BUSINESS ACADEMY AARHUS

# **Curriculum** 2014-2016 Joint National

**BA Degree Programme in Chemical and Biotechnical Technology, Food Technology and Process Technology**

PBA i laboratorie-, fødevare- og procesteknologi

Version 1.1

Revised 26.11.2014

# Table of Contents – Joint National Part

# 1. Scope of the curriculum

## 1.1. Commencement of the curriculum

The joint national part of the curriculum is valid for students starting in September 2014 and applies to the following academies:

*Business Academy Aarhus*
*www.baaa.dk*

*Lillebaelt Academy*
*www.eal.dk*

*Metropolitan University Collage*
*www.phmetropol.dk*

## 1.2. Transtional schemes

This joint national part of the curriculum is valid from the beginning of the study year 2014/2015 and applies to present and future students signing up for the programme and exams starting on 1 September or later.

The joint part of the August 2013 curriculum will no longer be valid from the beginning of the study year 2014/2015.

Exams that have been started before 1st September 2014 will be taken in accordance with the August 2013 curriculum, however no later than 1st February 2015.

# 2. Admission to the programme

Admission to the programme is in accordance with Ministerial Order no. 1486 of 16 December 2013 on the admission to Business Academy programmes and Professional Bachelor Programmes. The ministerial order can be found at retsinfo.dk.

# 3. Core areas of the programme

The programme contains the following core areas:

1. Compulsory part – Common for all study programmes (30 ECTS)
2. Study programme part (30 ECTS)

In all 60 ECTS

## 3.1. Content and learning objectives for the core area 1, Compulsory part

Weight: 30 ECTS

**Content**
Mathematics, physical chemistry, experimental design, philosophy of science, commerce, communication and dissemination.

**Learning objectives**

**Knowledge and understanding**
**The student will gain knowledge about:**

- Physical and chemical concepts, principles and their application
- Mathematical and statistical concepts and theories
- Methods and practice within communication
- Production and quality control systems
- Applied statistical models in analyses and experiments
- Key concepts within philosophy of science

**Skills**
**The student will get the skills to:**

- Apply mathematical and physical chemical knowledge for the solution of practical problems
- Gather the necessary knowledge to set up test plans and statistical data processing
- Apply basic tools for quality control and production planning
- Convey technical knowledge orally and in writing

**Competencies**
**The student will learn to:**

- Independently convey tests, results and assessments
- Apply, assess and document select management concepts
- Independently be responsible for the planning of tests and test sequences
- Take part in professional and cross-disciplinary cooperation
- Identify their own learning needs and develop their own knowledge

## 3.2. Content and learning objectives for core area 2, Study programme part

Weight: 30 ECTS

**Content of the study programme: Chemical and Biotechnical Technology**
Organic chemistry, chemical analysis techniques, cell biology, analysis of biomolecules and bioproduction.

**Learning objectives**

**Knowledge and understanding**
**The student will gain knowledge about:**

- Select chemical reactions and industrial production of chemical products
- Qualitative and quantitative analytical chemical methods
- Membranes, organelles and functions in the prokaryotic and eukaryotic cell
- Fermentation methods, production organisms and product types
- The theoretical background for methods for the analysis of biomolecules

**Skills**
**The student will get the skills to:**

- Identify and account for chemical reactions
- Assess and substantiate the choice of analysis method as well as the reliability of data
- Set up hypotheses and draw conclusions on the basis of experimental data
- Assess and prepare suggested solutions to problems within biological and chemical laboratory work

**Competencies**
**The student will learn to:**

- Relate theoretical knowledge of chemical reactions and analytical methods for practical execution
- Reflect on ethical problems related to laboratory work

**Content of the study programme: Food technology**
Food quality, quality measuring, food technology, food microbiology, food safety, legislation and innovation.

**Learning objectives**

**Knowledge and understanding**
**The student will gain knowledge about:**

- The quality of food and analysis methods for determining this
- Food production and food technology equipment
- Food-borne diseases, decay organisms, microbiological indicators and sampling
- Hygienic design and requirements for the cleaning of production equipment

- Market and consumer surveys and patenting

**Skills**
**The student will get the skills to:**

- Assess problems within food quality and food safety, plan and apply practical analysis methods for the assessment
- Apply food technological unit operations and evaluate the changes that the food components undergo during processing
- Apply select additives and evaluate their properties
- Substantiate the development of a fermentation process
- Set up and use quality control systems as well as relevant legislation for protecting food safety and food quality
- Apply innovative techniques and methods in a process-orientated course from idea to product

**Competencies**
**The student will learn to:**

- Assess problems from scientific articles within the food area
- Handle analysis results and methods with regard to the impact of production and processing processes on the quality of foods
- Handle problems regarding the choice of process equipment and additives
- Handle and convey problems regarding food safety and shelf life

**Content of the study programme: Process technology**

Working environment, risk assessment, calibration systems, systematic maintenance, resource management, design of pilot systems, construction of pilot systems and breaking-in of pilot systems.

**Learning objectives**

**Knowledge and understanding**
**The student will gain knowledge about:**

- Workplace manuals and workplace assessments including methods for improving the working environment
- Industrial maintenance including measuring technology and design of measuring equipment
- Mapping of resource consumption
- Qualification of pilot systems

**Skills**
**The student will get the skills to:**

- Gather knowledge, draw up and revise documents regarding risk management and working environment
- Set up test plans as well as plans for systematic maintenance and tests related to operational qualification

- Construct and maintain calibration systems
- Apply knowledge regarding methods for mapping and reducing consumption of resources in practice
- Gather the necessary knowledge regarding user requirements and convert user requirements into design specifications
- Work as day-to-day manager of pilot-scale construction projects

**Competencies**
**The student will learn to:**

- Be responsible for risk management regarding parts of production plants, including participation in working environment improvements in production
- Be responsible for planning and carrying out maintenance activities related to production and measuring equipment
- Be responsible for mapping of process-related consumption of resources associated with design, construction and breaking-in of pilot systems
- Be responsible for the qualification of pilot systems

# 4. Compulsory programme elements

The programme comprises compulsory elements with a total of 30 ECTS. For each study programme, there are additional compulsory elements corresponding to 25 ECTS.

