BUSINESS ACADEMY AARHUS
SCHOOL OF APPLIED SCIENCES

CURRICULUM

for

Chemical and Biotechnical Technology and Food Technology

(Bachelor's top-up)

National part

Content

This national part of the curriculum for the Bachelor's in Chemical and Biotechnical Technology and Food Technology has been released in accordance with §18, section 1 in the Ministerial Order for technical and commercial Academy Profession Programmes and Professional Bachelor Programmes. This curriculum is supplemented with an institutional part of the curriculum, which is provided by the individual institution that offers the programme.

It has been prepared by the Educational Committee for the Bachelor in Chemical and Biotechnical Technology and Food Technology and approved by the Board of Directors (or the Rectors) after consultation with Business Academy Aarhus' educational network and the chairmanship of IT Technology external examiners.

1. The programme's goals for learning outcomes

Knowledge
The graduate has knowledge of

- the natural sciences (mathematics, physical chemistry, statistics and experimental planning) as well as company conditions
- and can understand and reflect on communication forms, ethical dilemmas, production and quality control management in relation to analysis, development and production

Skills
The graduate will get the skills to:

- master planning of analysis and development work and include elements from the natural sciences, as well as quality assurance and quality management systems
- evaluate and substantiate solutions in relation to analysis and development work
- prepare and communicate solutions regarding the planning, development, analysis and production

Competencies
The graduate is able to:

- manage complex and development-orientated situations in relation to analysis and development work
- independently engage in interdisciplinary cooperation and assume responsibility for their own contribution within the framework of professional ethics
- identify their own learning needs and develop their own knowledge, skills and competencies in relation to analysis and development work

1.1 The individual study programme's goals for learning outcomes

The programme in English consists of 2 programme specialisations.

The programme specialisation **chemical and biotechnical technology** also has these learning outcomes:

Knowledge
The graduate has knowledge of

- selected chemical and biotechnological reactions and methods in relation to analytical work and the preparation of chemical products
- and can understand and reflect on the qualitative and quantitative analytical methods applied in practice

Skills
The graduate will get the skills to:

- master planning of operational and developmental work related to chemical and biotechnological production and analysis, with the involvement of safety and environmental aspects
- justify the choice of chemical and biotechnological methods and evaluate the reliability of data, as well as draw conclusions based on this data.
- prepare and communicate solutions to problem statements within the field of chemical and biotechnological production and analysis

Competencies
The graduate is able to:

- handle complex and development-orientated situations in relation to the development and validation of chemical and biotechnological laboratory work
- independently engage in interdisciplinary cooperation concerning safety, environmental and ethical aspects in relation to laboratory work and assume responsibility for their own contribution
- identify their own learning needs and develop their own knowledge, skills and competencies in relation to chemical and biotechnological analysis and production work

The programme specialisation **food technology** also has these learning outcomes:

Knowledge
The graduate has knowledge of:

- the quality of the food and the methods of analysis for the determination of this
- and can understand and reflect on methods of food production and the use of food technology equipment in practice

Skills
The graduate will get the skills to:

- master planning of operational and development work related to food production and analysis with focus on food quality and safety
- evaluate, justify and select methods for the processing of food and analysis of food quality and food safety
- prepare and communicate solutions to problem statements within the field of food development, production, quality and safety

Competencies
The graduate is able to:

- manage complex and development-orientated situations in relation to the production of food and quality assurance

- independently take part in interdisciplinary collaboration on food production and quality assurance
- identify their own learning needs and develop their own knowledge, skills and competencies in relation to food production and analysis

2. The programme includes 8 national subject elements

2.1 Applied mathematics and physical chemistry

Content
The subject element deals with selected basic mathematical and physical disciplines within the natural sciences' basic knowledge. This knowledge is a prerequisite for being able to work with issues related to analytical work and production within biotechnology and chemistry technology areas. It focuses on the relationship between theoretical calculations and practical situations where the disciplines are used.

Learning objectives for applied mathematics and physical chemistry

Knowledge
The student will gain knowledge about:

- and understand basic mathematical concepts and theories
- and understand the basic concepts in the data processing field
- spreadsheet structure and options
- and understand physical and chemical concepts and principles and their application

Skills
The student will get the skills to:

- describe and evaluate simple problem statements in natural sciences by using mathematics
- write, process and apply simple mathematical models
- use spreadsheets to solve mathematical problem statements
- use physical chemistry reference literature
- apply physical chemistry understanding in connection with reading of original literature and methodological requirements
- apply relevant theoretical models for the prediction and explanation of experimental data
- communicate physical chemistry problem statements to others in the organisation

ECTS weight
The subject element Applied mathematics and physical chemistry is weighted 5 ECTS credits

2.2 Applied statistics and planning of experiments

Content:
The subject deals with basic statistics of normally distributed variables as well as basic planning of experiments and the establishment of an uncertainty budget. In addition, statistical analyses which emphasise the establishment of a hypotheses and an assessment of result's assessment will be prioritised.

