

Chapter 9
The education specific part of the study programme for

Bachelor of Science in Engineering – Innovation and Business
Study Start September 2007

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§1 Job profiles

Innovation and Business is a unique combination of creativity, innovation, entrepreneurship and engineering skills with special core competencies:

- Creativity and innovation management skills in development of product and business ideas
- Product driven entrepreneurship
- Solid competencies in business administration
- Elaborated engineering skills in mechatronics

These competencies give wide possibilities for a job profile:

- Product development
- Project manager
- Technology manager
- International product manager
- Marketing manager
- Entrepreneur with your own business
- Consultant
- Research worker in Innovation and Business

The engineering focus of the program is on mechatronic product development, but also other branches and more business-oriented jobs are a possibility.

§2 Description of the competencies obtained from the study programme

The programme will enable students to plan, develop, and realize an own business concept. Hence, the competencies comprise:

- Basic creativity and innovation management skills, which allow generating, evaluating, selecting, and realizing product and business ideas. This encompasses creativity methods, moderator trainings and business case building.
- Basic skills in mechanical, electrical, and mechatronical engineering based on the specific profile of the Mads Clausen Institute in Mechatronics. Engineering skills acquired involve a solid understanding of the interplay between traditional engineering disciplines.
- Basic competencies in business administration are necessary to master and run innovative projects in a company.
- Skills in product development techniques, project management methods and other working methods as well as social competencies complementing the education towards excellent product driven entrepreneurship.
- Candidates in Innovation and Business will be trained in group collaboration with persons having diverse backgrounds and skills. The idea is that individual candidates become educated as experts-in-teams through the 3 year bachelor programme.

The bachelor must train fundamental skills in engineering and business administration as well as techniques to develop products and business ideas condensed into business cases.

§3 Subject columns of the study programme

The competencies of students are developed by studying the topics in 6 subject columns during the programme.

Creativity and innovation management

- Creativity techniques
- Barriers to creativity
- Creativity organizations
- Innovation process
- Innovation toolbox
- Internal and external innovation competencies
- Controlling and budgeting innovation activities

Entrepreneurship

- Business plan development and implementation
- Strategic innovation management
- Raising venture capital
- Establishment of a business/company
- Operation management and facilities
- Supply chain management
- Logistics
- Quality management
- Project management methods

Business administration and management

- Company analysis
- Management accounting
- Cost measurement
- Investment
- Financing
- Budgeting
- Organization design and changes
- Organizational management and strategy
- Strategy and cost management
- Technology management
- Marketing in a company or organization
- Consumer behaviour
- Global marketing management
- Consumer and business to business marketing
- Internet commerce

Mechatronic Product Development

A: Mechanical product development and manufacturing

- Methodical product development
- Sketching techniques
- 3 D modeling
- User-experienced design
- Selection of materials and technology
- Engineering mechanics
- Mathematical modelling
- Product documentation for preparing manufacturing
- Design review
- Prototyping
- Machine elements
- Strength of materials
- Operation management
- LEAN production
- Computer simulation of manufacturing

B: Intelligent electronic product development

- Electronic circuits and components
- Electronic simulation
- Analyzing and designing analogue circuit-realized systems
- Building LAB models
- Digital hardware design
- Embedded software
- Data communication
- Microprocessor/controller systems
- Programming
- Transducers, actuators and sensors
- Mathematical modelling

Personal competencies:

- Communication
- Analytical and critical abilities
- Independent
- Creative and innovative
- Management, collaboration and process

§4 Semester Themes

Semester	SEMESTER THEMES
6.	Innovation and business project
5.	From concept to business
4.	Intelligent product concept
3.	From idea to product concept
2.	Design & prototyping
1.	Innovation & creativity

§5 Semester Modules

Semester	STRUCTURE																													
6.	BPRO 6 IB Bachelor project—from idea to business															Optional					Optional					Optional				
5.	EXT 5 Experts in Teams															BSM 5 IB Business plan, Strategy, Management and Logistics														
4.	DSB 4 IB Digital Design, Simulation and Business Administration															DPM 4 IB Digital Systems, Programming and Mathematics														
3.	ADM 3 IB Analogue Design, Management and Business Administration															ECM 3 IB Electronic Circuits/Components and Mathematics														
2.	MDB 2 IB Mechanical Design and Business Administration																				IAM 2 IB Innovation and Mechanics									
1.	CDB 1 IB Creative Design and Business Understanding																									MECH 1 IB Mechanics				
ECTS POINT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30

§6 Description of 1st semester

Semester theme:

The theme of 1st semester is “Innovation and Creativity”

Value argumentation:

It is important for students in 1st semester to learn how to work creatively and innovatively in the product development process.

