UNIVERSITY OF SOUTHERN DENMARK

Chapter 9

The programme specific part of the curriculum for:

Bachelor (BSc) i teknisk videnskab (innovation og business)

Bachelor of Science (BSc) in Engineering (Innovation and Business)

Study Start 2009, Version 1.1

The curriculum is divided into general provisions (Chapters 1-8), a programme specific part (Chapter 9) and the module descriptions for the subjects studied for each programme. Students should familiarise themselves with all three parts in order to acquire a full overview of the rules that apply throughout the study programme.

§1 Job profiles

Innovation and Business is a bachelor of science that combines creativity, innovation, entrepreneurship and engineering courses .The student becomes a market-oriented engineer who is able to deal with different types of products in which business skills and technology assessment are combined. A bachelor of science in Innovation and Business provides the students with special core competencies in:

- Creativity and innovation management skills for developing product and business ideas
- Product driven entrepreneurship
- Solid competencies in business administration
- Elaborated skills in Mechatronics

These competences enable the graduate to work in various jobs, especially interdisciplinary and cross-functional job functions are areas where the combination of both business and engineering skills could be utilized. Understanding the process from development of product ideas to develop a business plan makes the graduate an important link between various specialists within an organization. Emphasizing the international dimension during the education fosters opportunities within more global job functions. Possible job profiles for a graduate are:

- Product developer
- Product development manager
- Technology manager
- International product manager
- Marketing manager
- Entrepreneur – start up of own business
- Consultant

The main engineering focus of the program is on mechatronic product development but other product, service or business development areas are possible.

§2 Description of the competencies obtained from the study programme

The programme will enable the students to handle the process from exploring and discovering new ideas to planing, managing and finally realizing an own business concept. The education is characterized by providing the graduates with the following competencies:

- 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 competences 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 competences 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 competences of the 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 competences
- 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 competences:

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

§4 Semester themes

Semester	SEMESTER THEMES
6.	**Bachelor Project**
5.	**Experts in teams**
4.	**Management and Control**
3.	**Development and Market**
2.	**Ideas and Concepts**
1.	**Explore and Discover Innovation**

§5 Semester modules

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§6 Description of 1st semester

SEMESTER THEME

The theme for 1st Semester is ”Explore and Discover Innovation”

VALUE ARGUMENTATION

It is important for students during the 1.semester to learn how to work creative and innovative 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.

COMPETENCE GOALS

The students should acquire competences within:

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

SEMESTER STRUCTURE

XPLO1IB - Explore and Discover Innovation (30 ECTS)

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

CONTEXT

The semester contains 1 module XPLO1IB with the following planning units: SPRO 1 IB (10 ECTS) – A project that introduces students shortly to different theoretical fields related to exploring and discovering innovation. BA2 (5 ECTS) – Introduction to relevant business theory involving managerial accounting. DES-UK (5 ECTS) - Introduces CAD as a usable tool for understanding and generating technical mechanical drawings. MAP-UK (5 ECTS) – Finding the right materials and the determination of failure and tolerance. DYM-UK (5 ECTS) – The theory of dynamic systems. The module intends to enable students to handle a creative and innovative product development process. They are working on a project with the design of a smaller mechanical product including economic aspects and technical documentation and calculations.

§7 Module Description – 1st semester

Module description for BSc (Eng) in Innovation and Business, applicable for first semester students enrolled in September 2009, is available in the Course Database under Course Description autumn 2009.

§8 Description of 2nd semester

SEMESTER THEME

The theme for the 2nd Semester is ”Ideas and Concepts”.

VALUE ARGUMENTATION

Students in the 2. semester should understand the connection between innovative product development, mechanical design, material and process selection, manufacturing and economy. The students work on transforming product ideas into concepts. This is accomplished through the integration of creativity tools, business administration knowledge and basic mechatronic skills.

COMPETENCE GOALS

The students should acquire competences within:

- understanding innovation management as a theoretical field that enables students to generate, evaluate, select and realize product ideas and business concepts
- Be acquainted with all phases of product development ending up with a working prototype/business concept
- optimizing a product with respect to design, manufacturing and business
- economic analysis including cost, investment and financing
- mechanical analysis

SEMESTER STRUCTURE

IDCO2IB – Ideas & Concepts (15 ECTS)
BAM2IB – Basic Mechatronics (10 ECTS)
IBINTF – International Finance (5 ECTS)

All modules are obligatory.