Learning objectives for statistics and planning

Knowledge
The student will gain knowledge about:

- selected statistical tests
- uncertainty calculations
- the necessity for the planning of experiments

Skills
The student will get the skills to:

- apply statistics for the assessment of data
- apply the uncertainty budget to measured results
- run and evaluate the experiment plans in connection with analysis and experimental work
- convey experiment plans and results to business partners

Competencies
The student will learn to:

- cooperate with practical planning of experiments
- participate in academic cooperation to create uncertainty budgets and plans for the use of resources in development projects

ECTS weight

The subject element Applied statistics and planning of experiments is weighted 5 ECTS credits

2.3 Production and quality control

Content:
The subject element deals with the basic concepts within the field of production management, including LEAN. This also includes GMP and important ISO standard elements for quality assurance for production and analytical work, including documentation, qualification and validation. Accreditation, certification and auditing of quality assurance systems are included peripherally.

Learning objectives for production and quality control

Knowledge
The student will gain knowledge about:

- part-elements in the process of implementation of quality control systems
- and understand control systems in production and laboratories

Skills
The student will get the skills to:

- use the basic elements of quality control and the most widely used quality control systems in production and laboratories
- in practice use validation as a tool in quality assurance
- apply, evaluate and document the selected control concepts and the associated tools in a practice-orientated context

Competencies
The student will learn to:

- independently be able to create and maintain quality control systems

ECTS weight
The subject element product and quality control is weighted 5 ECTS credits.

2.4 Design of experiments

Content
This subject element deals with the requirements necessary for the preparation of experimental planning when the results need to be evaluated by the use of statistical tests. Work will be done with statistical methods within parametric and non-parametric areas. Chemometrics is included, as an example of a method that in practice uses mathematical and statistical methods for the processing of large amounts of data

Learning objectives for design of experiments

Knowledge
The student will gain knowledge about:

- statistical models used in analysis and experimental work
- chemometrics as tool for data analysis
- and understand and can reflect on the establishment of hypotheses, configuration of experiments and the interpretation of results
- software for statistical calculations

Skills
The student will get the skills to:

- evaluate the experimental results from a statistical point of view
- configure experimental plans and can arrange the practical planning of statistical experiments and a range of experiments
- communicate results of experiments, results and assessments

Competencies
The student will learn to:

- work on design of experiments in development-orientated situations
- be part of academic and interdisciplinary collaboration regarding the implementation of analyses and equipment

ECTS weight
The subject element design of experiments s is weighted 5 ECTS credits.

2.5 Communication and theory of science

Content

The subject element deals with creating an understanding for theory of science and the basic ethical attitudes that characterise research and working life in the profession. This includes how communication is targeted to different audiences and how feedback can be used as a tool. Ethical guidelines are included in order to create an understanding for research ethics and for the profession's ethics in general. Information searches, formal requirements for scientific publications and research methodology will be worked with. You will be trained to convey academic knowledge in an understandable manner in both writing and in speech.

Learning objectives for communication and theory of science

Knowledge
The student will gain knowledge about:

- key theory of science concepts
- and can reflect on basic research methodology – and ethics
- theory, methods and practice in communication

Skills
The student will get the skills to:

- disseminate academic knowledge understandably and clearly
- use communication appropriately, including feedback, in relation to various target groups
- do information searches and evaluate source material
- apply the ethical analysis model

Competencies
The student will learn to:

- identify their own learning needs and develop their own knowledge
- cooperate in an interdisciplinary fashion with information searches in connection with development work

ECTS weight
The subject communication and theory of science is weighted 5 ECTS credits.

2.6 Commerce

Content
The subject element deals with the conditions that concern being an employee in an organisation and the accompanying culture. Decision-making processes and change processes will be exemplified. And there is focus is on cooperation and conflict management Classic and modern forms of organisation and related management duties. The company's interaction with the outside world, including labour market relations.

Learning objectives for commerce

Knowledge
The student will gain knowledge about:

- theories and methods in classical and modern forms of companies
- the interaction between the company and the wider community
- and understand the individual's role in the company
- and understand and can reflect on different forms of communication in the company
- management tasks

Skills
The student will get the skills to:

- convey problems and solutions in your company
- engage constructively in partner relationships
- evaluate principles for a company's structural organisation as well as decision-making and change processes

Competencies
The student will learn to:

- collaborate on interdisciplinary aspects in connection with decision-making and change processes
- collaborate in and manage factors that have an impact on the employee's well-being and cooperation among individuals within a company

ECTS weight
The subject element commerce is weighted 5 ECTS credits.