They are working on a project with innovative design of a smaller mechanical product including economic aspects and technical documentation.

Through courses and project work they are training subjects as creativity, team work, report writing, project planning, mechanical product development and design, selection of materials and technology, calculation of mechanics and calculation of economic aspects.

Objectives:

The 1st semester will enable students to work with:

- Creative and innovative product development process
- Team and project work
- Designing 3D models of mechanical products
- Selection of materials and processes to obtain optimal product properties
- Mechanical statics
- Calculation of economic aspects

Context of 1st semester:

1st semester includes 2 modules: CDB 1 IB (Creative Design and Business Understanding – 25 ECTS) and MECH 1 IB (Mechanics – 5 ECTS)

The module MECH 1 IB contains the subject mechanics (statics) which is used for mechanical calculations in the project.

In the module CDB 1 IB students learn to handle a creative and innovative product development process. They are working on a project with design of a smaller mechanical product including economic aspects and technical documentation and calculations.

The module is compulsory and constitutes the first-year exam.

§7 Description of Modules – 1st semester

Module description for B.Sc. in Innovation and Business, applicable for first semester students enrolled in September 2007, is available in the Course Database under Module Description autumn 2007.

§8 Description of 2nd semester

Semester Theme:

The theme for 2nd semester is “Design and Prototyping”

Value Argumentation:

It is important for students in 2nd semester to understand the connection between innovative product development, mechanical design, material and process selection, manufacturing and economy. They are working on a project with innovative design of a mechanical product where the end product is a working prototype of the product. Focus is on innovation, mechanical design, materials, processes, mechanics, economics and prototyping.

Objectives:

The 2st semester will enable students to work with:

- understanding of innovation management with generating, evaluating, selecting and realizing product and business ideas
- all phases of product development ending up with a working prototype
- optimizing of a product with respect to design, manufacturing and business
- economic analysis including cost, investment and financing
- mechanical analysis including machine elements and strength of materials

Context of 2nd semester:

2nd semester includes 2 modules: MDB2IB (Mechanical Design and Business Administration – 20 ECTS) and IAM2IB (Innovation and Mechanics – 10 ECTS)

The module IAM2IB contains the subject’s innovation management and mechanics (strength of materials). Focus is on the connection between innovation and design of mechanical systems.

In the module MDB2IB students learn to handle all phases from innovative product development to a working mechanical prototype. They are working on a project where they optimize the product with respect to mechanical function and economic aspects.

§9 Description of Modules – 2nd semester

Module description for B.Sc. in Innovation and Business, applicable for second semester students enrolled in September 2007, is available in the Course Database under Module Description spring 2008.

§10 Description of 3rd semester

Semester Theme:

The theme for 3rd semester is “From idea to product concept”.

Value Argumentation:

It is important for the students in the 3rd semester to understand the basic interaction between electronics and mechanics. There is a focus on the electronically components in connection with typical mechanical products.

Objectives:

The student will during the semester be able to:

- Construct an electronic system for measuring some physical unit. The construction has focus on electronics and mechanics.
- Seek information for marketing decision-making, with a focus on behavior analysis, competitors, price and distribution.
- Compile and use Value-Stream-Mapping.
- Demonstrate logistic in the form of computer simulation models.

Context of 3rd semester:

The 3rd semester consists of 2 modules: ADM 3IB (Analogue Design, Management and Business Administration – 15 ECTS) and ECM 3IB (Electronic Circuits / Components and Mathematics – 15 ECTS).

The module ECM 3IB consists of ELEC 1 (Electronics), ELECT 1 (Electrotechnics) and MATH 1 (Mathematics). The content of these courses are used for calculation on electric circuits in connection with the semester project.

The module ADM 3 IB will provide the students with a basic understanding of the interaction between electronics and mechanics. But also a good understanding of manufacturing costs and planning on the basis of costs, an insight in how to analyze, assess and plan the preparation of manufacturing products.

§11 Description of Modules – 3rd semester

Module description for B.Sc. in Innovation and Business, applicable for third semester students enrolled in September 2007, is available in the Course Database under Module Description autumn 2008.

§12 Description of 4th semester

Semester Theme:

The theme for 4th semester is “**Intelligent product concept**”.

Value Argumentation:

To provide students with the knowledge of design of smaller digital systems including hardware, software and data communications, an being able to analyse electrical and mechanical vibrations.

