knowledge

The students possess:

- knowledge about the company's core focus areas and mission
- knowledge about the company's organisation
- knowledge about the laboratory's communication and decision-making processes
- knowledge about the workplace's procedures for purchasing and ordering internal services

Skills

The students possess:

- skills in adapting to the norms, behaviour patterns and values of the workplace

Competencies

The students possess:

- competencies in cooperating and communicating with different professional groups affiliated with the laboratory

5.1.2. Health and safety at work

Knowledge
The students possess:

- knowledge about the company's internal Safety Organisation
- knowledge about use and preparation of material data safety sheets
- knowledge about workplace assessments
- knowledge about procedures for handling waste

Skills
The students possess:

- skills in choosing personal protective equipment

Competencies
The students possess:

- competencies in planning and performing laboratory work in a safe and environmentally appropriate manner
- competencies in participating in the preparation of workplace instructions and workplace assessments

5.1.3. Quality assurance systems

Knowledge
The students possess:

- knowledge about the company's quality assurance procedures, including the procedures for ensuring reliable results and procedures for documentation

Skills
The students possess:

- skills in documenting own work in relation to the quality assurance procedures, including registration and journalizing according to the set requirements

Competencies
The students possess:

- competencies in contributing to the maintenance/expansion of the company's quality assurance procedures
- competencies in participating in the company's validation of equipment and methods

5.1.4. Laboratory techniques and methods

Knowledge

The students possess:

- knowledge about the most important methods used in the workplace, including their principles and employment

Skills

The students possess:

- skills in using a wide variety of the analyses and methods employed at the workplace

Competencies

The students possess:

- competencies in planning, carrying out and evaluating own work

6. Exams

The programme's educational objectives are documented during the course of study through exams, in the form of oral and written exams, grades for assignments and projects, participation in seminars, exercise series etc.

The exams are either internal or external. At external exams, an external examiner is appointed by the Danish Ministry of Education. At internal exams, the assessment is carried out by one or more lecturers appointed by the educational institution. The exam provisions for the individual exams indicate whether the exam is internal or external.

To participate in exams during the course of study may imply that one or more of the student's compulsory assignments/activities in the individual courses and projects have been approved.

6.1. Overview of exams and tests

The programme comprises the following exams distributed by semester.

Exam	2nd Semester	3rd Semester	5th Semester	Assessment
First-year test – external – written	X			Danish 7-point scale
Third-semester test – external – report + oral exam		X		Danish 7-point scale
Internship test – internal – written report			X	Pass/Fail
Final project exam – external – project report + oral exam			X	Danish 7-point scale

Every exam/test must be passed.

6.2. Guidelines for exams

1. First-year test

This is a written test. The educational institution defines the terms for the exam – see the section on the educational institution in this curriculum.

3. Third-semester test

The test is in the form of a project/course work and an oral exam based on a written report.

Internship test

The internship's written report must be submitted and the exam passed before the student may submit his or her final project exam.
In the report, the student must describe in broad terms how the educational objectives for the internship period have been achieved. The individual institution will provide the student with supervision regarding the structure, scope etc. of the report – see the section on the educational institution in this curriculum.

Final project exam

The educational institution must hold an oral exam with an external examiner in accordance with the Danish Ministerial Order on Examinations (*Eksamensbekendtgørelsen*). There are four exam periods per year:
Weeks 3-4, Weeks 16-17, Weeks 25-26 and Weeks 43-44.

The grade reflects an overall evaluation of the project and the oral presentation.

7. Access to the exams

All exams that must be attended before the end of the first year after the commencement of studies according to the ministerial order or this curriculum must be passed before the end of the student's second year after the commencement of studies.
Finally, all tests/exams in 1st, 2nd and 3rd semester of the programme and the test for the internship must be passed before the student may submit a final project report.

In order to access the tests on a semester, all compulsory assignments and other compulsory conditions must be approved – see the section on the educational institution in this curriculum.
The exam regulations issued by the educational institution also apply.

PART 2: EDUCATIONAL INSTITUTION SECTION

8. Elective elements

The programme includes elective elements corresponding to 10 ECTS points. These 10 ECTS points are placed as one educational element in 3rd semester.

8.1. Specialisation (10 ECTS)

8.2. Educational objectives and content

Content

Project planning, use of selected methods and techniques, documentation and writing reports.