The compulsory programme elements within the core area "Compulsory part" are:

1. Applied mathematics and physical chemistry (5 ECTS)
2. Commerce (5 ECTS)
3. Production and quality control (5 ECTS)
4. Communication, dissemination and philosophy of science (5 ECTS)
5. Basic experimental design (5 ECTS)
6. Statistical design of experiments (5 ECTS)

In all 30 ECTS

The compulsory programme elements are completed with an exam.

The compulsory programme elements within the core area "Study programme part" for the study programme: **Chemical and biotechnical technology** are:

1. Organic chemistry (5 ECTS)
2. Chemical analysis technique (5 ECTS)
3. Cell biology (5 ECTS)
4. Bioproduction (5 ECTS)
5. Analysis of biomolecules (5 ECTS)

In all 25 ECTS

The compulsory programme elements 1 and 2 and the elective element are completed as a joint exam.
The compulsory programme elements 3, 4 and 5 are completed as a joint exam.
If the compulsory programme elements are not completed during the same exam period, examination in the individual compulsory programme element can be taken separately.

The compulsory programme elements within the core area "Study programme part" for the study programme: **Food technology** are:

1. Food quality and quality measuring (5 ECTS)
2. Food technology 1 (5 ECTS)
3. Food technology 2 (5 ECTS)
4. Food microbiology (5 ECTS)
5. Food safety and legislation (5 ECTS)

In all 25 ECTS

The compulsory programme elements 1, 4 and 5 are completed as a joint examination.
The compulsory programme elements 2 and 3 and the elective element are completed as a joint examination.
If the compulsory programme elements are not completed during the same exam period, examination in the individual compulsory programme element can be taken separately.

The compulsory programme elements within the core area "Study programme part" for the study programme: **Process technology** are:

1. Working environment and risk assessment (5 ECTS)
2. Calibration methods and systematic maintenance (5 ECTS)
3. Resource management (5 ECTS)
4. Construction of pilot systems (5 ECTS)
5. Breaking-in of pilot systems (5 ECTS)

In all 25 ECTS

The compulsory programme elements 1, 2 and 3 are completed as a joint examination.
The compulsory programme elements 4 and 5 and the elective element are completed as a joint examination.
If the compulsory programme elements are not completed during the same exam period, examination in the individual compulsory programme element can be taken separately.

## 4.1. Content and learning objectives for: Applied mathematics and physical chemistry

Weight: 5 ECTS

**Content**
**Mathematics:** Solution and analysis of relevant technical equations and other mathematical expressions, differential and integral calculus, use of spreadsheets.
**Physical chemistry:** Activity as a concept, electrochemistry, reaction kinetics, thermodynamic equilibriums.

**Learning objectives**

**Mathematics:**
**Knowledge and understanding**
The student will gain knowledge about:

- Basic mathematical concepts and theories
- Basic concepts within data processing
- The structure and possibilities of spreadsheets

**Skills**
The student will get the skills to:

- Describe and assess simple problems within natural science using mathematics
- Create, process and use simple mathematical models
- Apply spread sheets for solving mathematical problems

**Physical chemistry:**
**Knowledge and understanding**
The student will gain knowledge about:

- The concepts, principles and application of physical chemistry

**Skills**
The student will get the skills to:

- Apply handbooks of physical chemistry
- Apply the comprehension of physical chemistry when they read original literature and directions of method
- Apply relevant theoretical models for predicting and explaining experimental data
- Convey problems related to physical chemistry to other members of in the organisation

**Assessment**
The exam is assessed according to the 7-point scale and is weighted 5 ECTS.

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

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

## 4.2. Content and learning objectives for: Commerce – organisation, management and cooperation

Weight: 5 ECTS

**Content**

- Organisational structure - classical and modern types of organisation
- The organisation's interaction with their surroundings, including labour market conditions, working environment conditions and legal requirements for quality assurance
- Groups and informal structure, organisational culture, decision-making processes, change processes
- The individual in the organisation, communication in organisations
- Conflict resolution and cooperation, including roles, values, attitudes, motivation
- Management tasks

**Learning objectives**

**Knowledge and understanding**
**The student will gain knowledge about:**

- Theories and methods within classical and modern types of organisations
- The interaction between the organisation and the surrounding society
- Needs, framework and content of the various types of communication in the company
- Management tasks

**Skills**
**The student will get the skills to:**

- Convey problems and solutions in the organisation, including conflict resolution and cooperation
- Assess principles of an organisation's structure as well as decision-making processes and change processes

**Competencies**
**The student will learn to:**

- Handle theoretical and practical problems associated with decision-making processes and change processes
- Handle the factors that influence employee satisfaction and the cooperation between individuals in an organisation

### Assessment

The exam is assessed according to the 7-point scale and is weighted 5 ECTS.

The learning objectives for the programme element are identical to the learning objectives for the exam.
For information on examination form and organisation, etc., refer to the institutional part of the curriculum.

## 4.3. Content and learning objectives for: Production and quality control

Weight: 5 ECTS

**Content**

- Production strategy and production types
- Planning and management in production, examples of concepts and tools – including LEAN
- Quality as a concept and quality control in general, including quality tools
- Quality control systems used in production and laboratories
- Quality control procedures, including certification, accreditation and audits
- Validation

**Learning objectives**

**Knowledge and understanding**
**The student will gain knowledge about:**

- Sub elements of the process of implementing quality control systems
- Control systems in production and laboratories

**Skills**
**The student will get the skills to:**

- Apply basic elements of quality control and the quality control systems used most often in production and laboratories
- Apply validation in practice as a tool in quality control
- Apply, assess and document selected control concepts and the associated tools in a practice-related context

**Competencies**
**The student will learn to:**

- Independently take part in the establishment and maintenance of quality control systems

**Assessment**
The exam is assessed according to the 7-point scale and is weighted 5 ECTS.

The learning objectives for the programme element are identical to the learning objectives for the exam.
For information on examination form and organisation, etc., refer to the institutional part of the curriculum.