Objectives:

The student will during the semester be able to:

- Calculate og use the basics of logic components and theory
- Design and construct a digital hardware system
- Conduct basics of C++ programming
- Perform Laplace and Fourier-series analysis and electrical mechanical vibrations.

Context of 4th semester:

The 4th semester consists of 2 modules: DSB 4IB (Digital Design, Simulation and Business Administration – 15 ECTS) and DPM 4IB (Digital Systems, Programming and Mathematics – 15 ECTS).

The module DSB 4IB consists of SPRO 4IB (Semester Project 4IB), BUS 1S (Business Administration 1S) and PRM 1B (Production Management 1B). During the course, students must design a measuring system for measuring physical quantities such as power, deformation, flow and temperature. During project work, students must work on problems covering mechanical design including casing as well as the measuring system right from the theorem of signalling to digital signal.

The module DPM 4IB consists of DGS 1 (Digital Systems 1), PROG 1 (Programming 1) and MATH2 (Mathematics 2). The content of these courses are to provide with theory for the designing and analyse of the digital system build in the semester project.

§13 Description of Modules – 4th semester

Module description for B.Sc. in Innovation and Business, applicable for fourth semester students enrolled in September 2007, is available in the Course Database under Module Description spring 2009.

§14 Description of 5th semester

Semester Theme:

The theme for the 5th semester is "From concept to business".

Value Argumentation:

To provide students with the skills of working in cross-educational teams and utilizing the cross fertilization from various disciplines. Further, the students are provided with knowledge and tools within logistics and cost management that can support implementation mechanisms of their ideas.

Objectives:

- The student will get/ be able to:
- Participate and organize project work collaborating with students from Mechatronics and Interactive design.
- A basic understanding of theory of science
- A solid understanding of costs and cost behavior and how to use cost information for decision-making, planning and control decisions
- Evaluate practical quality management in manufacturing, be able to describe how to implement quality control in the basic organization and be able to discuss the development and maintenance of a complete quality control systems according to ISO 9000 standards.

Context of 5th semester:

The 5th semester consists of the two modules: EXS 5IB (Experts in Teams and Theory of Science -15 ECTS) and BSM 5IB (Business, Strategy, Management and Logistics – 15 ECTS)

The module EXS 5IB consists of the planning units EXT5 (Expert in Teams) and THS (Theory of Science). The content of these courses involves the introduction to using research methods in solving new problems or by suggesting new solutions for well-known problems. Also the insight in problem solving of complex, interdisciplinary engineering tasks, experience of project management, organization and financial management and experience of project cooperation with med many stakeholders, both internally and externally are content parts of this module.

The module BSM 5 IB consists of the planning units STRA1 (Strategy and Cost Management), LOG1 (Internal Logistics and Quality Management 1) and LOG2 (External Logistics and Strategy 1). The content of this module is used to provide the students with knowledge in management accounting and an understanding of costs and cost behavior and how to use cost information for decision-making, planning and control decisions. Further, the module provides a comprehensive and applicable insight in internal logistics as to material- and information flow as well as user-oriented knowledge of the external logistics regarding control of product- and information flow right from extraction of raw material to the end-user (SCM-Supply Chain Management).

§15 Description of Modules – 5th semester

Module description for B.Sc. in Innovation and Business, applicable for fifth semester students enrolled in September 2007, is available in the Course Database under Module Description autumn 2009.

§16 Description of 6th semester

Semester Theme:

The theme for the 6th semester is “Innovation and business project”

Value argumentation:

The bachelor project must demonstrate the students ability independently to locate and formulate potential innovative engineering or marketing problems. The project must demonstrate technical business analyses, development of alternative concepts and creative solutions to the problem. Additionally students can choose 3 elective courses where they define their own specialization.

Objectives:

The students will during the semester be able to:

- be innovative and creative in product development from idea, concept, prototype, business plan, management, logistics\manufacturing until business establishment.
- apply knowledge and skills achieved during the study to solve complex engineering and business problems.
- acquire new knowledge within relevant engineering and business fields.
- co-operate with industrial companies throughout the project. In many projects the project will be carried out in close co-operation with industrial companies.
- apply theory of science in their project work
- understand the importance of involving users in a design process.

Context of 6th semester:

The semester contains two modules BPRO 6 IB (15 ECTS) and Elective (15 ECTS) with the following planning units:

BPRO 6 IB: The Bachelor Project (15 ECTS)

Elective: 3 Elective courses (15 ECTS)

§17 Description of Modules – 6th semester

Module description for B.Sc. in Innovation and Business, applicable for sixth semester students enrolled in September 2007, is available in the Course Database under Module Description spring 2010.