Educational objectives

Knowledge

The students possess:

- knowledge about the methods selected to carry out the specialisation project, including the principles and use of the methods

Skills

The students possess:

- skills in choosing relevant methods and equipment to carry out the project chosen
- skills in independently planning a project, in cooperation with other students, that ensures optimum use of the available equipment and time
- skills in carrying out a project that involves relevant quality assurance and safety procedures
- skills in acquiring new knowledge relating to the project

Competencies

The students possess:

- competencies in using knowledge about and skills within analysis techniques in new contexts to solve complex, practise-oriented problems
- competencies in documenting, processing and evaluating laboratory results in a correct scientific manner

9. Rules for the implementation of the internship

An internship is on-the-job education

On-the-job education gives the student the opportunity to work with the company's assignments and, in so doing, fulfil the educational objectives. When planning an internship, consideration must be given to the student's qualifications and previous knowledge of the subject. All teaching must primarily be in the form of instruction and through integrating the educational objectives in the student's daily work. The student must participate in the company's safety, working environment and quality assurance-related work.

'Company' is understood as either the company as a whole or part of a company or public institution.

9.1. Requirements of the involved parties

Contacts

The educational institution appoints a contact to provide the company with guidance regarding the internship.

The company appoints a person who is responsible for the student's on-the-job education and contact with the educational institution. The person responsible must possess competencies within the study programme's focus area.

Study plan

At the commencement of the internship, the company and the student agree on a study plan to ensure that the objectives of the internship are fulfilled. The educational institution may provide advice on the organisation of the study plan if needed.
During the first week, the company must send the study plan to the educational institution for approval. If there are problems approving the study plan, it must be revised based on the advice of the educational institution. The plan must receive final approval within four weeks of the commencement of the internship period.

Scope

The internship period has a scope of 50 ECTS points, corresponding to 5/6 of a year of study.

Assessment

The outcome of the student's internship must be assessed in a report written by the student briefly describing how the educational objectives of the internship period have been fulfilled.

9.2. Study documents

The educational institution supplies the study documents that must be used to document the student's course of study. All study documents are available in electronic versions.
The documents comprise:

A. Parties to the agreement
B. Study plan
C. Final project exam
D. Weekly journal
E. Approval sheet

A) Information on the parties to the internship agreement – student, company and educational institution. The two top fields of the form must be completed by the company and submitted to the educational institution, which completes the bottom two fields and then submits a copy to the company.

B) In connection with the internship period, the company and the student must agree on a study plan.
The study plan for the 44-week period must be entered in a pre-printed form (Word). The educational institution must ensure that the internship study plan has the necessary structure with regard to subjects and the time division of subjects during the internship period.
The educational institution may be consulted in the process of drawing up the study plan.
The study plan must include time for the student to become acquainted with the principles and theoretical backgrounds of all the educational elements used during the internship period, as well as time to write the report for the internship exam.

C) Terms for the final project exam
C1) Terms for the final project exam
C2) Deadline for final project exam
The educational institutions have set four annual exam periods when the final project report may be submitted and the exam take place.
C3) Project formulation

Documents A, B and C2 must, if at all possible, be completed before the commencement of the internship period and must within the first week of the internship period be submitted to the educational institution where the student has followed his or her third semester of study. The educational institution must give final approval of the study plan within the first four weeks of the internship period.

Document C3 must be submitted for approval by the date set out in document C2.
If, during the internship period, there are deviations from the study plan, the educational institution must be contacted with a view to changing the agreements.

D) The student must keep a weekly journal throughout the internship period, stating the tasks, analyses etc. that have been performed each week and the topics the student has worked with. Examples of weekly journals are available from the educational institution.

The weekly journal must be shown during visits to the company. The weekly journal must be submitted to the educational institution along with the written report for the internship period.

E) At the end of the internship period, the educational institution must complete a form approving the weekly journal. This form will also state the grade earned for the internship (pass/fail). A copy of this form must be sent to the company.

The educational institution must keep the original documents A, B, C2, C3 and D in its records.

Absence:

In case of absence due to pregnancy/parental leave or other leave, the study period must be extended corresponding to the leave of absence period.

Dialogue with the educational institution:

During the internship period, the educational institution will maintain contact with the student and the company.
The dialogue may comprise:

- Advice in connection with setting out the timetable and completing the study documents
- Advice on educational objectives
- Agreement on extension of study period due to pregnancy/parental leave or other leave of absence
- Supervision in connection with the completion of the exam project in the company, including defining the problem formulation

10. Tests in elective elements and supplementary tests

A project must be carried out and a report completed within the student's area of specialisation. The specialisation report must be submitted on time and approved in order for the study element to be considered passed.
The report is assessed according to the Danish 7-point scale and must as a minimum earn a grade of 02 to be considered passed.
The specialisation report must be approved before the study programme can be considered passed.

11. Internationalisation

The students may carry out the internship at Danish as well as foreign companies or institutions.
The students may complete the final project at Danish as well as foreign companies or institutions.

The educational institution can provide assistance with information on the study programme, regulations and supervision etc.