## 4.4. Content and learning objectives for: Communication, dissemination and theory of science

Weight: 5 ECTS

**Content**

- Basic theory within: communication theory and communication models
- Presentation techniques, oral as well as written, dissemination of professional knowledge in various contexts
- Theory of science studies, including introduction to principal directions of science studies and paradigms as well as ethics
- Research methods, including quantitative and qualitative research methods as well as IMRAD
- Knowledge and information searching, gathering and processing of knowledge, including literature searching
- Source criticism

**Learning objectives**

**Knowledge and understanding**
**The student will gain knowledge about:**

- Key concepts within philosophy of science
- Basic elements of research methodology – and ethics
- Theory, methods and practice within communication and the theory of science

**Skills**
**The student will get the skills to:**

- Convey technical knowledge in an understandable and clear way
- Apply communication appropriately with regard to various target groups
- Carry out information searching and critical use of source materials
- Criticise/provide constructive feedback for other people's work
- Apply an ethical analysis model

**Competencies**
**The student will learn to:**

- Identify their own learning needs and develop their own knowledge.
- Convey technical problems independently and in cooperation with others

**Assessment**
The exam is assessed according to the 7-point scale and is weighted 5 ECTS.

The learning objectives for the programme element are identical to the learning objectives for the exam.
For information on examination form and organisation, etc., refer to the institutional part of the curriculum.

## 4.5. Content and learning objectives for: Basic experimental design

Weight: 5 ECTS

**Content**

- Basic statistics on normally distributed variables
- Statistical analyses with main emphasis on setting up hypotheses and result assessment
- Interfering parameters, randomisation of tests, calculation of uncertainty, clarification of concepts
- Setting up an uncertainty budget according to the GUM method. Experimental design
- Preparation: task analysis, reagents/agents, quality control, safety, test factors and interfering parameters, mathematical models
- Test plans: which measurements with which measuring equipment, uncertainty, test matrix, clean-up after test, estimation of time consumption, preparation of documentation
- Presentation of results, project management, Gantt chart, follow-up.

**Learning objectives**

**Knowledge and understanding**
**The student will gain knowledge about:**

- Normally distributed variables and statistical test types on normally distributed variables
- Sub elements in uncertainty calculation
- Comprehension of good experimental design

**Skills**
**The student will get the skills to:**

- Apply hypotheses and draw conclusions on statistical tests on normally distributed variables
- Apply an uncertainty budget for measuring results
- Set up test plans in connection with analysis and test work, including the gathering of necessary knowledge

**Competencies**
**The student will learn to:**

- Independently be responsible for planning of tests and test sequences
- Independently set up budgets and plans for the use of resources in connection with analysis and test work

**Assessment**
The exam is assessed according to the 7-point scale and is weighted 5 ECTS.

The learning objectives for the programme element are identical to the learning objectives for the exam.
For information on examination form and organisation, etc., refer to the institutional part of the curriculum.

## 4.6. Content and learning objectives for: Statistical experimental design

Weight: 5 ECTS

**Content**

- Applied statistics within the areas of specialisation: statistical process control (SPC), single, double or multiple variance analysis, block design, reduced test plans (screening tests), linear regression analysis, tests in binomial distribution (sensory analysis), tests in Poisson distribution (microbiological bacterial count), non-parametric tests
- Chemometrics
- Statistical experimental designs - as in Basic experimental design supplemented with: construction of hypothesis, choice of test structure, dimensioning, method for result processing.

**Learning objectives**
**Knowledge and understanding**
**The student will gain knowledge about:**

- Statistical models and associated analysis and test work within a wide selection of the fields of study
- Chemometrics as a tool for data analysis
- Applied statistical models in connection with analysis and test work within their own field of study
- Statistical test planning
- Construction of hypotheses, dimensioning of tests and interpretation of results

**Skills**
**The student will get the skills to:**

- Take part in the selection and the use of available software for statistical calculations
- Participate in the evaluation of experimental results from a statistical point of view

**Competencies**
**The student will learn to:**

- Independently construct statistical hypotheses and associated dimensioned test plans within one or more of the fields of study on the basis of a given problem
- Independently be responsible for practical planning of statistical tests and test sequences
- Independently present tests, results and evaluations

**Assessment**
The exam is assessed according to the 7-point scale and is weighted 5 ECTS.

The learning objectives for the programme element are identical to the learning objectives for the exam.
For information on examination form and organisation, etc., refer to the institutional part of the curriculum.

## 4.7. Content and learning objectives for: Organic chemistry Study programme: Chemical and Biotechnical technology

Weight: 5 ECTS

**Content**

- Select functional groups within organic chemistry as well as their reactions.
- Presentation of select organic compounds, suggestion of synthesis pathways and reagents for syntheses in multiple steps, the concepts of carbocation and carbanion
- The four reaction types: addition, elimination, substitution and re-arrangement as well as the reaction mechanisms SN1, SN2, E1 and E2
- The importens of Stereochemistry Unit operations in a synthesis laboratory. Characterisation of select synthesis products
- Select chemical reactions, reaction rate and equilibriums

**Learning objectives**

**Knowledge and understanding**
**The student will gain knowledge about:**

- Select chemical reactions
- Industrial production of organic products

**Skills**
**The student will get the skills to:**

- Identify and account for various reaction types
- Independently analyse experimental synthesis chemistry including the applied unit operations and characterisation
- Assess the progress of select chemical reactions
- Comprehend, describe and evaluate synthesis pathways and reagents of organic syntheses in multiple steps

**Competencies**
**The student will learn to:**

- Handle organic syntheses on the basis of theoretical knowledge about organic reactions and reaction mechanisms

**Assessment if the compulsory programme element is assessed separately:**
The exam is assessed according to the 7-point scale and is weighted 5 ECTS.

The learning objectives for the programme element are identical to the learning objectives for the exam.
For information on examination form and organisation, etc., refer to the institutional part of the curriculum.