2.7 Cell biology

Content

This subject element deals with the cell's functions in order to understand the processes and methods used in biotechnological analysis work and for bioproduction. The organising and function of organelles in the pro-and eukaryotic cells as well as regulation of the key processes in the cell are also covered. Examples are presented from obtained experimental results to help with the understanding of functions and mechanisms at the cellular level.

Learning objectives for cell biology

Knowledge
The student will gain knowledge about:

- the organisation and function of organelles in the pro and eukaryotic cells
- the cell cycle and principles of cell cycle regulation
- the regulation of membrane functions and intracellular processes

Skills
The student will get the skills to:

- evaluate problem statements in practical experiments on a cellular level
- evaluate the experimental results obtained in relation to cellular and cell molecular functions and mechanisms

Competencies
The student will learn to:

- participate in academic and interdisciplinary problem statements related to research in cell biology

ECTS weight
The subject cell biology is weighted 5 ECTS credits.

2.8 Organic chemistry

Content

The subject element deals with organic chemistry, in order to create awareness of the meaning substance groups, isomerism and reaction mechanisms have in the context of chemical production. You will work with concrete examples of synthesis in several steps, including associated unit operations, and the characterisation of the product.

Learning objectives for organic chemistry

Knowledge
The student will gain knowledge about:

- and can understand and reflect on selected chemical reactions
- the industrial manufacture of organic products

Skills
The student will get the skills to:

- identify and explain different reaction types
- independently analyse experimental synthesis chemistry including the applicable unit operations and their characterisation
- evaluate the progress of selected chemical reactions
- describe and evaluate synthesis pathways and reagents for organic synthesis in several steps

Competencies
The student will learn to:

- acquire new knowledge about organic synthesis
- collaborate on organic synthesis on the basis of theoretical knowledge of organic reactions and reaction mechanisms

ECTS weight
The subject organic chemistry is weighted 5 ECTS credits.

2.9 Food safety and legislation

Content
The subject element deals with risk analyses after HACCP with risk factor analysis, risk factor identification and assessment, as well as construction, implementation and operation of management systems for food products and animal feed. Management systems will primarily include ISO 22001 and BRC with reference to other systems such as IFS, HARCP and industry standards. In addition, food product and animal feed legislation, as well as audits and food fraud will be included.

Learning objectives for food safety and legislation

Knowledge
The student will gain knowledge about:

- the requirements for traceability in production
- and understand the requirements for equipment in connection with the hygienic production of food products
- and understand and can reflect on the requirements for cleaning of production premises and equipment

Skills
The student will get the skills to:

- be part of academic discussions and disseminate problem statements related to food safety
- run a self-regulation program
- develop and apply an HACCP system in connection with specific production
- use existing legislation (national and EU) for a given food product and the production thereof

Competencies
The student will learn to:

- cooperate concerning the planning and implementation of a risk factor analysis - physical, chemical and biological for food production
- take responsibility for the planning and implementation of an internal audit

ECTS weight
The subject element food safety and legislation is weighted 5 ECTS credits.

2.10 Food quality and quality measurements

Content

The subject element deals with quality as a concept, as well as various types of quality in relation to food products. Focus will be on hygienic, best before dates, sensory and nutritional quality. Sensory evaluations, and physical and chemical analysis methods for evaluating food quality will also be included

Learning objectives for food quality and quality measurements

Knowledge
The student will gain knowledge about:

- nutritional and sensory quality
- and understand and can reflect on food quality changes in relation to physical conditions
- food quality changes in relation to chemical changes
- and understand practical analysis methods to determine the quality of food
- food hygiene best before dates in terms of quality

Skills
The student will get the skills to:

- plan and apply practical analytical methods for the determination of food quality
- evaluate problem statements concerning the nutritional and sensory quality, and from this select relevant solutions

- evaluate problem statements from scientific articles, as well as select and justify appropriate solution models
- draw relevant conclusions in relation to the distribution to the end consumer

Competencies
The student will learn to:

- collaborate with the organisation and implementation of quality measurements of raw materials, finished products or steps in a process line

ECTS weight
The subject element food quality and quality measurements is weighted 5 ECTS credits.

2.11 The number of exams in the national subject elements

There are 8 exams in the national subject elements, as well as one further exam in the bachelor project. For the number of exams in the internship, please refer to section 3.

For a comprehensive overview of all the programme's exams, please refer to the institutional part of the curriculum, as the national subject elements described in this curriculum can be examined together with the subject elements specified in the institutional part of the curriculum.