12. Teaching and working methods employed

The programme places great emphasis on the working methods of the project group as well as the working methods employed. The project-oriented working method provides the students with important experience with group work.
In the planning of the courses, an effort is made to vary the teaching methods, including between theory and practice. The team of teachers strives to include topicality and relevance in the programme, both in terms of the topics taught and in its educational approach.
Group guidance and individual guidance interviews support the professional and personal development of the individual.
An important prerequisite for completing the programme is that the individual student takes active part in classes, the project work and the guidance interviews. The student is expected to share responsibility for own learning, which requires motivation, commitment, independence, initiative and critical thinking.

13. Guidelines for differentiated teaching

The teaching is adjusted regularly to take into account the academic level of the students.

14. Rules on credit transfer

The institution may approve passed study elements or parts of study elements taken at another institution that are equivalent to corresponding study elements or parts of the study elements in the current curriculum. If the study element in question has been assessed according to the Danish 7-point scale at the institution where the exam took place, and is the

equivalent of an entire element in the current curriculum, the grade may be transferred. In all other cases, the course may be transferred as 'passed', but may not be included in the calculation of the grade average.

The institution may approve passed study elements from another Danish or foreign institution of higher education as taking the place of study elements included in this curriculum. Upon approval, the study element is considered completed if it has been passed according to the terms of the study programme in question. The course is transferred as 'passed'.

15. Rules on the requirement of active participation by the student during the course of study and requirements for written assignments and projects

15.1. The requirement of active participation by the student during the course of study

If the institution decides that the student's study activity is unsatisfactory (large number of absences, assignments not handed in and presentations not made, insufficient participation in group work etc), a warning will be issued in writing consisting of an action plan that must be followed. If the action plan is not complied with, the student may not continue his or her studies and the institution may disenrol the student from the programme.

15.2. Repeating a semester

If a student accepts the institutions offer to repeat a semester, the student must again comply with all set requirements and pass all tests of the semester in question. Any results previously achieved for the same semester may not be considered as part of the evaluation for the repeated semester.

15.3. Assessment and exams at Business Academy Aarhus

The objective of the exams is to determine the degree of student's qualifications and whether they fulfil the objectives and requirements stipulated for the study programme.

The test type must suit the objective of the programme and allow for individual assessment of the students.

The tests may be internal or external:

Internal tests are assessed by the course lecturer or the lecturer and an internal examiner appointed by the head of study from among the lecturers at the educational institution.

External tests are assessed by the course lecturer and an external examiner appointed by the Danish Ministry of Education.

The test types and requirements for passing are listed in the complete overview below:

Placement	Test	Assessment	Require-ments
During 2nd semester	**First-year test (e)** Two written three-hour sub-test: - Subjects within chemistry and chemical technology, cf. module descriptions for 1st and 2nd semester - Subjects within microbiology and biotechnology, cf. the module descriptions for 1st and 2nd semester	7-point scale Sub-tests weight equally in one overall grade	Min. 02 for each sub-test
By end of 3rd semester	**Third-semester test (i)** Oral assessment based on course work*	7-point scale	Min. 02
By end of internship period	**Internship test (i)** Written report on internship	Pass/Fail	Passed
By end of 5th semester	**Final project exam (e)** Oral assessment based on project report*	7-point scale	Min. 02

(e) = external examiner (i) = internal examiner

*Basis for assessment: The grade is based on an overall assessment with the report and the oral presentation weighted equally.

15.3.1. First-year test

The first-year test takes place in the last part of 2nd semester, and consists of two written, individual sub-tests.

The sub-tests broadly cover important areas covered during the first year of study and must show the student's ability to solve theoretical laboratory assignments in the fields of chemistry / chemical technology and microbiology / biotechnology, respectively.

In order to sit the sub-tests that make up the first-year test, the relevant modules for 1st and 2nd semester must be approved.

Approval of a module requires:

- Approval of the study activity in the laboratory
- Approval of the skill card tests
- Participation in feedback and presentations
- All theoretical assignments and reports on laboratory work have been submitted to the course lecturer on time and approved

If the institution decides that the student's study activity is unsatisfactory, a warning will be issued in writing consisting of an action plan that must be followed. If the action plan is not complied with, the student may not sit the first-year tests and the institution may disenrol the student from the programme.

Each sub-test has a duration of three hours.
The two sub-tests are assessed separately according to the Danish 7-point scale, and each grade counts 50% towards the overall grade for the first-year test.
In order to pass the first-year test, each sub-test must be passed with at least 2.0.

If the student does not pass one or both of the sub-tests, he or she may resit the test(s) at the following ordinary test at the latest.

The first-year test must be passed within two years after the commencement of studies at the latest.

15.3.2. Third-semester test

The third-semester test is based on individual course work within a biotechnology or chemical technology theme assigned by drawing lots, and must show that the student, based on the acquired qualifications, is able to:

- Analyse, reason and evaluate
- Solve laboratory tasks independently and/or in cooperation with others, taking into account quality assurance and safety aspects

The third-semester test starts when the individual assignments have been submitted.