## 4.8. Content and learning objectives for: Chemical analysis technique
## Study programme: Chemical and Biotechnical technology

Weight: 5 ECTS

**Content**

- Separation methods: sample preparation, extraction, liquid chromatography, gas chromatography
- Detection methods: UV-VIS spectrophotometry, fluorometry, mass spectrometry (MS), atomic absorption spectrophotometry, inductively coupled plasma (ICP), infra-red spectrophotometry (IR), nuclear magnetic resonance spectroscopy (NMR)
- Qualitative and quantitative analysis: Calibration methods, parameters, concepts and terms describing the suitability of analysis methods
- Method development and optimisation: Procedures for systematic method development and optimization

**Learning objectives**
**Knowledge and understanding**
**The student will gain knowledge about:**

- The principles, apparatus construction, fields of application and sources of error from a wide selection of analytical chemical methods
  How to comprehend the normal terminology within pre-selected methods for the purpose of writing reports and reading literature

**Skills**
**The student will get the skills to:**

- Convey analysis results orally and in writing in a clear and terminologically correct way
- Analyse and assess qualitative and/or quantitative analysis in connection with selecting the most suitable methods.
- Assess and substantiate the reliability of data.
- Assess and substantiate the choice of method
- Relate knowledge about select methods to other analysis technical methods – within the chemical as well as the biochemical area
- Interpret experimental analytical data and draw relevant conclusions

**Competencies**
**The student will learn to:**

- Identify their own learning needs and develop their own knowledge within chemical analysis technique

**Assessment if the compulsory programme element is assessed separately:**
The exam is assessed according to the 7-point scale and is weighted 5 ECTS.

The learning objectives for the programme element are identical to the learning objectives for the exam.
For information on examination form and organisation, etc., refer to the institutional part of the curriculum.

## 4.9. Content and learning objectives: Cell biology Study programme: Chemical and biotechnical technology

Weight: 5 ECTS

**Content**

- The organelles of the cell, membrane structure and transport through membranes.
- Mitochondrial structure and functions, intracellular protein sorting and vesicle transport.
- Chromosome structure and organisation, cell cycle, cell communication and signal transduction.
- Examples of experimental work carried out at cellular level

**Learning objectives**

**Knowledge and understanding**
**The student will gain knowledge about:**

- The function of membranes and organelles in the prokaryotice and eukaryotice cell
- 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:**

- Assess problems associated with practical experiments at a cellular level
- Assess results achieved experimentally with regard to cellular and cell molecular functions and mechanisms

**Competencies**
**The student will learn to:**

- Take part in professional and cross-disciplinary work with problems regarding research at a cellular level

**Assessment if the compulsory programme element is assessed separately:**
The exam is assessed according to the 7-point scale and is weighted 5 ECTS.

The learning objectives for the programme element are identical to the learning objectives for the exam.
For information on examination form and organisation, etc., refer to the institutional part of the curriculum.

## 4.10. Content and learning objectives for: Bioproduction Study programme: Chemical and biotechnical technology

Weight: 5 ECTS

**Content**

- Fermentation methods as well as control and regulation of the production process
- Organism types, including genetically modified organisms, product types and their use
- Upstream processes, including selection and storage of the production organism
- Downstream processes, including purification and characterisation of product
- Environmental aspects of using GMO for bioproduction

**Learning objectives**

**Knowledge and understanding**
**The student will gain knowledge about:**

- Fermentation methods, production organisms and product types
- Up and downstream processes associated with bioproduction
- The possible environmental risks of using GMO

**Skills**
**The student will get the skills to:**

- Analyse and assess practice-related problems within the production of biomolecules using micro-organisms and cell cultures, and set up and substantiate suggestions for the solution of these problems

**Competencies**
**The student will learn to:**

- Enter into a professional and cross-disciplinary cooperation regarding the solution of problems within the production of biomolecules

**Assessment if the compulsory programme element is assessed separately:**
The exam is assessed according to the 7-point scale and is weighted 5 ECTS.

The learning objectives for the programme element are identical to the learning objectives for the exam.
For information on examination form and organisation, etc., refer to the institutional part of the curriculum.

## 4.11. Content and learning objectives for: Analysis of biomolecules Study programme: Chemical and biotechnical technology

Weight: 5 ECTS

**Content**

- Production of recombinant protein, techniques for purification of DNA, RNA and protein, techniques for characterisation of DNA and RNA, such as PCR, probing/hybridisation and sequencing, techniques for characterisation of protein, such as electrophoresis and protein sequencing, enzyme-based assays for detection of biomolecules
- Detection on the basis of antigen-antibody reactions, DNA chip technology and its applications
- Application of molecular biological methods, for example for screening of diseases, and within forensic genetics – possibilities and ethical problems

**Learning objectives**

**Knowledge and understanding**
**The student will gain knowledge about:**

- The theoretical background for methods for the analysis of biomolecules
- Analysis methods at DNA, RNA and protein level
- How to reflect on the application of cellular and molecular biological analysis methods.
- How to reflect on possibilities and ethical problems related to the use of analysis methods based on gene technology

**Skills**
**The student will get the skills to:**

- Assess analytical results
- Assess problems related to cell and molecular biological techniques and their application

**Competencies**
**The student will learn to:**

- Enter into a professional and cross-disciplinary cooperation regarding cellular and molecular biology techniques and their application

**Assessment if the compulsory programme element is assessed separately:**
The exam is assessed according to the 7-point scale and is weighted 5 ECTS.

The learning objectives for the programme element are identical to the learning objectives for the exam.
For information on examination form and organisation, etc., refer to the institutional part of the curriculum.

**Assessment if the two compulsory programme elements Organic chemistry and Chemical analysis technique and the elective element are assessed together**
The exam is assessed according to the 7-point scale and is weighted 15 ECTS.

The learning objectives for the programme element are identical to the learning objectives for the exam.
For information on examination form and organisation, etc. refer to the institutional part of the curriculum.

**Assessment if the three compulsory programme elements Cell biology, Bioproduction and Analysis of biomolecules are assessed together**
The exam is assessed according to the 7-point scale and is weighted 15 ECTS.

The learning objectives for the programme element are identical to the learning objectives for the exam.
For information on examination form and organisation, etc., refer to the institutional part of the curriculum.

## 4.12. Content and learning objectives: Food quality and quality measuring
## Study programme: Food technology

Weight: 5 ECTS

**Content**

- Quality as a concept and types of quality, including physical and chemical quality. Nutritional quality, sensory quality, hygienic and shelf life quality.
- Types of quality of various food groups, factors that influence food quality.
- Methods for evaluating food quality, including sensory evaluations, chemical analysis methods, physical analysis methods.