3. Internship

Learning objectives for programme's internship

Knowledge
The student will gain knowledge about:

- the profession and the subject area in practice, using applied theory and methodology, and includes the opportunity to reflect on this knowledge and its application

Skills
The student will get the skills to:

- apply methods and tools
- be able to evaluate theoretical and practical issues and justify and choose appropriate solutions.

Competencies
The student will learn to:

- evaluate and manage complex work relationships, this includes choosing and justifying appropriate solutions
- identify their own learning needs and develop their own knowledge and skills

ECTS weight
The internship is worth 15 ECTS credits.

Number of exams
The internship is completed with 1 exam.

4. Requirements for the Bachelor Project

The learning objectives for the Bachelor project are identical to the programme's learning objectives listed above under point 1.

The Bachelor's project must document the student's understanding of and ability to reflect on the practices of the profession and the use of theory and method in relation to a real-life problem. The problem statement that must be central to the programme and profession, is formulated by the student, possibly in collaboration with a private or public company. The educational institution approves the problem statement. The students work independently with a professionally orientated problem statement. The result of the project work is communicated in writing and is defended orally, it is prepared individually.

Formal requirements:

- The project is prepared according to the IMRAD structure:
  - Introduction: motivation for the topic/issue being worked on. A brief introduction to the topic, for readers who are not academically familiar with the topic. Thesis statement/research questions.
  - Method: presentation and discussion of the problem-solving method.
  - Results: clear and informative presentation of survey results
  - Discussion: what do the results of the study show? How are the results connected to theory and literature? Are the results valid?
- Report: maximum 25 standard pages. 1 standard page is equivalent to 2400 keystrokes including spaces.
  The front page, table of contents and bibliography are excluded from this.
- Appendices: maximum 30 pages - there must be a list of appendices, if not listed in the table of contents. The appendices must be numbered and have consecutive page numbering.
  Only appendices which are referenced in the text should be included.
- Source references - lack of referencing will be seen as plagiarism
- The report's front page must include the following:
  - Exam name
  - Class name
  - Project title
  - Name of the programme and educational institute
  - Name of student
  - Name of the supervisor
  - Name of company

- Number of keystrokes in the report and appendices
- Hand-in date

- If the project is confidential, this must be clearly stated on the front page.

Bachelor Project Exam
The Bachelor project completes the programme in the last semester and the exam can only take place once all the preceding exams have been passed.

ECTS weight
The Bachelor Project is weighted 15 ECTS credits.

Examination form
The exam is an oral and written examination with an external co-examiner, a combined mark is given based on the 7-point scale for the written project report and the oral presentation.

5. Rules on credit

Passed programme elements are equivalent to similar programme elements taken at other educational institutions offering this programme.

The students are obliged to inform us of any completed educational elements from another Danish or foreign higher education programme or any jobs which are likely to provide credit.

The Academy approves, in each instance, credit on the basis of completed programme elements and any jobs which meet the objectives of the subjects, the educational part and the internship parts.

The decision is taken according to an academic assessment.

For prior credit approval of studies in Denmark or abroad, students are required to document each approved and completed programme element on the completion of these studies.

In connection with the application for prior credit approval, the students must give permission to the institution to obtain any required information after the completion of their studies.

On approval according to the above, the programme element is deemed to be passed if it was passed according to the rules of the programme in question.

The following credit agreements have been made for the national subject elements:

Students who have passed selected modules from the Technical Diploma programme in biotechnology, process technology and chemistry can get credit according to the chart below:

Credit is given for the following subjects on the Bachelor's degree programme in Chemical and Biotechnical Technology or Food Technology ---	***- if the following modules from the 'Technical part-time?? Diploma programme in biotechnology, process technology and chemistry' have been passed ---***
• Applied mathematics and physical chemistry	• This includes applied mathematics and general chemistry (physical chemistry)
• Applied statistics and planning of experiments	• Applied statistics and experimental design
• Cell biology	• Cell biology

6. Academic criteria for selecting candidates for top-up programmes

If for capacity reasons it is not possible to accept all applicants for this programme, emphasis will be placed on one or more of the following academic criteria (listed in no specific order):

- Average from qualifying exam
- Relevant work experience (at least 3 months of 30 hours per week)
- Appropriate additional education and/or courses
- Other experience, such as Danish folk schools, stays abroad, volunteering (min. 3 months of 30 hours per week)

Applicants may also be asked to an interview before admission.

Each individual programme indicates on baaa.dk which of the above criteria twill be considered for admission.

7. Commencement

This part of the national curriculum is valid from 15.08.2018.

All enrolled students will be transferred to this curriculum on 15.08.2018 Exams started before 15.08.2018 according to earlier curriculums must be completed in accordance with the previous curriculum by 31.01.2019.

The previous national curriculum from is NOT valid any longer.