CONTEXT

The semester contains three modules: IDCO2IB and BAM2IB with the following planning units.

IDCO2IB ideas and concepts contains: Semester project SPRO 2 IB (10 ECTS). The focus is in creating ideas using creativity tools, derive and select product or service concepts that are interesting in an economic sense. BA3 (5 ECTS) Introduces the student to finance and investment principles. INC1 (5 ECTS) – Concerns creativity technology and idea creation.

BAM2IB basic mechatronics contains: ESY-UK (5 ECTS) - concerns mathematic and physics methods to analyse electronical systems. MECH1-UK (5 ECTS) - concerns methods to analyze static and dynamic mechanical systems.

IBINTF – International Finance provides students with a more comprehensive understanding of corporate finance management by introducing risk into the long term assets and liabilities decision of the firm and presenting modern financial theory

§9 Module Descriptions – 2nd semester

Module descriptions for BSc (Eng) in Innovation and Business, applicable for second semester students enrolled in September 2009, are available in the Course Database under Course Description spring 2010.

§10 Description of 3rd Semester

SEMESTER THEME

The theme of the 3rd Semester is ”Develop and Market”

VALUE ARGUMENTATION

The students should develop an understanding of how to access market knowledge, how to integrate tools in the business planning process and eventually how to find investors for their product or service concept. Further, the students should on the engineering part understand the basic interaction between electronics and mechanics. There is a focus on the electronical components in connection with typical mechanical products.

COMPETENCE GOALS

The student will during the semester be able to:

- Design a concept involving electronics for a selected marked.
- Demonstrate technical and business analysis, development of of alternative concepts and creative solutions of a problem.
- Seek information for marketing decision-making, with a focus on behavior analysis, competitors, customers, price and distribution.
- Use tools for business planning and for negotiating with investors
- Generate technical solutions involving sensors, actuators and electronics.

SEMESTER STRUCTURE

NADEMT3 – Development & Market (15 ECTS)
NANSENS3 – Sensors & Electronics (10 ECTS)
EMB1-UK – Embedded Systems (5 ECTS)

The modules are obligatory.

CONTEXT

The Semester contains three modules NADEMT3, NANSENS3 and EMB1-UK with the following planning units.

NADEMT3 - develop and market contains: Semester project SPRO 3 IB (10 ECTS) – focus is on developing products ready for the market and assessing relevant market information in relation to estimate its market potential. MIE (5 ECTS) – introduces tools and databases to be used for market evaluation.

NANSENS3 – Sensors and Electronics contains: ELEC-UK (5 ECTS) concerns analysis and constructions of elctronical systems. SAA-UK (5 ECTS) deals with analysis and constructions of systems with sensors and actuators.

EMB1-UK – Embedded Systems contains a mix of theory and hands-on exercises in programming.

§11 Module description – 3rd semester

Module descriptions for BSc (Eng) in Innovation and Business, applicable for third semester students enrolled in September 2009, are available in the Course Database under Course Description autumn 2010.

§12 Description of 4th Semester

SEMESTER THEME

The theme of the 4th Semester is "Management and Control"

VALUE ARGUMENTATION

The students should develop an understanding of how to manage innovation as a holistic process involving strategy formulation, planning, controlling and implementation. There is focus on product driven innovation involving intelligent products.

COMPETENCE GOALS

The students will during the semester be able to:

- carry out a project involving idea generation, concept, prototype, business plan, management, logistics/manufacturing and implementation.
- handle different phases in the process of innovation management
- develop a manufacturing concept and be able to analyse, estimate and plan production
- generate technical solutions involving intelligent dynamic systems with embedded software

SEMESTER STRUCTURE

NAINMG4 – Innovation Management (20 ECTS)
NACTRL4 – Control (10 ECTS)

CONTEXT

The semester consists of two modules NAINMG4 and NACTRL4 with the following planning units:

NAINMG4 – Innovation Management contains: Semester project SPRO 4 IB (10 ECTS) - The main focus is on manufacturing planning, concept assement and market research ending with a Business Case document. INM (5 ECTS) - contains the processing of market signals and strategy, resourcing and implemention of the innovation process. OPM1 (5 ECTS) concerns manufacturing concepts, process strategy, layout strategy and capacity planning visualised by computer simulations.

NACTRL4 – Control: CYB (5 ECTS) contains an introduction to the theory for feedback systems. EMB2-UK (5 ECTS) contains a mix of theory and hands-on exercises in constructing digital hardware.