**Learning objectives**
**Knowledge and understanding**
**The student will gain knowledge about:**

- Nutritional and sensory quality
- The quality changes of foods related to physical conditions
- The quality changes of foods related to chemical changes
- Practical analysis methods for determining food quality
- The hygienic shelf life quality of foods

**Skills**
**The student will get the skills to:**

- Plan and apply practical analysis methods for determining food quality
- Assess problems regarding the nutritional and the sensory quality, and choose relevant solutions on the basis of this
- Convey problems within food quality to others in the organisation

- Assess problems from scientific articles and choose and substantiate relevant solutions
- Apply knowledge regarding the quality of foods in connection with analysis results and methods
- Draw relevant conclusions with regard to the distribution to the end consumer

**Competencies**
**The student will learn to:**

- Handle the planning and execution of quality measurements of ingredients, finished products or steps in the process line

**Assessment if the compulsory programme element is assessed separately:**
The exam is assessed according to the 7-point scale and is weighted 5 ECTS.

The learning objectives for the programme element are identical to the learning objectives for the exam.
For information on examination form and organisation, etc., refer to the institutional part of the curriculum.

## 4.13. Content and learning objectives: Food technology 1 Study programme: Food technology

Weight: 5 ECTS

**Content**

- Heat treatment, drying, cooling/freezing, irradiation, separation processes, mixing
- The influence of processing on nutritional content, packaging and packaging gases
- Food groups' production technology related to functional quality

**Learning objectives**

**Knowledge and understanding**
**The student will gain knowledge about:**

- The equipment for heat treatment, drying, cooling/freezing, irradiation, separation processes and mixing respectively
- The theory behind the selected food technology processes
- Packaging and packaging gases
- The theory behind various food groups' production technology

**Skills**
**The student will get the skills to:**

- Apply unit operations within food technology
- Evaluate the changes that the food components undergo during processing
- Communicate with others in the organisation about problems within packaging

- Assess the influence of possible processes on food properties

**Competencies**
**The student will learn to:**

- Handle problems associated with the choice of process equipment for the production of various foods

**Assessment if the compulsory programme element is assessed separately:**
The exam is assessed according to the 7-point scale and is weighted 5 ECTS.

The learning objectives for the programme element are identical to the learning objectives for the exam.
For information on examination form and organisation, etc., refer to the institutional part of the curriculum.

## 4.14. Content and learning objectives: Food technology 2 Study programme: Food technology

Weight: 5 ECTS

**Content**

- Additives (including stabilisers, emulsifiers, preservatives, colouring, flavouring and aroma components, enzymes)
- Fermentation/Positive microbiology

**Learning objectives**

**Knowledge and understanding**
**The student will gain knowledge about:**

- The possibilities for the application of additives
- The theory behind fermentations
- Modern technologies for the production of food

**Skills**
**The student will get the skills to:**

- Evaluate the properties of emulsifiers, stabilisers, preservatives, colouring components, flavouring components, aroma components as well as enzymes
- Justify the development of a fermentation process as well as the factors that may affect the fermentation
- Apply selected additives in practice

**Competencies**
**The student will learn to:**

- Handle problems associated with the choice of additives
- Evaluate the impact of changes in physical/chemical conditions in a fermentation process.
- Evaluate problems from scientific articles as well as select and justify appropriate solutions

**Assessment if the compulsory programme element is assessed separately:**
The exam is assessed according to the 7-point scale and is weighted 5 ECTS.

The learning objectives for the programme element are identical to the learning objectives for the exam.
For information on examination form and organisation, etc., refer to the institutional part of the curriculum.

## 4.15. Content and learning objectives: Food microbiology Study programme: Food technology

Weight: 5 ECTS

**Content**

- Microorganisms in foods (bacteria, yeast, mould, viruses and parasites)
- Foodborne pathogens: clinical presentation, resistance, frequency, dispersal, epidemiology, outbreak investigation, typing, etc.
- Microbiological analysis methods (traditional, PCR, RT-PCR, immunological methods, etc.)
- Validation of new methods (such as NordVal, Afnor)
- Use of and requirements for indicator organisms (conventional and alternative)
- Microbiological criteria (including the commission regulation on microbiological criteria for foodstuffs)
- Assessment of colony forming unit

**Learning objectives**
**Knowledge and understanding**
**The student will gain knowledge about:**

- Foodborne diseases and epidemiological aspects
- The validation of new methods for analysis of microorganisms, including the parameters such as sensitivity and specificity
- The significance of the use of indicators for the existence of pathogenic micro-organisms
- The application of indicators for the existence of pathogenic micro-organisms

**Skills**
**The student will get the skills to:**

- Assess foods on the basis of microbiological criteria
- Assess how growth of unwanted micro-organisms can be controlled

- Assess microbiological analysis methods, for example with regard to costs, time consumption and response time
- Apply microbiological methods for the evaluation of food quality

**Competencies**
**The student will learn to:**

- Acquire knowledge regarding new methods for microbiological evaluation of foods and participate in phasing in of these methods in a laboratory

**Assessment if the compulsory programme element is assessed separately:**
The exam is assessed according to the 7-point scale and is weighted 5 ECTS.

The learning objectives for the programme element are identical to the learning objectives for the exam.
For information on examination form and organisation, etc., refer to the institutional part of the curriculum.

## 4.16. Content and learning objectives: Food safety and legislation Study programme: Food technology

Weight: 5 ECTS

**Content**

- Parameters: foreign bodies, medicine residues, pesticide residues, toxins and unwanted bacteria (summary), hygiene in food production; GMP and RPR, traceability
- Requirements for process equipment, relevant standards, hygienic design, materials, surfaces and joints/welds
- Cleaning and disinfection, methods and requirements for cleaning agents and disinfectants
- Control of food safety, self-regulatory control, HACCP according to ISO 22000, BRC and IFS
- Risk assessment, hazardanalysis, selection of critical control points (CCP), supervision of CCP, documentation, audit, legislation, Danish laws and ministerial orders
- EU regulations

**Learning objectives**

**Knowledge and understanding**
**The student will gain knowledge about:**

- Requirements for traceability in connection with production
- Requirements for equipment in connection with hygienic production of foods
- Requirements for cleaning of production rooms and equipment

**Skills**
**The student will get the skills to:**

- Take part in professional discussions and presentation of problems regarding food safety
- Set up a selfregulation program
- Establish and use a HACCP system in connection with concrete production
- Apply existing laws (national and EU) for a given food and the production of this food

**Competencies**
**The student will learn to:**

- Carry out a hazardanalysis - physical, chemical and biological risks of the production
- Carry out an internal audit

**Assessment if the compulsory programme element is assessed separately:**
The exam is assessed according to the 7-point scale and is weighted 5 ECTS.