In order to sit the third-semester test, every module in 1st and 2nd semester must be approved, and the modules from 3rd semester that make up part of the test must also be approved.

Approval of a module requires:

- Approval of the study activity in the laboratory
- Approval of the skill card test
- Participation in feedback and presentations
- All theoretical assignments and reports on laboratory work have been submitted to the course lecturer on time and approved

If the institution decides that the student's study activity is unsatisfactory, a warning will be issued in writing consisting of an action plan that must be followed. If the action plan is not complied with, the student may not sit the third-semester test and the institution may disenrol the student from the programme.

The exam is in the form of an individual oral test based on the course work.

The assessment is an overall evaluation of the written course work and the oral presentation. The grade is based on an overall assessment with the coursework and the oral presentation weighted equally.

If the student does not pass the third-year test, he or she may resit the test as soon as possible – but no later than the commencement of the following semester.

15.3.3. Internship test

The internship report must be submitted at the end of the internship period and must illuminate the outcome of the student's internship in relation to the defined educational objectives.

The student must continuously prepare a written report throughout the internship period, describing the educational objectives the student has worked with and providing examples of what the student has learned.
This report must be shown when the project supervisor visits the company.

The final report must be signed by both the student and the person responsible for the internship at the company.

15.3.4. Final project exam

The final project exam takes place after the internship period.
The objective of the project is to give the student the opportunity to document his or her ability on a methodically basis to process and communicate complex problems in relation to a specific assignment. The project is a way for the student to show that he or she can solve an assignment of a technical nature within the laboratory area in connection with production, development, advisory and control tasks in the company's laboratory.

The student must prepare, in collaboration with the company and the educational institution, a problem formulation that must be submitted to the educational institution at the latest four weeks prior to the end of the internship period. The problem formulation must be approved before the project may be initiated.

The assignment must take approx. 30 working days to complete. A report must be submitted presenting the exam work no later than two weeks before the oral assessment of the project. It is possible to register for the oral assessment of the final exam project at the institution four times a year.
All other tests in the study programme must be passed before the student may submit his or her project report.

The assessment is an overall evaluation of the written report and the oral presentation. Emphasis is placed on the process, product, documentation and project's oral account.

The written work is assessed based on the subject-specific content ('correctness', degree of difficulty, prioritization of appendixes), readability (clarity, proper use of specialist terminology and spelling) and on the inclusion of quality assurance and working environment aspects.
The oral presentation is assessed based on the subject-specific content ('correctness', degree of difficulty, choice of presentation), organisation, coherence and on the argumentation used in the presentation.

The grade is based on an overall assessment with the report and the oral presentation weighted equally.

If the student does not pass the final project exam, he or she may resit the exam as soon as possible – but not later that the commencement of the following semester.

16. Requirements for reading texts in foreign languages and for the required degree of foreign language proficiency.

In addition to texts written in Danish, the programme uses guidelines, standards, manuals and similar texts in English. The student must possess English language proficiency corresponding to the level C.

17. Rules for dispensation

Business Academy Aarhus may, in the event of special conditions, grant dispensation from the rules stipulated by the educational institutions in the curriculum.

18. Commencement provisions

The curriculum enters into force and applies to all students commencing studies as of February 1, 2010 or later.

18.1. Transitional schemes

Students commencing studies in 2nd semester after 1 July 2010 are – regardless of the date of commencement of studies – covered by the rules in this curriculum applicable to 2nd semester and the remainder of the study programme.
Students commencing studies in 3rd semester after 1 January 2011 are – regardless of the date of commencement of studies – covered by the rules in this curriculum applicable to 3rd semester and the remainder of the study programme.
Students commencing internships on 1 July 2010 or later are – regardless of the date of commencement of studies – covered by the rules applicable to internships and final exam projects in this curriculum.

19. References to applicable legislation

The curriculum is based on the following legislation:

- Danish Ministerial Order no. 636 of 29 June 2009 on vocational academy programmes and professional bachelor programmes
- Danish Ministerial Order no. 976 of 19 October 2009 on vocational training in the laboratory area (AP Graduate in Chemical and Biotechnical Science, in Danish: *Laborant AK*)
- Danish Ministerial Order no. 106 of 9 February 2009 on access, admission and leave etc. in connection with certain programmes of higher education (Danish Ministry of Education's *Adgangsbekendtgørelse*)
- Danish Ministerial Order no. 635 of 30 June 2000 on quality development and quality control vocational academy programmes
- Danish Ministerial Order no. 782 of 17 August 2009 on vocational academy exams
- Danish Ministerial Order no. 262 of 20 March 2007 the grading scale and other forms of assessment
- Danish Consolidated Act no. 207 of 31 March 2008 on vocational academy programmes and professional bachelor programmes

All legislation is available in Danish at www.uvm.dk