§13 Module Descriptions – 4th Semester

Module descriptions for BSc (Eng) in Innovation and Business, applicable for fourth semester students enrolled in September 2009, are available in the Course Database under Course Description spring 2011.

§14 Description of 5th Semester

SEMESTER THEME

The theme of the 5th Semester is “Experts in Teams”

VALUE ARGUMENTATION

The students should develop an understanding of collaborative innovation by working in groups together with students from other programmes – teamwork as “experts in teams”.

Depending on the project the focus will be on creativity and innovation management skills involving generating, evaluating, selecting and realizing product and business ideas.

Additionally students can choose an elective course to form their own profile.

COMPETENCE GOALS

The students will during the semester be able to:

- carry out a collaborative innovation project working in teams together with other engineering programmes as “experts in teams”
- understand their own strength and the focus of their profile compared with other engineering programmes
- understand the complexity of the innovation process – also including manufacturing concepts with operations-, supply chain- and information management
- use theory of science in problem solving
- understand philosophical aspects of science

SEMESTER STRUCTURE

NAEXS5IB – Experts in Teams and Theory of Science (15 ECTS)
IBOPMG5 – Operations Management (10 ECTS)
Elective courses equivalent to 5 ECTS

NAEXS5IB and IBOPMG5 are obligatory.

CONTEXT

The semester consists of three modules NAEXS5IB, IBOPMG5 and an elective course, with the following planning units:

NAEXS5IB - Experts in Teams contains: EXT5 (7 ECTS). The main focus of the project is to design and develop a complex product concept. The students work in groups across the educational study programmes. THS (3 ECTS) is science theory introducing subjects like areas of recognition within natural science and methods and limitation of ethical aspects.

IBOPMG5 – Operations Management contains: OPM2 (5 ECTS) contains production planning and control, forecasting, stock controlling, LEAN manufacturing and quality management. SCM (5 ECTS) containing logistic services, needs for capital, forecast, quality control and E-commerce. PDK (5 ECTS) introduces design and setup of web services with database connection.

§15 Module Descriptions – 5th semester

Module descriptions for BSc (Eng) in Innovation and Business, applicable for fifth semester students enrolled in September 2009, are available in the Course Database under Course Description autumn 2011.

§16 Description of 6th Semester

SEMESTER THEME

The theme of the 6th Semester is “Bachelorproject”.

VALUE ARGUMENTATION

The bachelor project must demonstrate 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.

Additional students learn about “user centred design” and they can choose 2 courses where they define their own specialization.

COMPETENCE GOALS

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 importans of involving users in a design process.

SEMESTER STRUCTURE

BPRO6IB – Bachleor Project Science (15 ECTS)
UCD6IB – User Centered Design (5 ECTS)
Elective courses equivalent to 10 ECTS

BPRO6IB and UCD6IB are obligatory.

CONTEXT

The Semester contains three modules BPRO6IB (15 ECTS), UCD6IB (5 ECTS) and electives (10 ECTS), with the following planning units:

BPRO6IB: The Bachelor Project (15 ECTS)

UCD6IB: UCD1 (user centered design - 5 ECTS) contains designing for people, design craft, expressive interaction design and reflective design practice. The course is divided into two design projects.

§17 Module Descriptions – 6th Semester

Module description for B.Sc.(Eng) in Innovation and Business, applicable for sixth semester students enrolled in September 2008, is available in the Course Database under Course Description spring 2012.

§ 17 External examiners and Study Board

The study programme belongs under the Academic Study Board of the Faculty of Engineering and the Danish corps of external examiners for engineering education. Modules that are offered by the Faculty of Business and Social Sciences belong under the Danish corps of external examiners for business and social sciences.

§ 18 Entry into Force

1. Approved by the Academic Study Board of the Faculty of Engineering and Director of Studies on behalf of the Dean of the Faculty of Engineering 18th June 2008.

2. Amendments approved by the Academic Study Board of the Faculty of Engineering and Director of Studies on behalf of the Dean of the Faculty of Engineering 23rd March 2010.

3. Amendments due to the new Ministerial order on bachelor and master's programmes (candidatus) at universities, Consolidation Act no 814 of 29 June 2010 (Version 1.0)

4. Amendments approved by the Academic Study Board of the Faculty of Engineering and Director of Studies on behalf of the Dean of the Faculty of Engineering 7th March 2012 (Version 1.1).