The learning objectives for the programme element are identical to the learning objectives for the exam.
For information on examination form and organisation, etc., refer to the institutional part of the curriculum.

**Assessment if the two compulsory programme elements Food technology 1 and Food technology 2 and the elective element are assessed together**
The exam is assessed according to the 7-point scale and is weighted 15 ECTS.

The learning objectives for the programme element are identical to the learning objectives for the exam.
For information on examination form and organisation, etc., refer to the institutional part of the curriculum.

**Assessment, if the three compulsory programme elements Food quality and quality measuring, Food microbiology, and Food safety and legislation are assessed together**
The exam is assessed according to the 7-point scale and is weighted 15 ECTS.

The learning objectives for the programme element are identical to the learning objectives for the exam.
For information on examination form and organisation, etc., refer to the institutional part of the curriculum.

## 4.17. Content and learning objectives: Working environment and risk assessment
## Study programme: Food technology

Weight: 5 ECTS

**Content**

- Supplier manuals (safety data sheets) and workplace material safety data sheets
- Workplace assessments and follow-up activities, root cause analysis of already occurred incidents
- Practical use of the FMEA (Failure Mode And Effect Analysis) method – proactive prevention of incidents

**Learning objectives**

**Knowledge and understanding**
**The student will gain knowledge about:**

- Legal requirements for workplace material safety data sheets and workplace assessments
- Methods for improving the working environment

**Skills**
**The student will get the skills to:**

- Produce workplace material safety data sheets
- Produce and revise workplace assessments
- Gather knowledge for FMEA analysis
- Participate in process changes based on FMEA analysis

**Competencies**
**The student will learn to:**

- Independently take charge of risk management regarding parts of production plants, including participation in work environment improvements in production

**Assessment if the compulsory programme element is assessed separately:**
The exam is assessed according to the 7-point scale and is weighted 5 ECTS.

The learning objectives for the programme element are identical to the learning objectives for the exam.
For information on examination form and organisation, etc., refer to the institutional part of the curriculum.

## 4.18. Content and learning objectives: Calibration systems and systematic maintenance
## Study programme: Process technology

Weight: 5 ECTS

**Content**

- Technical, financial and administrative principles, elements and tools that are used for optimising industrial maintenance
- Construction of calibration hierarchy and traceability, structuring of the information from the measuring equipment, including numbering and classification of measuring equipment
- Determination of calibration intervals, determination of requirements regarding measuring technology and design of the individual pieces of measuring equipment, determination of calibration methods and calibration points
- The significance of the uncertainty of measurements

**Learning objectives**

**Knowledge and understanding**
**The student will gain knowledge about:**

- Principles, elements and tools for systematic industrial maintenance
- Requirements for measuring technology and design of measuring equipment
- Uncertainty of measurements, calibration, traceability

**Skills**
**The student will get the skills to:**

- Participate in the establishment of plans for systematic maintenance
- Establish and maintain calibration systems

**Competencies**
**The student will learn to:**

- Independently be responsible for planning and carrying out maintenance activities related to production equipment
- Independently be responsible for planning and carrying out calibration and maintenance activities related to measuring equipment in production

**Assessment if the compulsory programme element is assessed separately:**
The exam is assessed according to the 7-point scale and is weighted 5 ECTS.

The learning objectives for the programme element are identical to the learning objectives for the exam.
For information on examination form and organisation, etc., refer to the institutional part of the curriculum.

## 4.19. Content and learning objectives: Resource management Study programme: Process technology

Weight: 5 ECTS

**Content**
Methods for mapping resource consumption, setting up system limits, mass and energy balances, collection of valid data (measuring of substance concentrations, temperature, pressure, flow and level), collection of knowledge regarding alternative solutions (changed process conditions, recovery of energy, water and chemicals), financial and environmental cost-benefit analyses.

**Learning objectives**
**Knowledge and understanding**
**The student will gain knowledge about:**

- Energy (types, applications, recovery)
- Methods for mapping resource consumption
- Working methods for setting up alternative solutions
- Cost-benefit analyses

**Skills**
**The student will get the skills to:**

- Set up system limits, massand energy balances
- Select correct measuring methods for collection of valid data
- Gather knowledge regarding alternative solutions
- Set up a financial and environmental cost-benefit analysis for a specific assignment

**Competencies**
**The student will learn to:**

- Independently be responsible for mapping of process-related consumption of resources
- Participate in connection with saving measures (water, energy, raw materials, waste, cleaning)

**Assessment if the compulsory programme element is assessed separately:**
The exam is assessed according to the 7-point scale and is weighted 5 ECTS.

The learning objectives for the programme element are identical to the learning objectives for the exam.
For information on examination form and organisation, etc., refer to the institutional part of the curriculum.

## 4.20. Content and learning objectives: Construction of pilot systems Study programme: Process technology

Weight: 5 ECTS

**Content**
Introduction to the desired function of the plant. Construction of specific pilot plants in practice, for instance a mobile CIP system, plate sterilisation systems for continuous sterilisation, ultrafiltration systems, and fermenters.

**Learning objectives**

**Knowledge and understanding**
**The student will gain knowledge about:**

- All the phases of qualification of pilot systems
- The installation phase (IQ)
- The training requirements for people who construct the sub elements of processing plants

**Skills**
**The student will get the skills to:**

- Present single elements of design qualification to relevant professiongroups, and convert P&I diagram with associated descriptions into specific job descriptions for the plant construction
- Work as day-to-day manager of the construction project

**Competencies**
**The student will learn to:**

- Independently be responsible for assurance control of the complete system (IQ)
- Independently set up budgets and carry out budget follow-up regarding the use of resources in connection with construction

**Assessment if the compulsory programme element is assessed separately:**
The exam is assessed according to the 7-point scale and is weighted 5 ECTS.

The learning objectives for the programme element are identical to the learning objectives for the exam.
For information on examination form and organisation, etc., refer to the institutional part of the curriculum.

## 4.21. Content and learning objectives: Breaking-in of pilot systems Study programme: Process technology

Weight: 5 ECTS

**Content**
Introduction to the desired function of the plant. Running-in of specific pilot systems in practice, e.g. a CIP system, plate sterilisation systems for continuous sterilisation, ultrafiltration systems, and fermenters.

**Learning objectives**

**Knowledge and understanding**
**The student will gain knowledge about:**

- Operational qualification (OQ) and performance qualification (PQ)
- Revalidation/requalification (RV/RQ)

**Skills**
**The student will get the skills to:**

- Set up test plans for operational qualification
- Carry out tests with connected measurements in accordance with test plan

**Competencies**
**The student will learn to:**

- Independently set up test plans for testing and assure quality of the finished set-up (OQ and PQ)
- Independently set up budgets and carry out budget follow-up regarding the use of resources in connection with the breaking-in

**Assessment if the compulsory programme element is assessed separately:**
The exam is assessed according to the 7-point scale and is weighted 5 ECTS.

The learning objectives for the programme element are identical to the learning objectives for the exam.
For information on examination form and organisation, etc., refer to the institutional part of the curriculum.

**Assessment if the two compulsory programme elements Construction of pilot systems, Breaking-in of pilot systems and the elective element are assessed together**
The exam is assessed according to the 7-point scale and is weighted 15 ECTS.

The learning objectives for the programme element are identical to the learning objectives for the exam.
For information on examination form and organisation, etc., refer to the institutional part of the curriculum.

**Assessment if the three compulsory programme elements Working environment and risk management, Calibration systems and systematic maintenance, and Resource management are assessed together**
The exam is assessed according to the 7-point scale and is weighted 15 ECTS.

The learning objectives for the programme element are identical to the learning objectives for the exam.
For information on examination form and organisation, etc., refer to the institutional part of the curriculum.

# 5. Internship

The internship is weighted 15 ECTS.

The internship of the bachelor programme takes place in one or more Danish or foreign companies. It is a 3-month internship scheduled during the 3rd semester and before the main bachelor project.

The purpose of the internship is to give the student some practical experience within the profession as a supplement to the programme's theoretical teaching.

The internship is completed with an exam assessed according to the 7-point scale. Examination form and organisation is determined by the individual institution and described in the institutional part of the curriculum.

## 5.1. Learning objectives for the internship

**Knowledge and understanding**
**The student will gain knowledge about:**

- The practice of the profession and the theory and methods applied, including the opportunity to reflect on this knowledge and its application

**Skills**
**The student will get the skills to:**

- Apply the methods and tools for the subject area
- Assess theoretical and practical problems and give reasons for and choose relevant solutions

**Competencies**
**The student will learn to:**

- Assess and handle complex work situations, including choosing and giving reasons for relevant solutions
- Identify their own learning requirements and develop their own knowledge

Based on the above-mentioned learning objectives for the internship, the student establishes the goal for the learning outcome of the internship together with the company and the supervisor from the Academy.

# 6. Main exam project

The main exam project is weighted 15 ECTS.

## 6.1. Requirements for the main exam project

The main examination project/bachelor project is evaluated as an external examination. The exam consists of a written project and an oral part, and students are given one total mark.
The main bachelor project must document the student's understanding of practice and the key theories and methods applied in relation to a practical problem based on a concrete assignment within the academic area of the programme. The thesis statement must be relevant to the programme and the trade and must be formulated by the student, possibly together with a private or public company. The Academy approves the thesis statement.

The student must work independently with the project and the project report must contain observations from the student's own work.

If other people have contributed observations to the project, this must appear from the report.

The main exam project must consist of at least 20 and 25 as maximum of standard pages.
Cover page, table of contents, bibliography and appendices do not count. Appendices should not exceed 25 standard pages.

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

The project report must be submitted in two copies both of which must be signed by the student.
The student is allowed to bring along other relevant documentation for the examination.

The oral presentation must be organised and prioritised as if it was intended for a selected target group.

The project, which constitutes the written part of the exam, must as a minimum contain the following:

- Cover page and title
- Table of contents (TOC)
- Introduction, including a presentation of the thesis statement
- Bibliography (including all sources that are referenced in the project)

## 6.2. Spelling and writing skills

Spelling and writing skills are included in the assessment of main exam project. The assessment reflects an overall assessment of the academic content as well as writing and spelling ability.

Students who can document a relevant disability can apply for an exemption from the requirement that spelling and writing skills are included in the assessment.
An application must be sent to the applicable head of department no later than four weeks before the exam is due to be held.

## 6.3. Learning objectives

The main exam project must document that the graduation level of the programme has been obtained, cf. appendix 1 in Ministerial Order for the Bachelor's Degree Programme in Chemical and Biotechnical Technology, Food Technology and Process Technology.

The learning objectives include the knowledge, skills and competencies that a graduating student must have obtained during the programme and must document that the learning objectives/ level of graduation have been obtained, cf. appendix in Ministerial Order no. 1178 of 07/12/2009 for the programme:

**Knowledge and understanding**
The graduate has knowledge and understanding of:

- Physical and chemical concepts, principles and their application
- Mathematical and statistical concepts and theories
- Methods and practice within communication
- Production and quality control systems
- Applied statistical models in analysis and experimental work
- Key concepts within philosophy of science

The graduate of *the study programme chemical and biotechnical technology* also has knowledge and understanding of:

- Select chemical reactions and industrial production of chemical products
- Qualitative and quantitative analytical chemical methods
- Membranes, organelles and the functions in the pro and eukaryotic cell
- Fermentation processes, production organisms and product types
- The theoretical background of methods for the analysis of biomolecules

The graduate of *the study programme food technology* also has knowledge and understanding of:

- Food quality and analysis methods for determining this
- Food manufacture and food technological equipment
- Foodborne diseases, decay organisms, microbiological indicators and sampling
- Hygienic design and requirements for cleaning of production equipment
- Market and consumer surveys and patenting

The graduate of *the study programme process technology* also has knowledge and understanding of:

- Working environments and methods for how to improve them
- Systematic, industrial maintenance
- Uncertainty of measurements, calibration, traceability and requirements of measuring techniques and equipment
- Methods for mapping and reducing resource consumption
- Phases of qualifying a pilot system
- Educational requirements for people who construct sub-elements in a process plant

**Skills**
**The graduate is able to:**

- Apply mathematical, physical and chemical knowledge for the solution of practical problems
- Gather necessary knowledge to establish experimental plans and statistical data processing
- Apply basic tools for quality and production control
- Convey professional knowledge orally and in writing

The graduate of *the study programme chemical and biotechnical technology* also has knowledge and understanding of how to:

- Identify and account for chemical reactions
- Assess and account for the choice of analysis method and data reliability
- Draw up hypotheses and come up with conclusions based on experimental data
- Asses and prepare solutions to problems within the biological and chemical fields.

The graduate of *the study programme food technology* also has knowledge and understanding of how to:

- Evaluate problems within food quality and food safety, and plan and apply practical analysis methods for the evaluation
- Apply food technological unit operations and assess the changes that components undergo during processing
- Apply select additives and assess their characteristics
- Account for the development of a fermentation process
- Set up and apply quality control systems as well as relevant legislation to ensure food safety and food quality
- Apply innovative techniques and methods in a process-orientated course from idea to finished product

The graduate of *the study programme process technology* also has knowledge and understanding of how to:

- Gather knowledge, and prepare and revise documents regarding risk control and working environment
- Construct and maintain calibration systems
- Set up experimental plants for systematic maintenance and experiments for operational qualification
- Apply knowledge about methods for mapping and reducing resource consumption in practice
- Gather necessary knowledge about user requirements and translate these into design specifications
- Function as day-to-day manager for pilot-scale construction projects

**Competencies**
**The graduate is able to:**

- Communicate experiments, results and evaluations independently
- Apply, assess and document select control systems
- Be responsible for the practical planning of experiments and series of experiments
- Take part in academic and cross-disciplinary collaboration
- Identify their own learning requirements and develop their own knowledge

The graduate of the *study programme chemical and biotechnical technology* also knows how to:

- Relate theoretical knowledge about chemical reactions and analysis to technical methods of practice
- Reflect on the ethical problems in relation to laboratory work

The graduate of the *study programme food technology* also knows how to:

- Assess problems from scientific articles within the food area
- Handle analysis results and methods in relation to the influence of production and processing processes on food quality
- Handle problems regarding choice of process equipment and additives
- Handle and convey problems regarding food safety and shelf life

The graduate of *the study programme process technology* also knows how to:

- Be responsible for the risk management of parts of the production plant and contribute to the working environment improvements in production
- Be responsible for the planning and execution of maintenance activities for production and measuring equipment
- Be responsible for the mapping of process related resource consumption in connection with design, construction and the breaking-in of pilot systems
- Be responsible for getting the pilot system qualified

### 6.4. Assessment

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

The exam consists of a project and an oral part. The student is given one total mark. The exam cannot take place before the main internship exam and all other exams on the programme have been passed.

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

# 7. Overview of the exams

Overview of all the exams on the programme.

| Exam | 90 ECTS distributed on the exams | Assessment |
|---|---|---|
| **Compulsory exams** | | |
| **Applied mathematics and physical chemistry** | 5 ECTS | 7-point scale |
| **Commerce – organisation, management and cooperation** | 5 ECTS | 7-point scale |
| **Production and quality control** | 5 ECTS | 7-point scale |
| **Communication, dissemination and philosophy of science** | 5 ECTS | 7-point scale |
| **Basic experimental planning** | 5 ECTS | 7-point scale |
| **Statistical experimental planning** | 5 ECTS | 7-point scale |
| **Internship exam** | 15 ECTS | 7-point scale |
| **Final project exam / Bachelor project** | 15 ECTS | 7-point scale |
| **Exams for the study programme: Chemical and biotechnical technology** | | |
| **Biotechnology**<br>With the compulsory programme elements<br>• Cell biology (5 ECTS)<br>• Bioproduction (5 ECTS)<br>• Analysis of biomolecules (5 ECTS)<br><br>If the compulsory programme elements are not completed during the same exam period, the individual exam can be taken separately. | 15 ECTS | 7-point scale |

| | | |
|---|---|---|
| **Chemical technology**<br>With the compulsory programme elements<br>• Organic chemistry (5 ECTS)<br>• Chemical analysis technique (5 ECTS)<br>• Elective: Chemical and biotechnical technology (5 ECTS)<br><br>If the compulsory programme elements are not completed during the same exam period, the individual exam can be taken separately. | 15 ECTS | 7-point scale |

| **Exams for the study programme: Food technology** | | |
|---|---|---|
| **Food quality and safety**<br>With the compulsory programme elements<br>• Food quality and quality measuring (5 ECTS)<br>• Food microbiology (5 ECTS)<br>• Food safety and legislation (5 ECTS)<br><br>If the compulsory programme elements are not completed during the same exam period, the individual exam can be taken separately. | 15 ECTS | 7-point scale |
| **Food technology and innovation**<br>With the compulsory programme elements<br>• Food technology 1 (5 ECTS)<br>• Food technology 2 (5 ECTS)<br>• Elective: Innovation and product development (5 ECTS)<br><br>If the compulsory programme elements are not completed during the same exam period, the individual exam can be taken separately. | 15 ECTS | 7-point scale |

# 8. Credit

The Academy may approve that programme elements or parts thereof that have been passed at another institution are equivalent to corresponding programme elements or parts thereof in this curriculum. If the programme element in question was assessed according to the 7-point scale at the institution where the exam was taken and is equivalent to a complete subject in this curriculum, the mark will be transferred. In all other cases, the assessment will be transferred as "passed" and will not form part of the calculation of the student's average mark.

The Academy can approve that programme elements passed from another Danish or foreign institute of higher education should replace the programme elements of this curriculum. Upon approval of such programme elements, the elements are considered completed if passed according to the rules for the programme in question. The assessment will be transferred as "passed"

The student must inform the Academy about previously passed programme elements that may be credited.

## 8.1. Credit for elective programme elements

Passed optional programme components are equivalent to the corresponding subjects at other educational institutions that provide this programme as well as other programmes.

## 8.2. Prior credit approval

Students can apply for prior credit approval. With prior credit approval for study in Denmark or abroad, students are required to document each approved and completed programme component when they have completed each programme component. In connection with applying for prior credit approval, the students give permission that the institution can obtain the necessary information after the student's 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. Rules of exemption

The educational institution can deviate from what the institution or the institutions themselves 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 joint national part of the curriculum has been enacted and approved by the programme network.